Valuing and Buying Farmland, with a Consideration of Non-Ag Features

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Introduction

The purpose of this publication is to provide background for users of the *KSU-Landbuy.xls* spreadsheet, which is a computer-based tool to help agricultural land buyers and sellers, whether producers or outside investors, make more informed land buying and selling decisions. The background is developed using historical information and economic intuition to develop a mathematical land buying model underlying the *KSU-Landbuy* spreadsheet. Those who desire less intensive understanding can go directly to the spreadsheet. Finally, although it is easier with a computer, all of the mathematics used in this paper can be handled with a pencil and paper and personal calculator. Additionally, the economic understanding and historical rules of thumb uncovered or developed in this paper should be invaluable to anyone wishing to consider a farm land investment – whether or not they use *KSU-Landbuy*.

Farmland purchasing and renting decisions invoke considerable consternation and emotion for agricultural producers and investors. This paper focuses on buying farm land and, to a lesser degree, on expected rate of return on farm land investments. A sister publication, entitled "Landowner vs. Tenant: Why Are Land Rents So High," (Dhuyvetter and Kastens, 2002), focuses on renting crop land. Both publications and related decision-aiding spreadsheets are available online at www.agecon.ksu.edu/kdhuyvetter/.

Historical Land Values

Land investment decisions depend intimately on projections of the future, and the most reliable projections often are those based on an understanding of the past. Fig. 1 depicts historical (1880-1997) farmland values (crop, pasture, and buildings combined) for Kansas and surrounding states using historical U.S. Agricultural Census data. The Census data were collected by the U.S. Dept. of

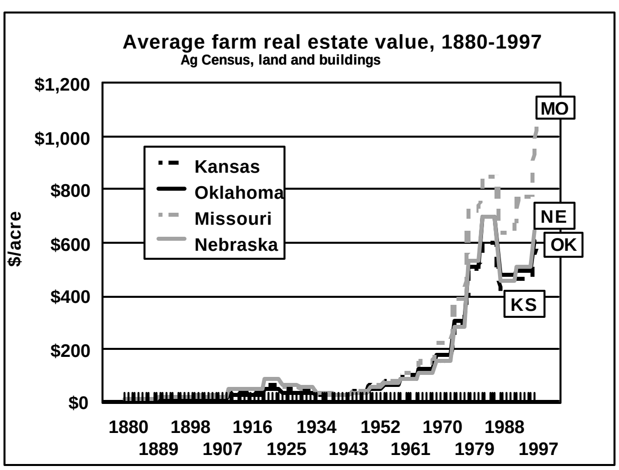

Fig. 1

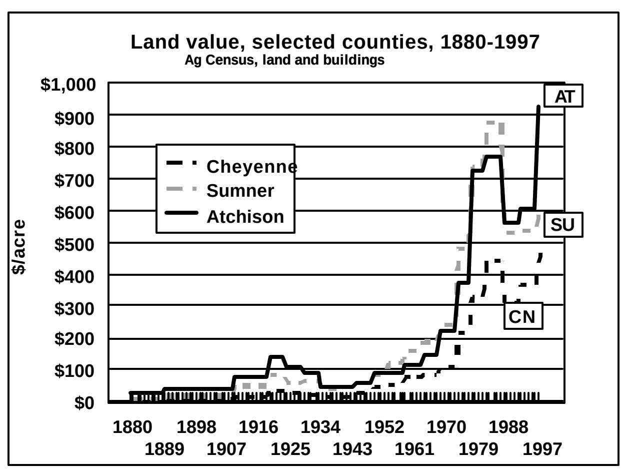

Fig. 2

Agriculture (USDA) in 1997 and by the U.S. Dept. of Commerce prior to that. Each state's values follow a similar pattern in figure 1, indicating that agricultural land is a broad market and not just a local one. Fig. 2, which compares values across three vastly different Kansas counties, makes this clear as well.

Growth Rates

Changes in the value of an investment asset, such as land, are often characterized in terms of annual growth rates. Algebraically, Eq. [1] states that the value of some asset at the end of time period *m*, referred to as V_m, is equal to its value at the end of time period *m*-1, i.e., V_{m-1}, as adjusted by the growth rate across year *m*, i.e., g_m:

$$V_m = V_{m-1} * (1 + g_m) . \quad [1]$$

For example, V_{m-1} might represent the land value at the end of year 2000, which is $605/acre, and g_m might be the annual growth rate expected throughout year 2001, say 3% or 0.03. Then, $V_{2001} = V_{2000} * (1+g_{2001})$ = $605 * (1.03) = $623.15. On the other hand, it could be that V_m and V_{m-1} are observed values and you would like to know the implied growth rate. That can be seen by solving Eq. [1] for g_m:

$$g_m = \frac{V_m}{V_{m-1}} - 1 . \quad [2]$$

After interpolating between Census years, and using annual land values from USDA's NASS (National Agricultural Statistics Service) website beginning in 1949, Fig. 3 shows end-of-year Kansas farmland values and the associated annual growth rates derived using Eq. [2]. The figure shows substantial variability in annual growth rates and a 121-year mean (i.e., average) growth rate of 3.65%.

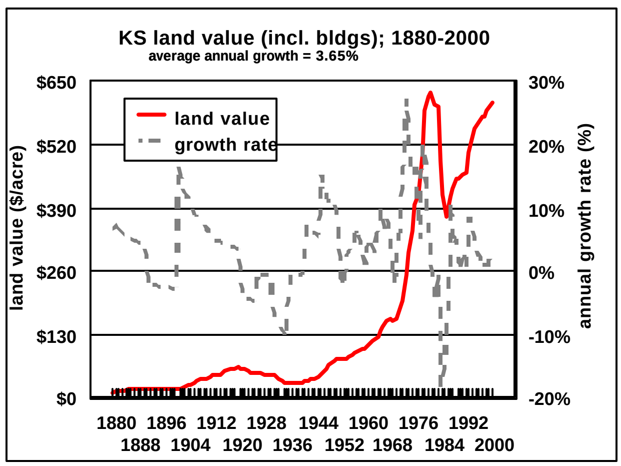

Fig. 3

The mean growth rate of 3.65% shown in Fig. 3 was derived according to

$$meangrowth = \frac{1}{121} * (g_{1880} + g_{1881} +, \ldots, + g_{2000}) . \quad [3]$$

In real-time prediction of future land values using today's land value as a starting point, the future annual growth rate is often assumed to be constant. Whenever an annual growth rate is expected to be constant across years, say from year *m* to year *n*, the associated value-growth relationship can be depicted as

$$V_n = V_m * (1 + g)^{n-m} , \quad [4]$$

where *g* represents the constant annual growth rate. Using the prior example, suppose 2000's land value of $605 was expected to grow at the same annual rate as it had in the past (i.e., 3.65%) through the year 2010. Using Eq. [4], the value in 2010 is expected to be $V_{2010} = V_{2000} * 1.0365^{(2010-2000)}$ =

$605 * 1.4312 = $865.88. Like Eq. [2], if V_n and V_m are known, Eq. [4] can be solved for g:

$$g = \left(\frac{V_n}{V_m}\right)^{\left(\frac{1}{n-m}\right)} - 1. \qquad [5]$$

For an historical time series of values beginning with value V_m and ending with value V_n, the g calculated from Eq. [5] is referred to as the geometric mean of the associated growth series. For the data underlying Fig. 3, the 1879 land value (not shown) was $10.30/acre and the 2000 end-of-year land value was $605/acre. Thus, the geometric mean was $(605/10.30)^{(1/121)}-1 =$ 0.3423, or 3.42%. Given an historical series of values, extracting the geometric mean has two advantages over using the mean. First, it is easy to calculate since it depends on only two values, the beginning and the ending value. Second, if a series is plotted that begins at the beginning value (V_m), and which grows each year at the rate of g, it will depict a smooth geometrically growing curve that will exactly pass through the ending value (V_n), which means it is a convenient tool by which to graphically generalize information regarding growth rates. For example, Fig. 4 repeats Fig. 3 only adding a geometric growth line calculated from the geometric mean as described. But, using a geometric mean rather than the mean for a growth series has two important disadvantages as well. First, it is not the statistically expected value for the series, meaning that it may not be the "best guess" for some future unknown growth rate. Second, since it depends on only two values (and the quantity of time between), it may result in an especially poor characterization of the series when the beginning or ending value is an outlier. In practice, when using historical land values to predict some distant future land value based on today's land value and an expected constant annual growth rate over time, we have observed similar forecast accuracies whether the historical mean or historical geometric mean is used as an estimate for future growth. Thus, in real-time prediction, the issue of mean vs. geometric mean is probably not particularly consequential.

