ILLINOIS AGRICULTURAL ECONOMICS STAFF PAPER

Series E. Agricultural Economics

LAND RETURNS AND LAND VALUES EFFECTED BY GRAIN PRICES AND GOVERNMENT SUPPORTS

by

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May, 1978 No. 78 E-50

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Introduction

Only about three percent of all the farm land in the United States is transferred from one owner to another each year. Some of this land is transferred by inheritance, some land is transferred from one blood related person to another, and some land is exchanged for other property. These transfers are never really in the land market, per se, where an arm's length transaction and therefore a "market" price is observable or reportable. Therefore, the actual market values of land that are reported and used represent only a very small fraction of the total land resources. Thus at any one time our "fix" on the land market is tenuous at best. Of course this is true of many capital assets where only a fraction may be marketed at any one time.

Land is different than man made capital assets in that there is a limit to the total supply and each parcel has a locational monopoly. The price of man made capital assets is affected by only a relatively few factors such as the net return, the rate of interest, the rate of technological change, location, and the cost of making new capital. Generally the returns on man made capital show a rate of annual return greater than or at least equal to the rate of interest. Some well built modern buildings with good location and return are selling at capitalization rates below the long term rate of interest, but it is easy to show this difference to be the value of the tax shelter and potential appreciation for the owner.

Land returns from current agricultural production as a percent of land value, except for three recent years (1972, 1973, 1974) have always been substantially less than the long term mortgage rate of interest. And this has been true throughout the developed world in economies with individual

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1/ *Paper given at the Western Economics Association Annual Meeting, June 25, 1978. The research reported was supported in part by the Illinois Agricultural Experiment Station with Project 305.*

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ownership of assets.

In Figure 1, we pictorially present some of the values which we believe affect farm land prices.

The basic foundation block of value comes from the current agricultural production return, the next block labelled Increased Income is the value perceived as expected increase in physical production over time due to improved varieties and other technological improvements. The average yield increase in corn production, for example, has approximately doubled in the last 40 years. There are many of the better farms which have tripled yields in that period.

The next block in Figure 1 refers to the extra price people are willing to pay because of expectation of further inflation. This, of course, depends on how important inflationary forces in the economy seem to be to the buyer. Prices reflect this to the extent that part of the expected future value increase is captured now by the seller, and the holding period required by the buyer to realize this increase in value is lengthened.

The next building block of values is listed as Job Security. A farmer buying land assures himself of longer tenure than he could if he were renting (assuming, of course, that he is able to pay for the land he buys). This extra value or price a farmer is willing to pay can be thought of in the light of union dues - something you have to do to maintain job security. Many people have pride of ownership or ego satisfaction in being able to say they own farmland. This ego satisfaction in owning farmland is certainly not confined only to rural people, as we all know. This makes up one block.

The permanent repository of value conceived here refers to the safety of the investment. The safety of land ownership depends on the political and economic system and its stability. This value block is large or small depending on how important and pervasive individual property rights are in the society. Land has some of the permanent value aspects of gold or diamonds. It will always be there and as long as there is either a steady or growing population, land will always have value. Unlike gold or diamonds, land is totally immobile so that land has little appeal to wealthy persons in unstable societies. If you have to leave your home or country, land can't be carried with you like diamonds or gold. The response of the new owner of a large tract of farmland to a question indicates that the permanent repository concept does have value for farm land. A realtor told a wealthy West German family that recently bought several million dollars worth of land in Illinois

that the outlook over the next few years for commodity prices didn't appear very favorable. It was unlikely the agricultural return would be more than 2% or 3% on the price they paid for the land purchase. The response was this, "We're not concerned about high returns. When we buy land, we expect it to remain in the family for the next two or three hundred years."

Some farm land has non-agricultural use potential. It highest and best use in a short period of time hence due to location near an expanding metropolis or an interstate highway intersection may return much more than agricultural rent could return. Anticipation of such use makes the present value of property greater than current agricultural rent would indicate.

As population spreads out from metro areas, open space begins to command a price even though the property has no foreseeable non-agricultural use.

One last block of value we have shown in Figure 1 is Tax Shelter. Actually most agricultural land is rather poor as a tax shelter compared to some other real estate, because the value of buildings which can be depreciated is usually a small part of the total value of most agricultural property when compared with apartment buildings which are allowed special extra depreciation allowance or other commercial buildings.

