Asset Bubbles, Inflation, and Agricultural Land Values

By Bryan Schurle, Christine A. Wilson, Allen M. Featherstone, Hugo Remaury, and Jacob Harmon

Abstract

This article discusses asset bubbles, the Kansas and Illinois land markets, estimates land values, and develops a land price/earnings ratio. Current land sales data are also examined. Finally, we examine relationships between land values and interest rates, inflation rates, and cash rents. Results show that real land values increase substantially when inflation increases. Recent land values are explored for both Kansas and Illinois with somewhat differing results. Development of land price bubbles could be enhanced if inflation becomes more widespread and land values are viewed as having good protection from inflation. Market fundamentals would suggest that an increase in land prices due to inflation occurs because of an increase in cash rental rates and not through a dramatic change in the price earnings ratio.

Introduction

Knowing current land values, forecasting them, and evaluating them relative to their earning potential are of interest to producers, landlords, investors, bankers, appraisers, and professionals in the field of agricultural economics. Such information is of even greater interest when land values are changing rapidly and with rapid change, concern arises about the potential for development of a bubble in land values. Asset bubbles have emerged a number of times in recent years in the stock market, the bond market, and the housing market. The recent bubble in the U.S. housing market caused serious consequences for the country that have not been resolved yet, illustrating just how devastating bubbles can be. Many remember the 1970s and 1980s and the rapid rise and subsequent fall of agricultural land prices, and some are concerned about the potential for a repeat of that situation. Hunter, Kaufman, and Pomerleano (2003) summarize the recent understanding of bubbles by saying that although the large gains and losses associated with asset bubbles have been well documented, surprisingly little consensus exists about the causes, characteristics, and behavior of asset bubbles. Despite this lack of consensus, all can agree that asset bubbles are problematic and a concern in the current agricultural land market.





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What is an Asset Bubble?

The term asset bubble is sometimes used to refer to different economic phenomena. Sometimes the term is used somewhat loosely to describe any period when asset prices rise rapidly and then fall precipitously. Hunter, Kaufman, and Pomerleano (2003) state that all explosive movements are not bubbles. Shiller (2000b) also argues that more than rapid movement is necessary to form a bubble. Kindleberger (1992) states that a common element of asset bubbles is that asset or output prices increase at a rate greater than can be explained by market fundamentals. A bubble also requires a feedback mechanism whereby high prices encourage people to bid higher until the bubble bursts, at which point the dropping prices encourage people to sell. Hunter, Kaufman, and Pomerleano (2003) say a loose definition is a rise in the price of an asset or asset class that generates additional increases, or a rapid upward price movement based on exaggerated beliefs about the potential of a new technology or organizational structure to generate earnings. Another common definition of an asset bubble is a situation in which asset values trade in high volumes at prices that are considerably higher or lower than market fundamentals would suggest.

Causes of Bubbles

No widely accepted theory explains why bubbles occur, but they occur under a wide range of conditions. However, none of them can individually lead to a bubble (Miller, 2002). Bubbles can occur without uncertainty, speculation, or irrational behavior (Smith, 2000). Bubbles occur even in highly predictable experimental markets, even with managers and professional traders when there is no uncertainty and participants find it easy to calculate returns (Smith, Suchanek & Williams, 1988). Bubbles can occur even if participants are trying to behave rationally (Shiller 2000b), though bubbles may be explained by emotional behavior where individuals get caught up in the enthusiasm of a rising market, or the panic of a falling market. In general, both the boom and the bust of a bubble are due to a positive feedback mechanism. For example, when prices are rising, people bid them even higher. Enthusiasm largely offsets the estimation of the asset's real value and a speculative bubble starts to develop (Shiller, 2000a). Then, when prices are falling, people quit buying and sometimes sell so that prices go even lower. These reactions are the result of "herding behavior" in the markets. These reactions are different from what happens in normal more stable markets in which high prices encourage people to buy less and low prices encourage people to buy more.

During both phases of a bubble, Keynes (1936) argued that long-term investors often ignore private information as well as their own beliefs and imitate other investors so they don't jeopardize their reputations. He explained, "It is better for reputation to fail conventionally than to succeed unconventionally." This mentality causes many investors to follow market trends instead of following rational information.

While there is no widely accepted theory for why bubbles occur, asset bubbles have been associated with low interest rates and high liquidity. These conditions lay the foundation on which bubbles can develop. As will be seen in this paper, these conditions exist currently in production agriculture because crop incomes have been exceptionally high for several years, interest rates have been exceptionally low, and, on average, the financial condition of farms has been good and improving.