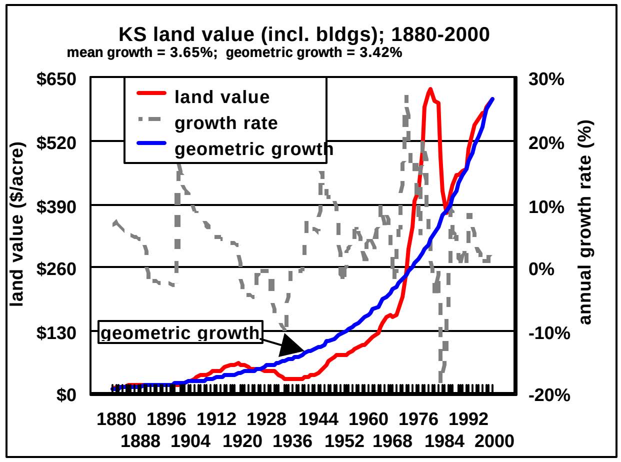

Fig. 4

Land Value, Crop Price, and Crop Yield

It is not unusual for farmers and policy makers to note instances of land prices (or other input prices) being "too high" relative to crop prices, indicating that farmers are increasingly being economically squeezed over time. For example, it might be noted that wheat price in 2000 ($2.65/bu) was essentially the same as in 1976 ($2.73/bu), yet land prices were 50% higher ($605/acre in 2000 vs. $398/acre in 1976). However, long term historical relationships indicate a much tighter relationship between crop prices and land values. For example, Fig. 5 shows Kansas land values against annual market-year average U.S. wheat prices. Although the annual variability of wheat price is much greater than that of land price, the figure shows similar long-term patterns between the two series. The correlation coefficient, which can range between -1 and 1, is routinely used as an indicator of the strength of the relationship between two series. A value of -1 indicates that two series move exactly opposite of each other; a value of 1 indicates that they move exactly together, and a value of 0 indicates no relationship. Here, the 121-year 1880-2000 correlation coefficient between land value and wheat price is 0.87. Fig. 6 shows a similarly strong relationship (correlation = 0.92) between Kansas land values and U.S. wheat yields. Finally, using a hypothetical "wheat revenue" series created by simply multiplying U.S. wheat price by U.S. wheat yield, Fig. 7 shows a very strong relationship (correlation = 0.96) between land prices and wheat revenue. Fig. 7 indicates that crop sales (assuming wheat revenue is a reliable proxy) and land values are probably strongly related, at least over the long run.

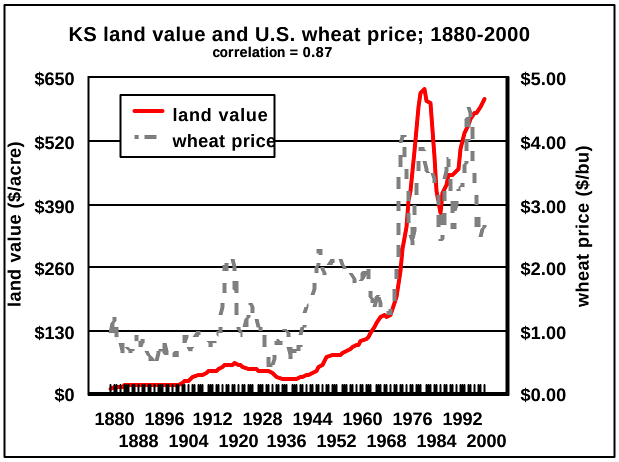

Fig. 5

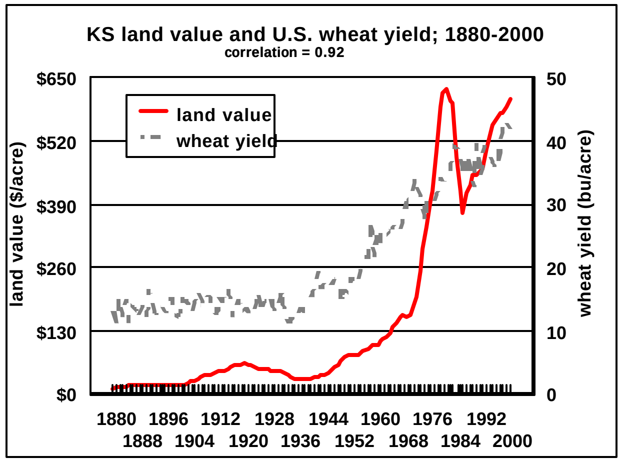

Fig. 6

Inflation

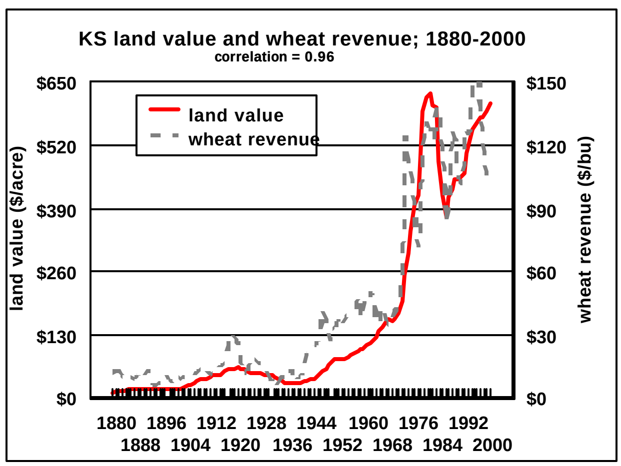

Fig. 7

Consumers and producers are familiar with the fact that prices of goods generally tend to increase over time. Economists refer to this tendency as *inflation*. For example, a pair of leather work gloves probably costs more today than it did 50 years ago. The observed change in price for the leather gloves could be used as a measure of inflation over the period. Of course, for individual goods, generalizing price patterns over time is more complex. For example, cost-reducing technologies have sharply reduced the cost of long distance phone calls and computers over time. Further, some goods are difficult to compare over time. Certainly, given improvements in productivity, reliability, and operational comfort, it would be inappropriate to naively reference the change in price between a new tractor in 1950 and one in 2000 as inflation. Consequently, economists compute inflation by measuring the change in cost over time for a fixed basket of goods. Although they could report the observed cost for the basket of goods over time, economists typically reduce the series to an index by dividing each year's cost by the cost in some particular year (the reference year of interest), and then multiply the values by 100. Thus, an inflation index might be valued at 100 in year 2000 (the reference year) and say 97.46 in year 1999 (as it actually was). In that case, the *rate* of inflation from 1999 to 2000 is (100-97.46)/97.46 = 0.026, or 2.6%. Put another way, an item with an observed price or cost of $5 in 1999 is expected to have a price or cost of $5.13 in 2000, i.e., $5 * 1.026 in 2000. Thus, the 1999 item is said to have an inflation-adjusted price (referred to as a *real* price by economists) of $5.13 *in 2000 dollars*. Of course, one might also ask, What is the real price, in *1999 dollars*, of an item with an observed price of $10 in 2000? In that case the answer is $10/1.026 = $9.75. Note that real prices must always be expressed in terms of some particular year's dollars.

The usual justification for considering inflation in an economic analysis is that decision-makers are not subject to money illusion. That is, if the government were to run the printing presses and suddenly inject twice as much money in the economy, economic behavior would remain the same (people would still buy and sell the same number of items), only observed prices would simply be twice as high.

Inflation can be expressed in terms of an index or in terms of a rate of change in that index over time (i.e., a growth rate, and referred to as an inflation rate in this case). Considering inflation in a study of observed growth rates means observed growth rates are essentially divided into an inflation rate and a real growth rate. Thus, the observed growth rate in a series from period *t-1* to period *t* (here referred to as g_t) can be considered a mathematical function of the observed inflation rate over the same time period (ir_t) and an unobserved (calculated) real growth rate (rg_t):

$$(1+g_t) = (1+ir_t)*(1+rg_t)\,. \qquad [6]$$

Eq. 6 can be solved for any of the three measures given the other two. For example, solving Eq. [6] for g_t gives

$$g_t = ir_t + rg_t + ir_t * rg_t\ , \qquad [6a]$$

which says that the observed growth rate is the sum of the inflation rate and a real growth rate, plus the product of the inflation rate and the real growth rate. Alternatively, Eq. [6] might be solved for rg_t:

$$rg_t = \frac{1+g_t}{1+ir_t} - 1\,. \qquad [6b]$$

As a numerical example, Kansas land values rose from $590/acre to $605/acre from the end of 1999 to the end of 2000, implying an observed growth rate (g_{2000}) of $605/$590 - 1 = 0.0254 = 2.54% according to Eq. [2]. As indicated earlier, the observed inflation rate (ir_{2000}) over the same time period was 0.026 or 2.6%. Using Eq. [6b] with these numbers implies the real growth in land values from 1999 to 2000 was rg_t = (1+0.0254)/(1+0.026)-1 = -0.00058 = -0.058%. Thus, it can be said that there was essentially no real growth in land values from 1999 to 2000.