The Measurement and Allocation of Value

If we try to measure the different blocks of value we have depicted, we find that most of these are subjective to the individual buyer. Even agricultural returns into the future (the main value block) are subjective to each individual buyer. Looking at Table 1, we have listed in the first column the average dollar return per acre to the landowner on crop share leases on high quality corn and soybean producing soils, the better soils in Illinois. These returns are given for years from 1959 through 1976. Returns in 1977 will drop to around $80. So we have a small annual increase in income over the years from 1959 through 1971 which is mainly due to increases in yield and application of new technology or improved farm organization rather than price increase. The large increase in returns beginning in 1972 through 1976 is mainly due to price increase beginning when the Russians came in and cleaned out our closet for us.

The current agricultural return block and increasing return block can be obtained by calculating the present value of future returns. If we start

at time t_1 in Figure 2, but let $t_1 = 0$ the present value will be:

$$(1)\quad PV = \int_0^{\infty} \frac{a + bt}{(1 + r)^t}\, dt = \frac{a}{r} + b \int_0^{\infty} \frac{t}{(1 + r)^t}\, dt$$

$$= \frac{a}{r} + \frac{b}{[\ln(1 + r)]^2} \qquad \ln$$

where: a = the intercept at the beginning of the period t_1 (in this case $80 per acre)

b = the slope of the increasing net revenue line (in this case $1.23 per year per acre)

r = the discount rate

t = the time in years

and: $\frac{a}{r}$ = the capitalization of a constant income into perpetuity for the current agricultural returns block of value, and

$\frac{b}{[\ln(1 + r)]^2}$ = the present value of the expected increased income block of value.

If a at t_1 is $80/acre and we use the 1976 average rate of interest charged (8.7) for federal land bank loans shown in the second column of Table 1, then the current agricultural return value is $920/per acre.

We have calculated that the slope during the period from 1959 through 1971, which was an increase due mainly to technology, was $1.23 per acre per year. Applying the second part of the formula above, we get the present value of the increased income block to be $176 per acre. This would give a total for the first two blocks of $1,096 per acre. Yet land which is of high enough quality to return $80+ per acre net to the landlord is selling for $3,000 to $3,500 per acre or about three times as much as our calculated present value. Thus we must conclude that at least some of the remaining blocks represent a highly significant part of land value.

Now let us examine the third block - Inflation Hedge. If instead of capitalizing future returns by the mortgage rate of interest, we capitalize by the "real" rate of interest we should have the present value of future returns including the hedge for inflation. The second column in Table 1 gives the federal land bank rate of interest, the fourth column gives the consumer price index, the fifth column gives the annual percent change in the consumer price index, and the sixth column gives what we define here as

Table 1. Economic Factors Related to the Price of Farm Land[1/]

Year	Net Rent	Federal Land Bank Mortgage Rate of Int.	Land Price Index	Consumer Price Index	% Change in CPI	Col. (1)- Col. (5)	Ave. Price of Corn	Ave. Price of land in Ill.	Ave. Corn Yield
1976	103.00	8.66	260	170.5	5.7	2.96	2.67	1066	127
75	80.09	8.69	209	161.2	9.1	- .41	3.20	857	126
74	107.18	8.14	173	147.7	10.9	-2.76	2.85	710.62	89
73	85.98	7.48	129	133.1	6.2	1.28	1.57	529.89	105
72	48.66	7.42	116	125.3	3.3	4.12	1.51	476.49	102
71	34.71	7.86	108	121.3	4.3	3.56	1.59	443.63	108
70	33.74	8.68	107	116.3	6.5	2.18	1.42	439.52	71.2
69	30.56	7.82	109	109.8	5.4	2.42	1.15	447.73	108.4
68	24.12	6.84	104	104.2	4.2	1.44	1.08	427.19	82.7
67	29.39	6.02	100	100.0	2.9	1.82	1.26	410.76	124.7
66	33.66	5.82	94	97.2	2.8	2.92	1.27	386.12	83.0
65	30.26	5.60	84	94.5	1.7	2.8	1.11	345.04	99.5
64	27.85	5.60	78	92.9	1.3	2.49	1.15	320.40	72.4
63	29.19	5.60	75	91.7	1.2	4.3	1.25	308.07	104.0
62	26.57	5.60	71	90.6	1.1	4.4	1.22	291.64	105.3
61	23.92	5.64	69	89.6	1.0	4.54	1.01	283.43	89.2
60	21.46	6.00	71	88.7	1.6	4.4	1.03	291.64	85.6
59	17.39	5.51	71	87.3	1.5	4.01	1.10	291.64	80.2

