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Farmland Ownership

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Purchasing land can be a difficult and emotional process for agricultural producers. Many economic questions arise: Can land ever pay for itself? How much can I pay? How can my neighbor pay that much?

As an agricultural input, the supply of land is more fixed than supplies of other inputs such as labor, fertilizer or machinery. Land purchases often involve large financial commitments, which can greatly affect the farm's or ranch's financial position and financial performance.

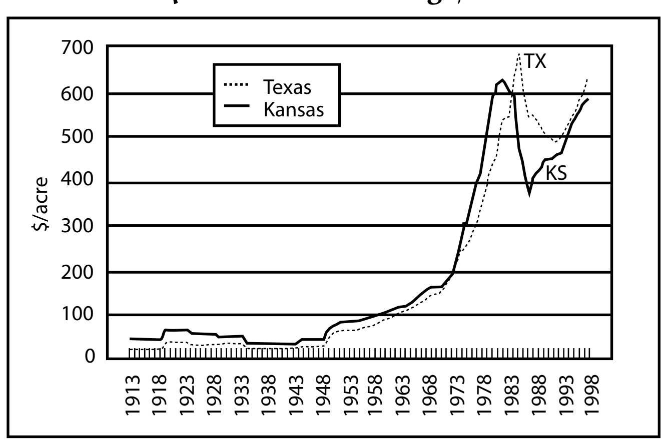
Because land is a long-term investment, expectations of future crop production costs, crop yields, crop prices, land financing costs, government farm programs, and legal issues greatly affect land prices. The planning horizon for land often extends 20 to 30 years into the future, which emphasizes the variability of expectations among individuals and across time. This variability can lead to large swings in agricultural land values.

Following a brief historical perspective of land values, this publication describes the primary determinants of land value, focusing on land rent and a related measure, rent-to-value. The maximum bid model can help with decisions about buying land.

Historical Perspective

Figure 1 depicts historical farmland (cropland, pasture and buildings) values for Kansas and Texas using Department of Commerce Agricultural Census data prior to 1950 and USDA's National Agricultural Statistics thereafter. Land values in Kansas and Texas follow a similar pattern, indicating that agricultural land is a broad market, not just a local one. Overall, from 1913 to 1998 land values grew at an annual rate of 3.2 percent and 4.5 percent for Kansas and Texas, respectively. For only the 1950-1998 period, Kansas and Texas growth rates were 4.7 percent and 5.7 percent, respectively. As a reference, the overall economic U.S. inflation rate was 3.2 percent for 1913-1998 and 3.8 percent for 1950-198.

Figure 1. Average Farm Real Estate Value, 1913-1998 (land and buildings).



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Predicting Future Land Values

Expectations about future land values are important when deciding whether to buy land. More profitable decisions can be made with accurate land value expectations. However, land values are notoriously difficult to forecast—especially 10 to 30 years in the future—which is often required of land purchase decisions. Kastens and Dhuyvetter show that using the historical annual inflation rate for the most recent 30 years is a simple and relatively accurate land value forecasting method. For example, annual inflation from 1968 through 1998 was 4.9 percent. Thus, land values are expected to advance 4.9 percent per year from 1998, meaning $1,000 land in 1998 would be $1,613 land in the year 2008 ($V_{2008} = 1000 \times 1.049^{10}$).

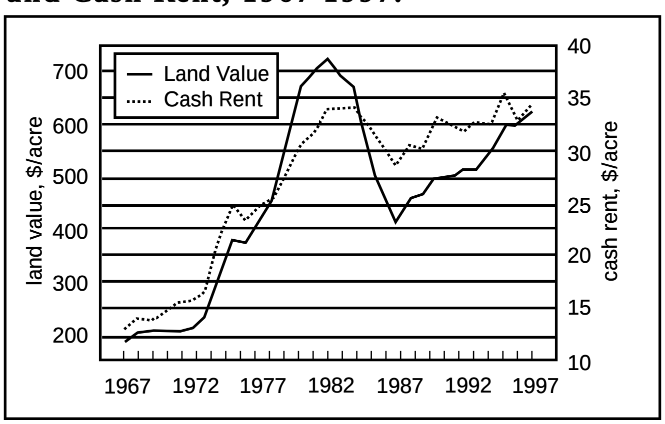
Factors Affecting Farm Land Value

In general, land values are subject to expectations about economic, social, political, and technological conditions. Because these expectations vary widely among potential landowners and across time, land values vary accordingly. Many factors affect land values, and they can be hard to measure. Expected agricultural earnings potential, or rent, is probably most important.