It should be noted that the relationship in Eq. [6a] is often approximated with the much simpler relationship, $g_t = ir_t + rg_t$, which ignores the often-small ir_t*rg_t term. In the numerical example just given, this approximation would result in a real growth rate of -0.006 (from 0.254 - 0.26), which is very close to the real growth appropriately calculated (i.e., -0.0058). Thus, from a single-year-of-growth perspective, it probably does not matter much whether one uses the correct relationship in Eq. [6] or the simpler $g_t = ir_t + rg_t$ one. But, keep in mind that investment analysis often deals with growth rates multiplied over many years; then subtle differences can matter.

Inflation pervades many historical economic value series. For example, Fig. 8 depicts Kansas land values against an inflation index from 1880 to 2000. The index was calculated from the PCE index offered by the Federal Reserve Bank of St. Louis (1947-2000) and a CPI index obtained from the website www.lib.umich.edu/govdocs/historiccpi.html (1880-1947). The correlation of 0.94 shown at the top of Fig. 8 confirms the strong visual relationship between the series shown in the figure.

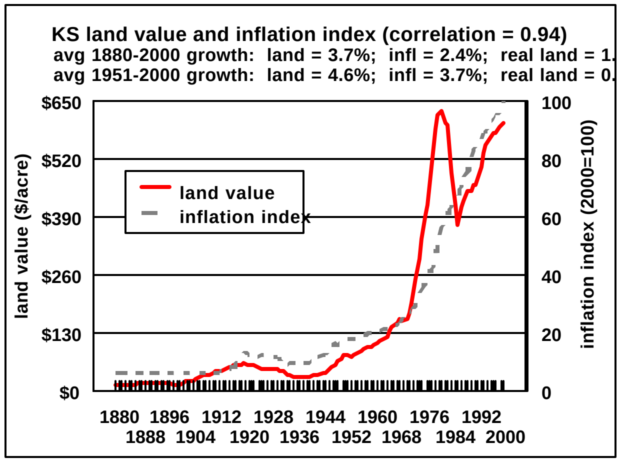

Fig. 8

As will be described later, because land is often held for long time periods (typically 30 years, according to Rogers and Wunderlich, 1993), optimal land purchase decisions will depend on accurate predictions of land prices, often far into the future. Ideally, it would be useful if the strong relationship between land price and other factors, as shown in Fig. 5-8, could be used to help forecast land prices. Unfortunately, that typically is not the case because predicting the potential land price causal factors is often just as difficult as predicting the land prices themselves. For example, having an accurate forecast of 2000's inflation index back in 1970 indeed could have lead to an accurate prediction of 2000 land value in 1970, when a parcel of land that was to be sold in 2000 might actually have been purchased. But, making 30-year-ahead forecasts of an inflation index is most difficult.

Predicting Land Values: Rules of Thumb

In the research underlying this paper, we examined numerous methods for forecasting future land values (especially 30 years ahead) using historical growth rates. We considered short-term and long-term historical average and geometric average growth rates for land values themselves, inflation, and real land values, as well as various combinations of different methods. In an out-of-sample predictive framework, even our best methods resulted in 30-year-ahead land value forecasts that were off by 50% or more on average. More importantly, 30-year prediction accuracy barely improved when we formalized land value predictions in a framework that considered historical inflation rates and historical real growth rates rather than one that included only observed land value growth rates. However, finding large prediction errors does not preclude a land buyer from making land value projections – indeed he must. It only means that, until evidence of much better forecasts is forthcoming, we see little merit in excessively complicating the land value forecasting procedures in the *KSU-Landbuy* land buying model described later. In short, measures of inflation and real growth rates are not directly used in the *KSU-Landbuy* spreadsheet, but enter only as discussion background to foster an understanding.

Further, if a *KSU-Landbuy* user does happen to have access to an inflation forecast he trusts, it is easy for him to construct expected land value growth rates from his expectation of inflation and real land value growth rates – using either the simple approximation of observed growth rates as the *sum* of inflation and real growth rates, or the more correct approach as given in Eq. [6].

Over the 121-year period 1880 through 2000, the average annual growth in land values was approximately 3.7%, which is comprised of an average inflation rate of 2.4% and an average real land value growth rate of 1.3%. For these data, the 30-year time period with the lowest average annual growth rate was 1911-1940, which saw an average annual growth rate of -0.84%. The highest 30-year period was 1950-1979, which saw an average annual growth rate of 7.76%. Arbitrarily focusing on only the most recent 50-year time period 1951 through 2000, the average annual growth in land values was 4.6%, which is comprised of an average inflation rate of 3.7% and an average real land value growth rate of 0.9%. Given the foregoing discussion, it seems reasonable to project total future annual land value growth rates in the 3% to 5% range. Notice that this is a statement about the *total* annual land value growth rate. Thus, when working with two rates, as can be done in *KSU-Landbuy*, it is reasonable to expect that the sum of the two rates should fall in that 3% to 5% range.

Time Value of Money

Invested money always has an opportunity cost – because it can always be invested elsewhere to earn a rate of return (as in some interest-bearing account). Because competing investments often have expected returns that vary in magnitude and/or in timing, investment evaluation must consider the time value of money. Eq. [4] showed how a constant growth rate impacts the future value of an investment given its value at an earlier point in time. Because an interest rate is merely a growth rate, a nearly identical equation can be used to describe the value n years in the future (V_n) of a value invested today (V_0 – today is depicted as year 0), with interest reinvested, and given an interest rate i (a percentage expressed as a decimal):

$$V_n = V_0 * (1+i)^n . \qquad [7]$$

The relationship shown in Eq. [7] also can be used to answer the question, What would be the value today of an amount of money expected to be received n years in the future? In that case, Eq. [7] is solved for V_0:

$$V_0 = \frac{V_n}{(1+i)^n} . \qquad [8]$$

Eq. [8] states that, given an interest rate of 8% (i.e., 0.08), a person would be indifferent between receiving \$100 thirty years in the future and receiving \$9.94 today. That is because $100/(1.08)^{30}$ is \$9.94. In other words, an investment of \$9.94 earning an annual interest of 8% a year (assuming the interest is reinvested each year) would grow to exactly \$100 in 30 years. Eq. [8] depicts a process known as discounting. The value V_n is said to be discounted by a discount factor equal to $1/(1+ i)^n$ to arrive at today's value V_0.

Rents

Numerous books and papers have been written about the causal factors underlying land values. Climate, soil quality, interest rates, government payments, and distance to market are a small sample of the numerous factors impacting land value. In the face of the numerous factors impacting land value, many of which are hard to measure, focusing on the most quantifiable ones is necessary in order to make management decisions regarding land investment. One important factor that is easily measurable, yet captures many of the other factors, is expected earnings or rents. Thus, having an estimate of expected rents in the future is important for determining appropriate bid prices for land.

Up to now the discussion has focused on land value growth, or capital gain. But, just as investments in common stocks have two classes of returns, cash returns (dividends) and growth returns (capital gains), so do agricultural land investments. For land, the cash returns are referred to as rents, whether they are actual rents paid by tenants to landowners, or simply the returns assigned to land for owner operators. As with stock market investments, to gain an understanding of how land investments compare to other investments, or of how much a buyer should bid for land, it is necessary to characterize land in terms of *both* cash returns and capital gains. For a more comprehensive discussion of how agricultural land returns compare to stock market investments see "Stock Market vs. Land vs. Farming Returns" (Kastens 2001).

Agricultural rents are often characterized as rent-to-value ratios, rather than as $/acre values, because such ratios are directly interpreted as percentage returns just as are the capital gains which have already been discussed. Further, rent-to-value ratios are reasonably stable over time. For example, the Dhuyvetter and Kastens (2002) paper referenced earlier refers to Kansas non-irrigated crop land rent-to-value ratios averaging approximately 6% per year. Adding that number to an average growth rate (capital gain rate) of around 4% per year implies total returns to Kansas crop land investments averaging around 10% per year.