1/ *This information is compiled from various sources including the Illinois Farm Business Records, prices paid by farmers, and Federal Reserve Bulletin.*

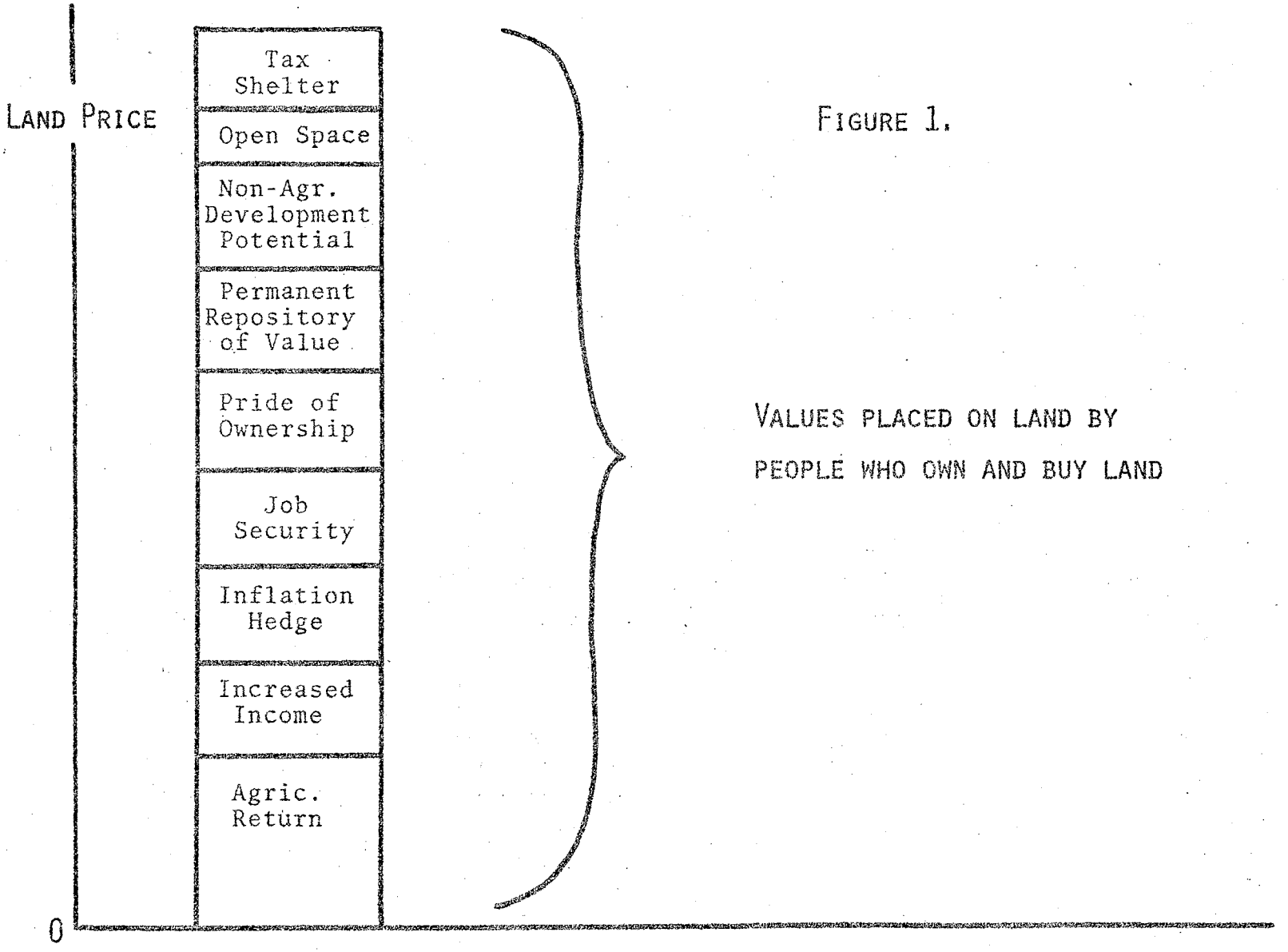
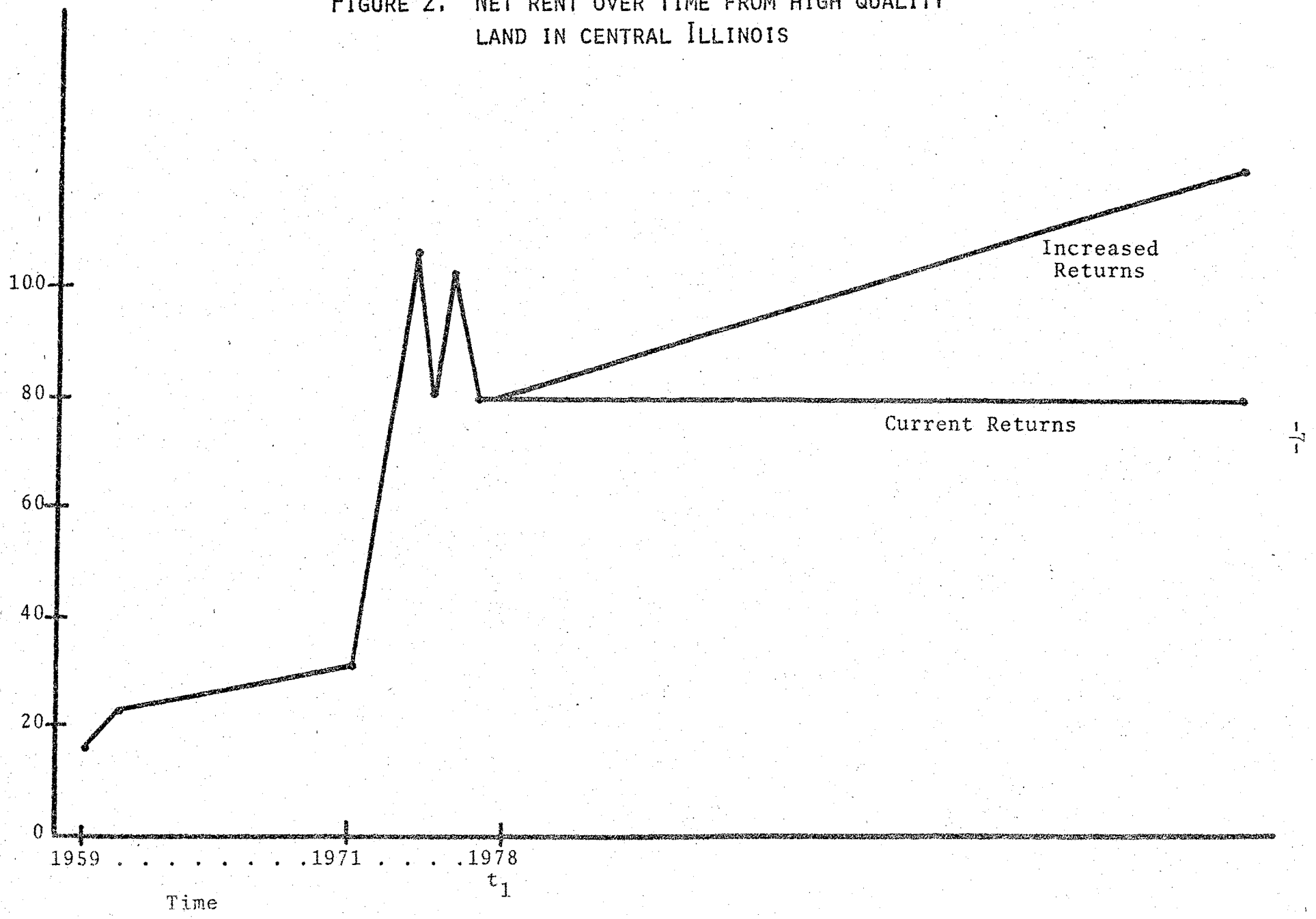