Impacts of Bubbles

Asset bubbles are more damaging if they are leveraged than if they are built on equity. The latest housing bubble, for example, was exacerbated with debt, that contributed to the severity of the bubble because as housing values fall, house mortgages go underwater, which forces more houses on the market, which again pushes down values. In addition, the bubble cannot be easily contained because of spillover effects in other industries like the banking sector. If assets are purchased with cash and prices drop, the investment may not provide a good return, but the market is not flooded with more assets due to forced sales that further depress prices. Therefore, the effects are less likely to spill over into other markets. Anecdotal evidence suggests that the current increase in land prices is partly due to the investment behavior of producers who have other investment opportunities that offer relatively low returns or high risk, so they invest in land instead with little use of debt. Notably, the agricultural land crash of the 1980s was similar to the current housing market crash, whereas current land investments are made more as an investment of past income that has been generated within agriculture. So, while some of the conditions that are favorable to bubble development exist, the current use of cash rather than debt for land purchases reduces the threat of land prices falling "too much" due to a surge of foreclosed land on the market.

Fundamentals of the Land Market

In theory, land values are influenced by the fundamentals in the market which are incomes from the land, and interest rates. Land values increase when incomes increase, and increase when interest

rates decrease. Thus, the relationships between incomes and land prices and between interest rates and land prices are important to consider.

Figure 1 shows land values (NASS) and accrual farm incomes (Kansas Farm Management Association) for the state of Kansas. Land values have risen rapidly in Kansas during the past few years, increasing on average by 7.9 percent per year since 2005. This is a much faster rate of increase than the 3.8 percent increase on average from 1988 to 2004. Figure 1 shows the increase in land values accelerating in 2005. Accrual net farm incomes from the Kansas Farm Management Association averaged $32, 197 per farm from1999 to 2002, $54,392 from 2003 to 2006, and $126,103 from 2007 to 2010. Land values began their steep increase in 2005, during the middle period when farm incomes improved, which coincides closely with the first rapid rise in crop prices.

Figure 2 shows land values (NASS) and interest rates (Federal Reserve Bank of Kansas City) for real estate loans. Interest rates may also influence land values substantially. The general trend has been toward lower rates since a peak of 18.5 percent in 1981. Interest rates in 2010 were at a low for this period at just over six percent. Land values increased from $199 per acre in 1973 to a peak of $628 in 1982 before falling to $373 per acre in 1987. Since then, land values increased, averaging 3.8 percent per year until the more rapid increase which began in 2005. In 2010, the average land price was $1,060 per acre.

Looking for Bubbles in Land Values

We have defined an asset bubble as an asset value that deviates substantially from what the market fundamentals support. So, to identify an asset bubble, we must compare values in the market to values based on fundamentals of the market. We calculated land values based on the fundamentals of income from the land, and interest rates. The present value of an annuity in perpetuity is equal to income divided by interest rate. For our purposes we calculated the expected income per acre as the net farm income for the state (ERS) divided by the number of acres of land in farms in the state (ERS). We also calculated a five-year moving average of the income stream to smooth the income pattern. Then we divided this moving average by the interest rate for real estate loans (the expected interest rate) which gives us the land value based on historical fundamentals. These values can then be compared to current land values to determine if there is evidence of a land price bubble. Figure 3 shows the calculated land values and the market values (NASS) for land in Kansas. Land prices diverged significantly from the calculated values from 1977 through 1984. This suggests the presence of an asset bubble during that period. However, recent trends in actual values and calculated values show that both are increasing, and that market values are not diverging significantly from the calculated trends in this chart. This suggests that an asset bubble does not appear to be developing through 2010 in Kansas when average land prices are used. The calculated price represents only the value of the income from the land. The difference between calculated prices and actual land prices is due to the value of the potential appreciation in land price that the land owner receives in addition to the value of the income from the land.

Price earnings ratios are used extensively to evaluate whether the stock market is overpriced or underpriced. The S&P P/E ratio provides an indication of whether the stock market is high or low relative to past price-earnings relationships. To look for the potential emergence of a land price bubble, we developed a Kansas land price-earnings ratio similar to the one calculated in the stock market. The Kansas land P/E ratio was calculated as the market land price (NASS) divided by the five year moving average of income per acre. Income per acre was calculated the same as it was above, which was a five-year moving average of income for the state (ERS) divided by number of acres in farms (ERS). The Kansas land P/E ratio is shown in Figure 4. From 1966 to 1977, the Kansas land P/E ratio averaged about 18. From 1980 to 1984, the P/E ratio averaged almost 71, an indication of a bubble. From 1987 to 2010, the P/E ratio averaged 19.4, and the P/E ratio in 2010 was just over 21. Note that the Kansas P/E ratio in 2010 (the last year for which data are available) is not out of line with historical relationships suggesting that current USDA prices may not be out of line with incomes in agriculture in Kansas.