Rent-to-value often is a quick validation test of land values. For example, suppose the market cash rent for a Kansas crop land parcel is $60/acre annually. If that parcel is offered for sale at $800/acre it likely is a good deal for the buyer – because the rent-to-value is 7.5% (i.e., 60/800) rather than the 6% expected, implying that the denominator (land value) may be "too low."

Although rent-to-value is an important way to validate land values and to express return on investment, an estimate of the $/acre rent each year in the future is needed in the *KSU-Landbuy* spreadsheet. Typically, current (year 0) market cash rent is known with reasonable certainty by potential land buyers or sellers. Then, rents are assumed to grow over time at the same rate as land values – at least for predominantly agricultural land. Mathematically, given a constant rent-to-value ratio and a constant growth rate on land values over time, this has to happen. More importantly, in a predominantly agricultural setting, rent is the only factor that can impart value to land. Thus, if rents are not expected to grow over time, neither will land values.

Time value of money discounting procedures already described can be used to answer the question, What would I pay today (year 0) for the right to collect a future stream of rents. Assume that the first annual rent will come one year after today (i.e., in year 1) and that its $/acre value is represented as R_1. Similarly, year 2's rent is depicted as R_2 and the *T*th year's rent as R_T (*T* for *T*erminal). Using *i* to represent some relevant interest rate, today's value of the future stream of *T* annual rents (referred to here as *PVR* for the $/acre *P*resent *V*alue of *R*ents) is

$$PVR = \frac{R_1}{(1+i)^1} + \frac{R_2}{(1+i)^2} +,...,+ \frac{R_n}{(1+i)^n}. \quad [9]$$

Recall that because buyers and sellers are probably familiar with today's rent (R_0) it often is most appropriate to characterize future rents in terms of today's rent and some annual growth rate, say *g*. Thus, an estimate of the $/acre rent expected in year *T* is $R_T = R_0 * (1+g)^T$. Notice that even the first rent actually received (R_1) is depicted in terms of year-0 rent: $R_1 = R_0 * (1+g)^1$. Making these changes reduces Eq. [9] to

$$PVR = \frac{R_0 * (1+g)^1}{(1+i)^1} + \frac{R_0 * (1+g)^2}{(1+i)^2} +,...,+ \frac{R_0 * (1+g)^n}{(1+i)^n}. \quad [10]$$

Mathematically, Eq. [10] can be condensed to the simpler expression $PVR = (d - d^{T+1})/(1 - d)$, where $d = (1+g)/(1+i)$. However, we leave the expression as it is because the fractional numerators on the right hand side of Eq. [10] will have meaning in the *KSU-Landbuy* spreadsheet in that they are the expected cash rents expected over future years and can be viewed to see if they appear reasonable.

Interest Rate i

What is an appropriate value for *i*, the discount rate, for someone using *KSU-Landbuy*? Although arguments to the contrary can be made, the most appropriate answer is "a market-determined fixed-rate interest rate on long-term land loans." The idea behind discounting is that investments have alternatives. Here, a long-term land loan represents a reasonable alternative investment for at least two reasons. First, an investor using debt to finance land purchases might choose between paying down debt and reinvesting a portion of land's rents into additional land. Second, an investor using equity to finance land purchases might choose to loan money to other investors for their land purchases instead. Thus, land loans and land purchases can be viewed as viable alternatives to each other. Having said that, as will be seen later, *KSU-Landbuy* also will report the internal rate of return for the land investment (and internally computed value for *i*) given the various assumptions. And, a potential land buyer can easily compare this expected rate of return to that of other competing investments of his choice.

Taxes

In planning land purchases or sales, taxes are important in many ways. First of all, in all states, a real estate tax is levied against land and buildings. For notational purposes, we refer to that tax (dimensioned as $/acre in year 0) as Ptx_0 (for *p*roperty *tax*, but not to be confused with personal property tax, which states might levy against items such as trucks and livestock). Though property tax is expressed as $/acre, rules of thumb often emerge around property tax as a percentage of land values. For example, Kansas average annual property tax rates have ranged from 0.45% to 0.72% of land value over the last 10 years. Thus, a rate of 0.6% of land value might be a reasonable estimate. Likely, in Eq. [10]'s expression of PVR, property tax is best viewed as a $/acre deduction from year-0 rent. That is, expressions of the form $R_0 * (1+g)^t$ in Eq. [10], where t is used to represent any year from year 1 to year T, should be replaced with the expression $(R_0 - Ptx_0) * (1+g)^t$. This assumes property taxes will rise over time at the same rate (g) as rents and land values, which likely is reasonable.

Income tax rates are also especially important in land value analysis. Rents are subject to income taxes and thus recipients do not get to keep 100% of the rents earned. Hence, using Itx to denote the relevant income tax rate (a percentage expressed as a decimal), the after-tax rent earned in year t is $(R_0 - Ptx_0) * (1 - Itx) * (1+g)^t$. Like rent, interest is also a taxable item. That is, both paid and received interest are subject to income taxes. Consequently, if i is used to represent some observed, thus pre-tax, interest rate (e.g., a market-reported 30-year fixed interest rate for land loans), then the i in Eq. [10] should be replaced with the expression $i * (1 - Itx)$. Thus, accounting for property and income taxes, Eq. [10] is modified as Eq. [11]:

$$PVR = \frac{(R_0 - Ptx_0)*(1-Itx)*(1+g)^1}{[1+i*(1-Itx)]^1} + \frac{(R_0 - Ptx_0)*(1-Itx)*(1+g)^2}{[1+i*(1-Itx)]^2} + ,..., + \frac{(R_0 - Ptx_0)*(1-Itx)*(1+g)^T}{[1+i*(1-Itx)]^T}. \qquad [11]$$

The income tax rate in Eq. [11], or Itx, should be thought of as a constant (over the time a land parcel is expect to be held) tax rate and typically should include all income-type taxes due on rents. Generally, for sole-proprietor owner-operators, Itx should include federal income taxes, state income taxes, and self-employment taxes. Currently (2002), marginal federal income taxes range from 15% to 39.6%, with most U.S. farmers falling on the low end of that range. The current self-employment tax rate for most owner-operators is 15.3% before the taxable income deduction equal to one half of the self-employment taxes – implying an effective self-employment tax rate of around 14%. State income tax rates vary substantially across states, but many Kansas farmers fall in the 4% to 6% range. Thus, a typical sole-proprietor owner-operator in Kansas might use an Itx value of around 34% (15% federal, 14% self-employment, and 5% state). High-income sole-proprietor owner-operators may not have to pay self-employment tax (except for a 2.9% medicare tax) but would probably see that reduction in Itx being offset by higher federal tax rates, still leaving them at an Itx rate of around 30% to 40%. On the other hand, corporate owner-operators and landowners who actually rent their land to tenants, are not subject to self-employment taxes and should thus estimate their Itx rates accordingly. Although it is possible to contrive examples where the Itx rate for rents (numerator of Eq. [11]) should be different than that used against interest in the discounting term (denominator of Eq. [11]), we believe that it is generally appropriate to consider a single Itx rate.

Besides property and income taxes, capital gains taxes also are relevant for land investment analyses. That is, when a land parcel is sold, it's taxable gain is assessed a federal tax called the capital gains tax. Although there are some nuances (e.g., when depreciable items such as wells or fences are included in the purchase price of land, or when land gets passed to heirs upon death and gets a "stepped up basis"), for *KSU-Landbuy* purposes, the taxable gain on land can be approximated as simply the expected selling price less the purchase price. More discussion around capital gains taxes is included in the next section.

Present Value of a Land Sale

The previous section described the present value of the stream of rents arising from a land investment (*PVR*). As such, it would represent the current value of the right to that future stream of rents, thus an appropriate value at which that right might be traded in an open market. But, a landowner has another important right, which is the right to sell that land at any time. Consequently, an appropriate bid on land also must account for the expected reality or even the possibility of an eventual land sale. Ideally, a land buyer would like to know when (number of years in the future) he or his heirs expects to sell the land. In practice, buyers who expect themselves to be long-term land holders simply insert a value of *T* around 30 years (since 30 years is the typical time period an agricultural land parcel is held by the same owner in the U.S.).