LAND PRICE
Tax Shelter
Open Space
Non-Agr. Development Potential
Permanent Repository of Value
Pride of Ownership
Job Security
Inflation Hedge
Increased Income
Agric. Return
0
VALUES PLACED ON LAND BY PEOPLE WHO OWN AND BUY LAND

FIGURE 1.

FIGURE 2. NET RENT OVER TIME FROM HIGH QUALITY LAND IN CENTRAL ILLINOIS



the "real" rate of interest relevant to land valuation. The "real" rate of interest is the difference between the percent change in the consumer price index and the land mortgage rate of interest. As we know, the rate of inflation in 1974 was greater than the rate of interest. This was true also in 1975. However, if we average 1959 through 1973, we find that the real rate of interest was 3.18%.

If we use 3.2% in our foregoing formula instead of 8.7 we get a total present value of $3,742 per acre (2,500 + 1,246). This figure would be generally above the current market by 4 to 5 hundred dollars leaving negative values for the remaining value blocks. Most buyers probably substantially discount potential future returns from inflation. At the least, a buyer thinking of property in terms of inflation would want to capture a big share of that value for himself and therefore would not pay the full present value that he might expect would result from inflation.

Although the "real" rate of interest from 1959 through 1973 was only 3.2%, the rate used by any prospective buyer to discount future returns, even if he thinks in these terms, is likely to be larger than the historic real rate of interest because of risk in all factors involved: (1) continuance of current returns, (2) increasing future returns, (3) and continuance of the past relationships of mortgage interest rate and the general rate of inflation.

In Table 1, we can see that the "real" rate of interest ranged from 4.01 to 4.54 in the first 5 years of our data and average 4.33 for the five year period. For 1964 through 1968, the range was from 1.44 to 2.92 with an average of 2.49. In the next five year period there was a wider range from 1.28 to 4.12 averaging 2.72. The real rate of interest was negative in 1974 and 1975, with a reversal in 1976. Six out of the 18 years listed or 1/3 of the time, the real rate of interest was over 4%.

In Table 2, we have calculated the present value of future returns assuming that current net returns of approximately $80 per acre will increase into perpetuity due to increases in technology at the same rate as the increase from 59 to 71, which is $1.23 per acre per year. This calculation is made for a range in rates of real interest. In making these calculations, we assume that these increases in technology and organization would occur with a stable dollar. We use the procedure given in formula (1), but with what we have defined as the "real" rate of interest to take the inflation

Table 2. The Present Value of Future Returns at Different "Real" Rates of Interest

r	Inflation Rate	a/r	$\frac{b}{[\ln(1+r)]^2}$	Total	Inflation Hedge Values	Present Value of Land at 8.7%
3	5.7	2667	1404	4075	2979	1096
3.2	5.5	2500	1224	3724	2628	1096
3.5	5.2	2285	1039	3324	2228	1096
3.7	5.0	2162	932	3094	1999	1096
4.0	4.7	2000	800	2800	1704	1096
4.5	4.2	1778	635	2411	1317	1096
4.7	4.0	1702	583	2285	1189	1096
5.0	3.7	1600	517	2117	1021	1096

hedge block of value into account. The difference between using formula (1) with the current mortgage rate of interest and the "real" rate of interest gives the value for the inflation hedge block of value. This value is shown in Table 2 in the last column. The row sum of the first two columns in Table 2 is always 8.7 thus using different rates of inflation but always the same mortgage rate from a logical and theoretical standpoint. I would expect the mortgage rate of interest to increase with inflation so that the "real" rate of interest might be about the same or even increase somewhat. However, the empirical data shows a moderate decline in the real rate of interest over the last 20 years even though the rate of inflation has been increasing.

In column 2 of Table 2 is given the rate of inflation implied by the various "real" rates of interest assuming the federal land bank rate is 8.7%. The average real rate of interest of 3.2% implies a rate of inflation of 5.5% and results in land valuation of $920 for current returns, $176 for future increases in returns due to technology for a total of $1,096 and $2,628 for inflation hedge. However, the sum of these three blocks (3,724) is somewhat more than this quality of land is now selling for ($3,200). If the "real" rate of interest is 3.7% or higher or a rate of inflation of no greater than 5%, the formula will give a land value for these three blocks of less than the total price of land. It seems hard to believe that many will actually pay out now a price that would assume a guaranteed 5% rate of inflation.

The range of the sum for these first three blocks of value for an inflation rate range of 4 to 5% is from $2,285 to $3,094 per acre. We might relate here that several tracts of land of high quality soil over the last 6 months have sold from $2,700 to $2,800; but these particular tracts had little else to recommend them, so that the additional blocks of value would be greatly compressed. Our observations would suggest this implies that buyers are subjectively using a real interest rate of 4.0% to 4.5% implying belief in a continuing rate of inflation around 4.5%

As we naturally expect, Table 2 shows that as the rate of inflation increases (without a proportional increase in rate of interest), the proportion that the inflation hedge value is of the total of the first three blocks also becomes larger. At an implied rate of inflation of 3.7% the inflation hedge is just under 1/2 of the total value, while at an inflation

rate of 5.7% the inflation hedge value becomes 73% of the combined value from earnings and inflation. Another way to look at this is: Even at a relatively high "real" rate of interest of 5% (the highest in the last 18 years was 4.5), half of the value attributable to current returns and inflation is due to expected inflation.