Rent and Rent-to-Value

The concept of rent is as pertinent for owner-operators as it is for tenants. For owner-operators, rent is net returns assigned to land—the "profit" after all opportunity costs but land costs are considered. Figure 2 shows the 1967-1997 relationship between Kansas nonirrigated cropland value and cash rental rates (rates from *Kansas Land Prices and Cash Rental Rates* and *Agricultural Land Values*).

Figure 2. Kansas Nonirrigated Land Value and Cash Rent, 1967-1997.



Rent-to-value ratios are often used to characterize the relationship between rents and land values. Rent-to-value has been directly reported by the USDA for three land classes—nonirrigated cropland, irrigated cropland and pasture. Alternatively, it can be computed as reported rent divided by reported land value. When computed, the value of buildings is included in land values, which makes computed rent-to-value ratios lower than USDA reported ratios. Over the 1976-1995 period, Kansas reported nonirrigated, irrigated and pasture rent-to-value ratios (no buildings) were 6.6 percent, 8.4 percent and 4.4 percent, respectively. During the same time comparable Texas values were 3.1 percent, 5.9 percent and 1.5 percent. Historically, rents have risen over time, causing land values to rise as well; rent-to-value ratios have been more stable.

Rent-to-value offers a quick way to value land or to determine if land is over- or under-valued. For example, assuming 6 percent is the "typical" rent-to-value and a particular parcel has a cash rent of $30/acre, then that parcel would be valued at $30 \div 0.06 = \$500$/acre. Current or future nonagricultural uses for land will cause rent-to-value to be lower than it otherwise would be.

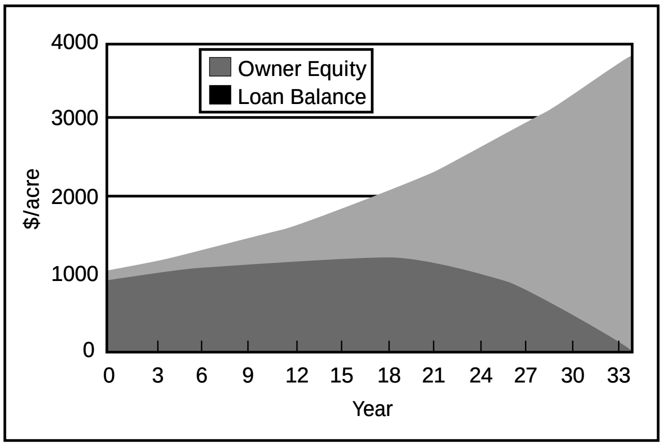
Investment Returns to Land

Because land values have risen over time, agricultural landowners get two returns, rents and capital gains. Adding the 1950-1998 capital gains rate stated earlier (Kansas 4.7 percent, Texas 5.7 percent) to the nonirrigated returns of 6.6 percent and 3.1 percent, and subtracting 0.5 percent for real estate taxes (a typical rate in both Kansas and Texas in recent years), results in total returns of 10.8 percent for Kansas and 8.3 percent for Texas. Such returns are comparable to other investments with similar risks (Featherstone and Daniel, 1998).

Financing Land

Rent, at say 6 percent of value, is not sufficient to cover principal and interest on a 100 percent loan (assuming an interest rate greater than 6 percent). However, that is a statement of cash flow, not profitability, as capital gain plus rent would offer sufficient coverage. Thus, land loans have down payments or other land that can contribute collateral mortgage and additional cash flow to meet loan payments. Interestingly, land loans that initially appear infeasible might end up being workable because of increasing rents over time. Consider a $1,000 purchase with a down payment of only $150, a rent-to-value of 6 percent (ignoring real estate taxes), capital gain and rent growth each of 4 percent, and interest of 10 percent. In the first year, the \$60 cash rent is insufficient to cover the \$85 interest (\$850 x 10 percent). But if loan principal is allowed to increase, rents that grow at 4 percent per year will ultimately make the loan pay out (Fig. 3). Of course, such loans are risky because overestimation of rent can cause such loans to fail (e.g., rent growth and capital gain of only 2.5 percent would bankrupt this loan in 13 years).

Figure 3. Financing a Land Purchase when Rent = 6%, Capital Gains = 4%, Interest = 10%, Purchase = \$1,000 and Down Payment = \$150.