In words, computing the present value of an expected land sale (referred to here as *PVS*) can be described as follows. First, the taxable gain is calculated, which is simply the selling price (*SP*) less the purchase price (*PP*). Using *Ctx* to represent the relevant capital gains tax rate (a percentage expressed as a decimal), the amount of money left in year *T* after the land is sold and capital gains taxes are paid is $SP - Ctx * (SP - PP)$. But, this net money amount will not be received until year *T*, and thus must be discounted back to the present in the manner already described. In short, it must be divided by the same denominator used in the year-*T* rent term of Eq. [11]. Thus, the $/acre present value of the expected land sale can be computed as

$$PVS = \frac{SP - Ctx * (SP - PP)}{\left[1 + i * (1 - Itx)\right]^T} . \qquad [12]$$

In the forecasting-future-land-values framework discussed earlier, future land values are viewed as the outcome of a current land value growing over time at the annual rate of *g*. Although *PP* would be a natural for representing current land value, we intentionally distinguish purchase price and current market value in *KSU-Landbuy* because we want users to be able to judge the economic impact of buying land above or below the market, that is, of "getting good or bad deals." Thus, we use MV_0 to represent the current (year-0) market land value. Then, assuming the market value of land grows at a rate of *g*, the selling price can be depicted as $SP = MV_0 * (1+g)^T$. These changes modify Eq. [12] as Eq. [13]:

$$PVS = \frac{MV_0 * (1+g)^T - Ctx * \left[MV_0 * (1+g)^T - PP\right]}{\left[1 + i * (1 - Itx)\right]^T} . \qquad [13]$$

Currently (2002), the effective capital gains tax rates for land purchased in year 2001 or later and held for at least five years range from 8% (for those who otherwise would be in a 15% income tax bracket) to a maximum of 18% (for those in the highest tax bracket). Thus, many farmer land purchasers will probably use a *Ctx* value near the lower end of that range, while some farmers and many outside investors may need to consider a Ctx value near the upper end. Of course, *KSU-Landbuy* is flexible enough for users to insert any value they want for Ctx. For example, recognizing that tax policies routinely change over time, some potential buyers might expect capital gains taxes to be much higher by the time their land is eventually sold. Other potential land buyers might choose to insert a Ctx value of 0, believing their land will not be sold until they die and their land is passed with a stepped-up basis to their heirs.

How Much Can I Pay for Land?

The previous sections showed how the present value of a rental income stream (*PVR*) and the present value of an expected land sale (*PVS*) are calculated. Then, the present value of the land investment (referred to as *PVL*) is simply the sum of *PVR* and *PVS*:

$$PVL = PVR + PVS \ , \qquad [14]$$

where *PVR* and *PVS* are taken from Eq. [11] and Eq. [13], respectively. If each of a buyer's expectations (inserted into the model by his choices placed into the *KSU-Landbuy* spreadsheet) comes true over time, then purchasing the land for the price determined in Eq. [14], i.e., *PVL*, it will result in a pre-tax rate of return on the investment exactly equal to *i*. Of course, if the land is purchased at a price less than *PVL*, the pre-tax return will be greater than *i*, and lower than *i* for land purchased above the *PVL* price.

Is should be noted that whether or not land is financed has no impact on a land parcel's expected profitability – because owner equity is assigned an opportunity cost equal to the interest rate on land loans. However, the financing decision does impact risk; investments using more borrowed funds result in exacerbated return on investment (return on equity) numbers for the land investor. Consequently, the *KSU-Landbuy* spreadsheet does allow the user to input his leverage position so that he can see how his various land growth and rate assumptions might impact his return on equity at different leverage levels.

Agricultural Land as a Non-Ag Investment

A number of rising issues make treating agricultural land investment as solely an investment in farming activities less and less appropriate. For example, near urban areas, the pressure is mounting to secure agricultural land for future development of housing and business sites. Also, the demand for life-style farms and ranchettes is rapidly increasing, sometimes even far from urban centers. Additionally, the demand for on-going non-ag uses of agricultural land is increasing as well. Examples include fee-based hunting and recreational or sightseeing outings. Thus, considering agricultural land's non-ag potential is becoming increasingly important, even for states that traditionally have been considered predominantly ag states. The upshot to all of this is that traditional farm land investors, such as farmers, may increasingly find themselves out of the market because they cannot find worthwhile farm land investments by considering only expected returns related to farming. This might not be a problem if the only investment they are missing is the one near a city that ultimately will end up not being farmed anyway at some point. However, it could be a problem for farmers trying to compete with other farmers who are taking into account farm land's non-ag features in their land investments and activities. On the other side, careful consideration of farm land's expected farming returns should help non-ag farm land investors, such as real estate developers, view their investments more as a business than as a lottery, which should make them more effective competitors with other real-estate developers. Either way, understanding that agricultural land has ag and non-ag components should increase an investor's comparative advantage over those who view land investment more naively.

Modifications to the Land Buying Model to Accommodate Non-ag Returns

For years, economic researchers have devised ways to price non-market goods. For example, models referred to as hedonic models have been used to value non-market features of land such as "distance to market" or "road accessibility," even when such features are not directly priced in the market. To a certain extent that is our problem here. We observe a land parcel's value that is based partly on it's expected ag returns and partly on it's expected non-ag returns.

This part of the paper deals with constructing a new land investment model, based on the base model already developed in Eq. [9] through Eq. [14], only incorporating additional features that allow it to appropriately consider non-ag components of land investment. Additionally, we would like the new model to be able to answer the question, What does the model's assumptions imply about ag and non-ag portions of market value? That is, how much of land's current market value is attributed to its ag and how much to its non-ag features? This will be important for validating the model user's assumptions. In particular, a user would be able to compare the model-derived ag-part of land value to other land parcels he is familiar with that are thought to be more purely ag parcels. Second, he will be able to compare the model-derived ag and non-ag percentages of land's market value with what might be expected given historical data (guidelines for such expectations are provided later in this paper).

Having ways to validate the assumptions in the new land investment model is especially important because, while historical ag-returns information is thought to be readily available, historical information to guide expectations for future non-ag returns is quite sparse. More importantly, despite efforts to the contrary, USDA-collected land value and rent information likely has increasingly become an agglomeration of ag and non-ag information – and the informational contamination will probably only increase in the future. Thus, it is important to have a model where users can individualize their situations, but where some model output can readily be compared to information outside the model.

Our new mathematical model will have three additional components over the base model: a) a non-ag rent (year-0 non-ag rent is depicted as RN_0), b) a growth rate assigned to that rent, referred to as gNr, and c) a new non-ag growth rate on land value referred to as gNv. We begin development of the new model by noting that the present value of future rents (Eq. [11] in the base model) will now be recast as the sum of an ag present value of rent (*PVRA*) and a non-ag present value of rents (*PVRN*):

$$PVR = PVRA + PVRN \, . \qquad [15]$$

PVRA is described by rewriting Eq. [11] by replacing R_0 with RA_0, and g with gA, to make it clear that these are now ag-only variables:

$$PVRA = \frac{(RA_0 - Ptx_0) * (1 - Itx) * (1 + gA)^1}{[1 + i * (1 - Itx)]^1} + \frac{(RA_0 - Ptx_0) * (1 - Itx) * (1 + gA)^2}{[1 + i * (1 - Itx)]^2} +,...,$$
$$+ \frac{(RA_0 - Ptx_0) * (1 - Itx) * (1 + gA)^T}{[1 + i * (1 - Itx)]^T} \, . \qquad [16]$$

In Eq. [16], *PVRA* is the \$/acre present value of the future stream of only agricultural rents, RA_0 depicts the current (year-0) agricultural rent in \$/acre, and *gA* is the annual percentage agricultural growth rate expressed as a decimal. All other terms have already been described in relation to the base model.

The present value of the future stream of only non-ag rents (*PVRN*) is developed as

$$PVRN = \frac{RN_0 * (1 - Itx) * (1 + gNr)^1}{[1 + i * (1 - Itx)]^1} + \frac{RN_0 * (1 - Itx) * (1 + gNr)^2}{[1 + i * (1 - Itx)]^2} +,...,$$
$$+ \frac{RN_0 * (1 - Itx) * (1 + gNr)^T}{[1 + i * (1 - Itx)]^T} \, , \qquad [17]$$

where RN_0 is the expected current rental value in \$/acre associated with non-ag activities (e.g., hunting leases) and *gNr* is the annual percentage growth rate (expressed as a decimal) expected on this non-ag rent. If no non-ag renting activities are expected, RN_0 should be set to 0 in the *KSU-Landbuy* spreadsheet. Of course, the value selected for the non-ag rent growth rate (*gNr*) is immaterial when RN_0 is set to 0. If, on the other hand, non-ag rent is already firmly in place or expected to be so soon, the expected growth rate on those rents should probably be set to the expected inflation rate at a minimum. That is because well-established consumer prices often rise over time with inflation. What probably is more likely is a *gNr* value greater than expected inflation – because the demand for such non-ag activities is probably growing faster than the rate of inflation at this time.