A Second Approach

It is our observation that most farmers who buy land are willing to mortgage an acre or more of land without debt to buy an acre. They are willing to take the net rent from at least two acres to pay for one. This says in effect that they expect to pay at least 2 times the current earning power of land for the privilege of owning it. When net returns are compared with land prices, our conclusion is that many farmers are willing to take the income from as many as three acres to pay for one.

Table 3 gives a chart showing the number of acres of land from which the net income would be required to amortize the payments on one acre over 35 years at 8 1/2% interest at various prices of land and corn. For example, if the price of corn was $2.50 per bushel, it would take the net income from 2.02 acres of land to amortize one acre of land at a cost price of $3,500 per acre. This approach takes the cash flow approach to buying land. The question is not what is the value of land, but how much land can I afford to buy, how much land can I pay for with the income and assets I already have, how much of my income and assets am I willing to pledge to buy land, and how much land will this income and assets I am willing to pledge actually buy. This is a somewhat different approach that I want only to introduce in this paper. This is one of the ways many farmers apprach land purchase.

Clearly if the cash flow approach to buying land is used, the price that will prevail for commodities produced becomes paramount in the effect on land prices. Corn prices about six months ago dipped under $2 per bushel. Using the assumption that farmers will not go beyond pledging the income from two acres of land for 35 years to pay for one, two dollar corn would limit land prices to $2,000 per acre. The government has recently settled a support price on corn of two dollars per bushel, therefore the price of $2,000 per acre essentially becomes a floor rather than a limit. Currently corn is fluctuating around $2.35 per bushel which would suggest a land price of about $3,200 per acre based on our cash flow assumptions. From our observation and analysis a farm support program will place a floor on land

TABLE 3. NUMBER OF ACRES OF LAND REQUIRED TO AMORTIZE ONE ACRE AT VARIOUS PRICES OF CORN AND LAND a/

Price Per Acre of Land	Price per bushel of corn						
	$3.00	$2.75	$2.50	$2.25	$2.00	$1.75	$1.50
	1-2 Acres Required		2-3 Acres		More than 3 Acres		
$4,000. . .	1.63	1.91	2.31	2.93	3.96	6.15	13.85
3,500. . .	1.43	1.67	2.02	2.56	3.46	5.38	12.12
3,000. . .	1.22	1.43	1.73	2.20	2.97	4.62	10.38
2,500. . .	1.02	1.19	1.44	1.83	2.47	3.85	8.65
	Less Than 1 Acre						
2,000. . .	.81	.95	1.15	1.46	1.98	3.08	6.92
1,500. . .	.61	.72	.86	1.10	1.48	2.31	5.19
1,000. . .	.41	.48	.58	.73	.99	1.54	3.46

a/ If all returns above non-land costs are used for this purpose, assuming non-land cost at $1.30 per bushel and yield at 130 bushels per acre.

Source: Illinois Research, Fall, 1977 "Returns on Corn-Soybean Farms, and Implications for Land Values" John T. Scott, Jr., Professor, Farm Management, University of Illinois. Data based on 1976 Illinois Farm Business Records for grain farms.

prices and push them upward even if the grain support price is set at or near the mean of commodity prices, because it effectively cuts off the lower half of the price distribution and substantially reduces uncertainty.

Conclusion

Thus far we have not measured or allocated values to the remaining value blocks listed so confidently in Figure 1. So far I have not deduced a way to estimate these value blocks short of conducting a survey of the behavior of land buyers. Nevertheless, I still believe they all have value. The size of these value blocks may be compressed in one situation and time and expanded in others and their proportions among each other may vary greatly from one buyer to another even on the same property with the same total cost.

This paper is partially experimental in nature and reveals some thoughts and approaches to land value and some approaches to researching this topic that are not yet well developed. Yet I believe that some of the outcomes shown here on the first three bolcks of value and in the cash flow approach add to the calculus and understanding of land values.