Maximum Bids on Land Purchases

Land is a capital investment where profits play out over many years. Consequently, the maximum bid on land that can be supported economically is based not only on current rents but also on expectations of future rents and future land values. In determining maximum bids, it is assumed that land will be sold after a certain number of years (referred to as the horizon), typically 20 or 30 years. Whether the land will actually be sold at that time is not particularly relevant. Interest, or discount, rates also matter in determining maximum bids, as do income tax rates on ordinary income and capital gains.

Land purchase decisions depend on the present value concept. Because money earns interest (at the assumed rate i), a dollar today is worth more than a dollar in the future. That is, the future value (in some year k) of some current (year 0) cash flow, is given by $FV_k = PV_0 (1 + i)^k$. Similarly, the present value of a cash flow that won't come until year k is given by the discounting formula $PV_0 = FV_k \div (1 + i)^k$. Essentially, the amount of money that can be paid for land is the sum of: 1) the sum of the future cash rents, after paying income tax each year, discounted to the present; and 2) the value, after capital gains taxes are paid, of the supposed future land sale, after discounting to the present. Building up to a mathematical model, the maximum bid process is as follows.

1) Select a time horizon in years, N, as in $N = 30$.

2) Determine the market interest rate on land loans, r, as in $r = 0.09$.

3) Determine the typical income tax rate paid on the last dollar of earned income, t, as in $t = 0.43$. Be sure to include self-employment tax if you normally pay that on earned farm income.

4) Determine the tax rate expected on capital gains on land, ct, as in $ct = 0.15$.

5) Determine an expected annual growth rate on rents, $g1$, as in $g1 = 0.03$.

6) Determine an expected annual growth rate on land values, $g2$, as in $g2 = 0.04$. Historically, $g1$ and $g2$ have been around 0.03 to 0.05. Also, unless nonagricultural demand for farm land is expected to spur prices, $g2$ should be identical to $g1$. The two growth rates are different here to expedite the example.

7) Determine the current cash rent in \$/acre, R_0, as in $R_0 = 40$.

8) Determine the current annual property taxes in \$/acre, CPT, as in $CPT = 3$. Typically, property taxes are about 0.5 percent of land values.

9) Determine the after tax interest rate on land loans, $ar = r \times (1 - t) = 0.09 \times (1 - 0.43) = 0.0513$ in the example.

10) Determine the current after-income-tax, after-property-tax rent, $aR_0 = (R_0 - CPT) \times (1 - t) = (40 - 3) \times (1 - 0.43) = 21.09$ in the example.

11) Compute the actual bid price, BP_0, given available information.

Maximum Bid Model

$$BP_0 = \frac{aR_0 \times \{1- [(1+g1)^N \times (1+ar)^{-N}]\}}{[(1+ar) \times (1+g1)^{-1}-1] \times (1-\{[(1+g2)^N \times (1-ct)+ct] \times (1+ar)^{-N}\})}$$

$$= \frac{21.09 \times \{1 - [(1.03)^{30} \times (1.0513)^{-30}]\}}{[1.0513 \times (1.03)^{-1} - 1] \times (1 - \{[(1.04)^{30} \times (1-0.15)+0.15] \times (1.0513)^{-30}\})}$$

$$= \frac{21.09 \times \{1-[2.4273 \times 0.2229]\}}{[0.0207] \times (1-\{[3.2434 \times 0.85+0.15] \times 0.2229\})} = \frac{9.6772}{0.0073} \approx \$1,330$$

It should be noted that the maximum bid price is extremely sensitive to interest rate and choice of land value growth rates. Had *g2* been set at 0.03 instead of 0.04, as it normally might have been, the calculated maximum bid would be only $924. Had 0.08 been used for the interest rate rather than 0.09, the bid would have been $2,132 (holding $g1 = 0.03$ and $g2 = 0.04$).

If you are contemplating a land purchase, there is software that can make these calculations for you. In Kansas contact Dr. Terry Kastens in the Department of Agricultural Economics, Waters Hall, Kansas State University, Manhattan, Kansas 66506, (785) 532-5866. In Texas, The "Beef Cattle and Forage Business Management Decision Aids for Excel™ or Lotus™ for Windows" software can be purchased by contacting Dr. Jim McGrann, Department of Agricultural Economics, Texas A&M University, College Station, Texas 77843-2124, (409) 845-8012.

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