Notice that, in Eq. [17], and unlike in its Eq. [16] ag counterpart, property tax is not subtracted from rent. Likely that is appropriate given that all or nearly all states in the U.S. no longer tax agricultural land based on its market value, but rather on its "ag use" value. Notice also that the interest rate (*i*), the land holding time horizon (*T*), and the income tax rate (*Itx*) are assumed to be the same for both the ag and non-ag renditions of the present value of rent computations (Eq. [16] and [17]).

For the new model, the \$/acre present value of the expected future land sale (*PVS*) can be computed as

$$PVS = \frac{MV_0 * [(1 + gA) * (1 + gNv)]^T - Ctx * \left[MV_0 * [(1 + gA) * (1 + gNv)]^T - PP \right]}{[1 + i * (1 - Itx)]^T} \, . \qquad [18]$$

In Eq. [18], MV_0 depicts the land's current (year-0) market value, *gA* is the growth rate on ag rents (which we simply declare to be the "ag part" of the growth rate on land's market value since that would make sense in an ag-only investment), *gNv* is the non-ag part of the growth rate on land's market value, and *PP* is the expected purchase price. Notice that the non-ag growth rate here (*gNv*) is different than the non-ag growth rate (*gNr*) in Eq. [17] to allow for flexibility in describing non-ag characteristics of land investment. For example, land buyers might want to posit a growth rate equal to inflation for non-ag rents, but one that results in a much higher total land value growth rate – but itself not necessarily higher than *gNr*, as the total land value growth rate is depicted by the term (1+ *gA*)*(1+ *gNv*). From an understanding standpoint, keep in mind that an additive framework for considering two growth rates, (1+ *gA* +*gNv*), is not dramatically different from the multiplicative one that is more theoretically correct (the total growth rate only differs by a *gA***gNv* term that will be very small). That means it is still appropriate to think of a total rate of growth that is simply the sum of its parts.

The complete model can be specified as

$$PVL = PVRA + PVRN + PVS \ , \tag{19}$$

where *PVRA*, *PVRN*, and *PVS* are taken from Eq. [16], Eq. [17], and Eq. [18], respectively. Keeping mindful of our validation goal of being able to show what the model expects for the portion of market value attributable to ag and to non-ag features, note that Eq. [19] depicts a separate present value of rents for ag and non-ag. Thus, having at least those components of land value (i.e., *PVRA* and *PVRN*) made explicit will help nail down the division of land market value into ag and non-ag. However, given the theoretical framework of the model, there is no *theoretically* correct way to develop an "ag-only" and a "non-ag-only" present value of the expected land sale whose values would add up to the present value of the expected land sale *PVS*. Part, but not all, of the problem is that we never get to observe an ag-only or a non-ag-only growth rate; rather, what we observe is land value growing by some overall growth rate. In short, *PVS* cannot be *theoretically* disentangled into additive ag and non-ag present value components. But, that should not preclude us with coming up with a reasonable, albeit somewhat arbitrary way for thinking about the question, How much lower would land value be if it were not for its non-ag growth? For example, we might start by calculating an ag-only *PVS* value, referred to as *PVSA*. To do that we would compute Eq. [18], only dropping out the non-ag growth term:

$$PVSA = \frac{MV_0 * \left[(1+gA)\right]^T - Ctx * \left[MV_0 * \left[(1+gA)\right]^T - PP\right]}{\left[1 + i*(1-Itx)\right]^T} \ . \tag{20}$$

This allows us to compute a hypothetical ag-only *PVL* value, referred to as *PVLA*:

$$PVLA = PVRA + PVSA \ . \tag{21}$$

That would seem to imply that the proportional share of land's market value that should be assigned to ag, referred to here as *AMVP* (for *A*g *M*arket *V*alue *P*ortion), is simply the relative share that the ag-only-based land present value is of the ag-and-non-ag-based land present value:

$$AMVP = \frac{PVLA}{PVL}. \quad [22]$$

Then, the proportional share of land's market value that is non-ag is simply 1 - *AMVP*. It should be noted that this division of land market value into ag and non-ag components is by no means a complete procedure. After all, if there actually was no non-ag growth, relative to Eq. [18], market value (MV_0) and purchase price (*PP*) would undoubtedly need to be lowered, which would ultimately lead to an iterative procedure that may or may not be mathematically stable. Thus, Eq. [22] should only be considered a crude approximation of ag's share of land market value. Nonetheless, as noted earlier, having a model-based estimate (even a crude one) of land's agricultural market value could be important to validate the model's assumptions. For example, a potential land buyer might find that the model-predicted ag-only market value (i.e., $AMVP*MV_0$) is much lower than what he observes for area land parcels that are essentially "purely ag." Thus, assuming his estimate of market value (MV_0) is not in question, he might adjust his expected non-ag growth (*gNv*) downward to give him more believable results.

Historical Land Returns and Ag and Non-ag Growth over Time

Among other things, the *KSU-Landbuy* spreadsheet requires its users to insert an expectation for future ag and future non-ag growth rates. To aid their selection of such growth rates, we have attempted to extract historical growth rate information by analyzing state level historical information on land values, land rents, and taxes.

State level annual land values, cash rents, and property taxes used in this historical data analysis were taken from *Farm Real Estate Values* (86010), *Farm Real Estate Taxes* (92002), *Cash Rents for U.S. Farmland, 1963-1993* (90025), USDA (1997, 1999), *Agricultural Land Values and Agricultural Cash Rents* (PLR-BB), and *Farm Real Estate Values, Rents, and Taxes*. Data from 35 states were considered agriculturally relevant and sufficiently complete to be used here. New England states, New Jersey, Maryland, and Delaware were intentionally excluded from the analysis; Nevada, Arizona, California, and New Mexico were excluded due to insufficient data. The rent-to-value ratios (*RTV*) used in this research were computed as cash rent ($/acre) for non-irrigated crop land divided by the non-irrigated crop land value ($/acre). Commensurate measures for crop land were used for states not distinguishing irrigated from non-irrigated crop land. In most cases (typically, 1967-2000), rents and *RTV* could be calculated directly from the data. In some cases (typically, 1960-1966), rent-to-value reported for all farm real estate was used directly as an estimate of non-irrigated crop land rent-to-value. Generally, land values, but not cash rents, were reported in the 1950's, meaning annual land value growth rates could easily be calculated. To fill in or back-estimate the *RTV* values for the 1950's (thus the rents themselves), a state-specific statistical regression considering *RTV* as a function of land growth was estimated using known data (typically, 1960-2000).

In the data, land values are reported as of January 1 each year (at the outset of this paper land values were assigned to the prior year, i.e., December 31, to make them compatible with earlier land value surveys and more comparable with other information from the year before). Land value growth rates are calculated from January 1 to January 1 and associated with the first January 1. Thus, the annual land value growth rate associated with 2000 is the percentage change in land value from January 1, 2000 to January 1, 2001. Cash rents are reported pertaining to the year in which they are observed, but are assumed here to be received at the end of each year. Thus, 2000's cash rent is assumed to be obtained by the landowner on December 31, 2000. Thus, the *RTV* calculated for some year can be considered the cash part of land returns for that year, only expressed as a percentage return on investment (similar to a stock dividend).

In our development of the *KSU-Landbuy* model and spreadsheet, we depicted an ag growth rate (*gA*) and a non-ag growth rate (*gNv*) rate on land value. In the historical data we observe only an overall growth rate on land value (depicted here as *gO*). In an additive growth rate framework, it would be true that $gO = gA + gNv$. Though it does not result in largely different results as already noted, the more correct and consistent way to handle multiple growth rates is in the multiplicative fashion shown in Eq. [6] and in the numerator of Eq. [18]. Thus, whatever values we estimate from the historical data for *gA* and *gNv*, it must be true that $(1+gO) = (1+gA)*(1+gNv)$, where *gO* is the observed proportional change in land's market value from one year to the next. A year-specific observed growth rate pegged to year *t*, thus throughout or "over" the *t*th year, can be computed as $gO_t = MV_{t+1}/MV_t - 1$, because land's year-*t* reported land value is as of January 1 that year, and hence the growth rate is from year *t* to year *t+1*.

Assuming, as we did in the *KSU-Landbuy* model, that the growth on agricultural rents and the ag growth rate for land values are one and the same, then an estimate of *gA* can be derived from the historically observed growth in agricultural rents. Thus, assuming that historically reported cash rents have been *agricultural* rents (as opposed to including rents tied to non-ag activities), a year-specific value for *gA* (i.e., gA_t) might be calculated as $gA_t = R_t/R_{t-1} - 1$, where R_t is the observed cash rent in year *t*. Then, gNv_t can be calculated by using gO_t, i.e., $gNv_t = (1+gO_t)/(1+gA_t) - 1 = (gO_t - gA_t)/(1+gA_t)$. Alternatively, it can be shown that a theoretically appropriate way to compute non-ag growth is from inverse changes in rent-to-value ratios: $gNv_t = RTV_{t-1}/RTV_t - 1$. Then, gA_t can be computed from gO_t and gNv_t. Because it resulted in more stable annual measures, we used the latter approach to calculate the two land value growth rates.

Using the historical data, we calculated rent-to-value ratios on an "after property tax is paid basis," and assume that all observed historical rents are in fact ag rents and not non-ag rents (which we assume are 0 in our data). Then, these values are averaged across 1951-2000 for each state and reported in the *Ag Rent* column of Table 1 at the end of this paper. These values are to be interpreted similarly to stock dividends. That is, they represent the expected agricultural cash return to ag land in the respective states, expressed as a percent of market value. It should be noted however, that using these averages as expectations for future ag rents may be less appropriate in the future because ag *rent-to-value* ratios are expected to decline over time given that land's market value likely will reflect a growing non-ag component (increasing the denominator in the rent-to-value ratio). This is not to say that ag rents in $/acre are expected to decline. On the contrary, we would expect those rents to rise at the ag growth rate. For exposition, property tax rates (% of value) for the year 1997 (the last year reported numbers could be used straightaway, without extrapolation) are also reported in Table 1 – in the column headed *Property Tax*.

As discussed above, we also computed ag and non-ag growth rates from the data that are comparable with the *gA* and *gNv* terms in the model developed earlier. More specifically, for each state and for 1951-2000, a $(1+gA_t)$ series, a $(1+gNv_t)$ series, and a $(1+gO_t)$ series were computed using the procedures already discussed. Then, the geometric mean of each of these series was computed by state. Then, after subtracting 1 and multiplying by 100 to convert the values to percentages, the state-specific "expected" *gA* and *gNv* values are reported in Table 1's *Ag Growth* and *Non-ag Growth* columns, respectively. With a slight "to make additive" modification to the *Ag-Growth* and *Non-ag* series of Table 1, Fig. 9 depicts a visual representation of the historical total returns to land by return type and by state, and ranked by non-ag growth. This "to make additive" modification was required in the graphing exercise to make the calculated growth returns (from the geometric mean framework) additive while making them still come out to the overall expected total returns (the largest single adjustment of this type was only about 0.05%). However, a handful of states had mathematically calculated non-ag growth rates that were negative. These were set to 0 so the stacked bar graph could be made (ND, OK, OR, TX, and WA). Fig. 10 shows the same information as Fig. 9, only with the states ranked by total return, and with a stock market benchmark (dividends-inclusive S&P returns).

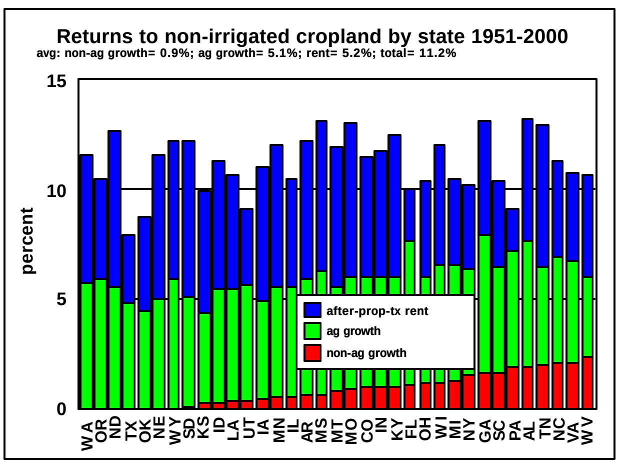

Fig. 9

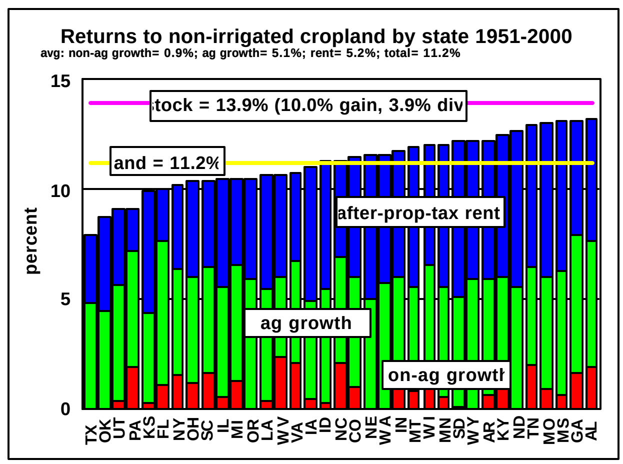

Fig. 10

To derive some history-based estimates of agricultural market value portion of land value (*AMVP*) we supplemented the historical land values and rents database with information for developing usable interest rates (*i*), income tax rates (*Itx*), and capital gains tax rates. The historical interest rates were taken to be the prevailing annual Federal Land Bank interest rates from 1951-1986 as reported in earlier version of the *Agricultural Finance Databook*. From 1987-2000 we used the most common interest rate charged on long term real estate loans in the 10th Federal Reserve District as reported in the *Agricultural Finance Databook* (Walraven). The annual interest rate is assumed to be the same for all states. The year- and state-specific *Itx* tax rate used in the various equations developed in the land buying model is the sum of a marginal federal income tax rate (*fit*), a marginal state income tax rate (*sit*), and a marginal federal self-employment tax rate (*set*). Self-employment taxes are included because our potential land buyer/seller is considered to be an owner-operator, meaning that "rental" income is subject to self-employment tax. The land buyer/seller is assumed to have a personal income of $40,000 in 2001 and associated taxable income of $30,000 (allowing for personal and standard deductions). The $30,000 taxable income, which is converted to current dollars in each year 1951-2000 using the PCE deflator, is used to compute the relevant marginal tax rates from historical data on tax rates, taxation caps, and income brackets. U.S. self-employment tax rates and caps used for computing the *set* values were from page 29 of Durst and Monke (2001), which reported values for 1955-2001; *set* values for 1951-1954 were assumed the same as for 1955. Historical federal income tax rates and income brackets used for computing *fit* values were taken from *History of Federal Individual Income Tax Rates*, which reported rates for 1951-2000. State income tax rates and income brackets were readily available for only 2001, and were obtained from an online calculator provided by Bankrate.com. Thus, we used 2001 information to compute a *sit* value for 2001 for each state, and then assumed *sit* values for other years to be the same as for 2001. Summarizing data development related to the income tax rate used in the model: $Itx_{jt} = fit_t + sit_j + set_t$, where *j* denotes state and *t* denotes year. Capital gains tax rates, caps, and brackets underlying *Ctx* in the model were from *Historical Tax Rates*.

After obtaining the data, the discounting term from the model, $[1+ i^*(1- Itx)]$ was averaged across years for each state, as was the after-property-tax after-income-tax rental rate, which is equivalent in the model (e.g., Eq. [16]) to $(RA_0 - Ptx_0)^*(1 - Itx)$. Two additional assumptions were made. First, we assumed no non-ag rents in the historical data (RN_0 and *gNr* are both 0). Second, we normalized land market values to $1 so that rent-to-value ratios could be considered rent in $/acre. Then, following each of these assumptions, we could compute an estimate of the agricultural market value portion (*AMVP*) for each state using the procedures described around Eq. [20] through Eq. [22], which is reported as a percentage in the *Ag Part of Land Value* section of Table 1 (column heading is $AMVP_{data}$). As one other crude measure, we simply calculated the percentage that the non-ag growth is of the bars in Fig. 9 or Fig. 10, making the ag part 1 minus that value. These measures are reported in Table 1 under the column heading $AMVP_{fig}$.

Trends Over Time from the Data

To generalize information from the growth rate and rent calculations from the data, we estimated simple linear time trends using statistical regression by state across the 1951-2000 time period. The average predictions from these models for a number of variables are reported as Fig. 11. The figure clearly shows ag growth rates declining over time, non-ag growth rates increasing over time and rent returns (as a percent of land value) slightly falling over time. As noted earlier, we would expect ag rent-to-value ratios to fall over time given that land values are increasingly reflective of non-ag investment features. This does not mean that rent-to-value is useless as a benchmark – in fact it has often been our most important benchmark when helping investors think through their potential land purchases – only that our benchmark itself may need to be gradually lowered over time.

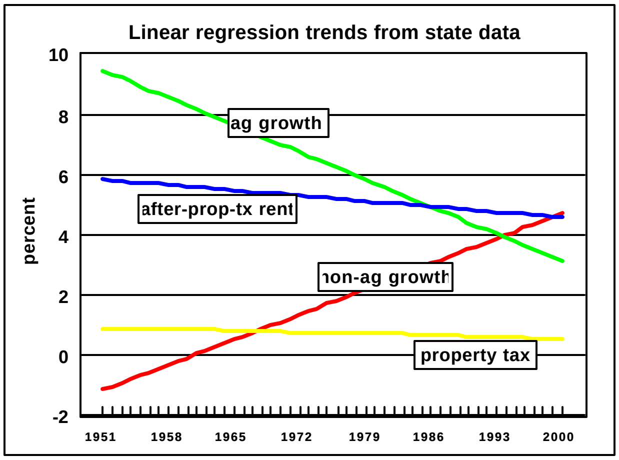

Fig. 11

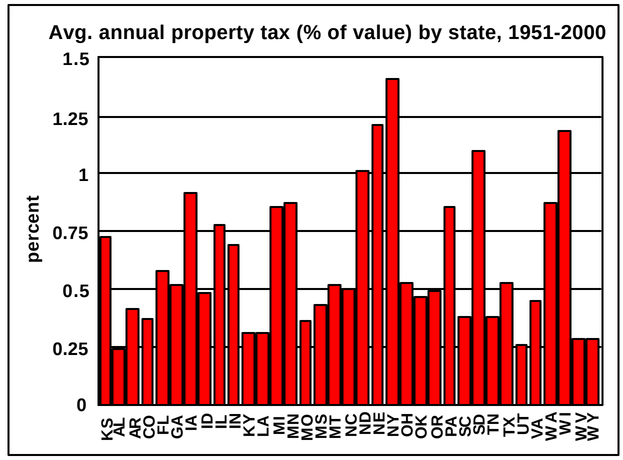

Fig. 12

Fig. 11 also shows a line for property tax rates, which have declined over time. This decline reflects the fact that all states in the study have eventually gone to "ag-use" taxation of ag land rather than market-value taxation. However, Fig. 12, which reports average 1950-2000 property tax by state, shows substantial variability across states due to taxation policies – New York, Nebraska, and Wisconsin lead the pack.

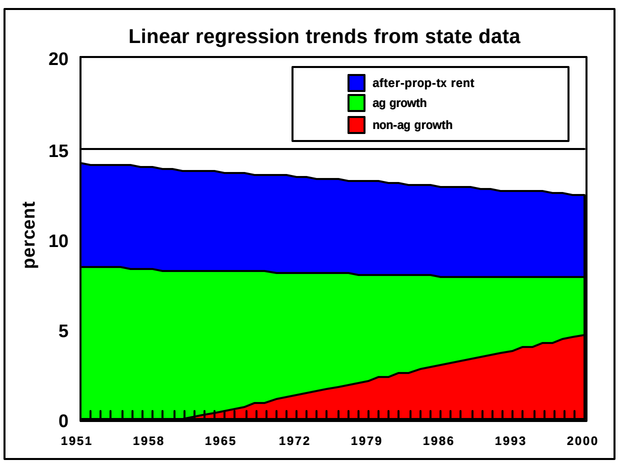

Fig. 13

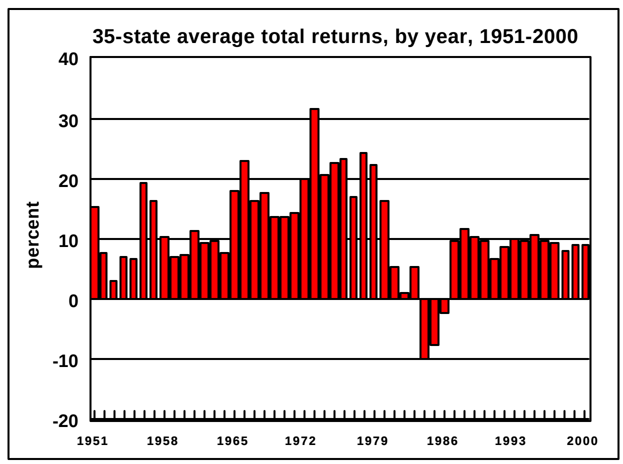

Fig. 14

Fig. 13 shows the same information as Fig. 11, only showing the time trends additively and after properly prorating the negative predicted non-ag growth values to the ag growth and rent lines. There does appear to be a slight downtrend in total land returns over time. However, Fig. 14, which shows 35-state average total land returns by year, suggests that it may be difficult to make sweeping generalizations about the expected total returns to ag land over time.

Brief Conclusion

This paper provided a somewhat detailed analysis of the background behind the *KSU-Landbuy.xls* spreadsheet for analyzing land purchases. That spreadsheet is an ongoing project for the purpose of meeting the needs of land buyers and sellers in their land transactions. As such, it will continue to see further development and refinement over time. The idea of incorporating non-ag features of land investment into the land purchase decision has been introduced in the current version of *KSU-Landbuy*. Thus, this part will surely see changes in the future. At this point, our theoretical development of the "agricultural portion of land value" is still crude, which means that those columns in Table 1 should be viewed cautiously when used as expectations for differences in land parcel prices due to differences in their being more or less purely ag. Hopefully, over time and as we get more feedback from users, these values can be estimated with greater accuracy so that decision makers can rely on them with more certainty. On the other hand, the core components of the *KSU-Landbuy* spreadsheet have been around for some time now and are quite reliable – many users have reported successful land purchases made with earlier versions of this spreadsheet. We have no reason to think that will change with the added features of the current version.

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Table 1. Expectations for certain agricultural land investment assumptions based on historical data, 1951-2000.

					Ag Part of Land Value	
state	*Ag Rent*[a] % of Value	*Property Tax*[b] % of Value	*Ag Growth,* (%); for *gA*	*Non-ag Growth* (%); for *gNv*	$AMVP_{data}$[c] % of Value	$AMVP_{fig}$ % of Value
KS	5.49	0.72	4.10	0.26	93	97
AL	5.58	0.24	5.60	1.90	59	85
AR	6.31	0.41	5.32	0.58	85	95
CO	5.45	0.37	5.06	0.90	78	92
FL	2.41	0.58	6.49	1.06	74	89
GA	5.19	0.52	6.28	1.52	65	88
IA	6.10	0.92	4.47	0.43	89	96
ID	5.78	0.48	5.17	0.28	92	97
IL	4.93	0.78	5.01	0.48	87	95
IN	5.74	0.69	4.98	0.93	77	92
KY	6.39	0.31	5.02	0.99	76	92
LA	5.12	0.31	5.10	0.34	91	97
MI	3.95	0.86	5.23	1.24	70	88
MN	6.46	0.88	5.13	0.45	88	96
MO	6.97	0.36	5.17	0.85	79	93
MS	6.86	0.43	5.58	0.60	84	95
MT	6.33	0.52	4.72	0.80	80	93
NC	4.44	0.50	4.76	1.99	57	82
ND	7.23	1.01	5.48	-0.01	100	100
NE	6.51	1.21	4.99	0.01	100	100
NY	3.86	1.41	4.77	1.48	65	85
OH	4.40	0.53	4.82	1.08	73	89
OK	4.28	0.47	4.48	-0.00	100	100
OR	4.59	0.49	5.90	-0.12	103	100
PA	1.92	0.85	5.29	1.79	60	80
SC	3.90	0.38	4.81	1.58	64	84
SD	7.08	1.10	4.98	0.08	98	99
TN	6.37	0.38	4.48	1.92	58	85
TX	3.13	0.53	4.81	-0.01	100	100
UT	3.45	0.26	5.24	0.36	90	96
VA	4.03	0.45	4.56	2.08	56	81
WA	5.82	0.87	5.75	-0.83	126	100
WI	5.50	1.19	5.28	1.20	71	90
WV	4.72	0.28	3.57	2.30	52	78
WY	6.32	0.29	5.88	0.02	99	100

[a] Ag rents already have real estate (property) tax subtracted.
[b] 1997 property tax values
[c] Interpret numbers calculated to be greater than 100 as 100.