These previous approaches to identifying asset bubbles were also applied to data from Illinois. Figure 5 shows NASS land prices and calculated prices, calculated in the same way as they were calculated for Kansas. It is again possible to see the large gap between calculated price which is lower and the actual prices which are higher in the late 1970s and early 1980s. This suggests the presence of an asset bubble at that time. Unlike Kansas, there appears to be an increasing spread between calculated prices and NASS prices after the late 1980s, and the gap appears to be quite large with a NASS price of $4,650 and a calculated value of $2,040 in 2010. Figure 6 shows the Illinois Land P/E ratio, again calculated as it was for Kansas above. The P/E ratio averages 18.8 from 1966 to 1976 which is very similar to the P/E ratio from Kansas for that period. Then the P/E ratio averages 47.8 from

1980 to 1988, a sign of an asset bubble. Unlike Kansas, the P/E ratio again trended up significantly from its low of 26.4 in 1994, and has been averaging 42 from 2001 to 2010. This is significantly higher than the P/E ratio of 21 in Kansas in 2010. This may suggest the potential of an asset bubble development in Illinois, though the difference could also be explained by non-agricultural development pressures.

Use of Land Sales Data

One of the difficulties in this analysis is gaining access to the most current land price information as well as current incomes. When values are changing rapidly, accessing the most current data is crucial. We examined farm land sales data from the state of Kansas to look at price levels from the last few years. The data were obtained from the Kansas Society of Farm Managers and Rural Appraisers which maintains a land sales database. Table 1 shows values from USDA surveys and from land sales data. The USDA data show increases in land values averaging less than four percent until 2011 when they increased by 13.6 percent. However, note the average of 9.6 percent increase in values for three years in the sales data followed by a 13.1 percent increase in 2011. The sales data values are lower in 2007, but values in 2011 are over 14 percent higher. Shultz (2006) reports by comparing land values developed from surveys and actual sales data that land value surveys results were six and nine percent lower than market sales. He also found that differences between surveys and market values were not constant over time and appeared to be increasing at that time. He suggested that differences may have been increasing at that time due to rapidly increasing land values and that opinion surveys may not be identifying land value changes as quickly as they are occurring. Shultz was evaluating an earlier period of time, but his arguments may be applicable to the present.

When comparing average land values to calculated values, and examining land P/E ratios, we observed that current average land prices in Kansas do not appear out of line with historical relationships. However, it may be useful to examine individual sales data to examine the range of prices. Figure 7 shows the distribution of Kansas sales price data in 2010. Notably, more sales fell in the price range from $1,000 to $1,200 per acre than any other range. Although several high prices are listed, several prices fell into the lower $200 to $400 per acre range. The lower priced land was likely lower quality or pasture and was likely in the lower priced regions of Kansas. The sales data reported have no controls for the types of land or location of land, so comparison between years needs to be made with that in mind, as well as the fact that land sales of different qualities and in different locations may be some of the reason for the change in values over time.

Kindleberger (1978) identifies three stages in the prelude to a crisis. We feel it may be useful to apply these same three stages to the development of an asset bubble. The three stages are: 1) an economic shock that reflects structural change outside the experience of most people and that objectively justifies higher prices (a "new era"); 2) rising investor confidence, leading to the increased use of leverage and speculative instruments; and 3) a herding effect, where demand increases because prices are going up. If we apply these stages to the current agricultural land market, we could argue that we are certainly in stage 1. Development of the ethanol industry and overseas markets are the most commonly identified reasons that we are in a "new era." How far we are into stage 2 and stage 3 is debatable, but anecdotal information suggests that much land is being purchased with cash equity rather than through the use of high leverage (debt).

Looking ahead to potential events that could move the land market into the higher stages identified by Kindleberger may have some merit. Increases in inflation in the future could increase investor confidence, which could lead to increased use of leverage. This might add momentum to the development of a bubble in the land market, caused by increased confidence that the land market is a good investment with protection from inflation. Along with lending practices that accommodate the use of leverage for the purchases, this could accelerate the formation of a land price bubble.

Relationship Between Inflation and Land Values

To understand how inflation may affect land values, historical data were obtained so that the relationship between inflation and land values could be investigated. Table 2 contains the mean values for inflation adjusted interest rates, inflation rates, and nominal and inflation adjusted land values and cash rents. All data are from 1967 through 2010. The cash rents and land prices are from the annual land value and cash rent survey (http://www.nass.usda.gov). The interest rates are the average effective interest rate on non-real estate bank loans made to farmers from the Agricultural Finance Databook (https://www.kansascityfed.org/research/indicatorsdata/agfinance). The inflation rate was calculated from the personal consumption expenditures (PCE) index of the GDP deflator from the Saint Louis Federal Reserve bank (http://research.stlouisfed.org/fred2/). The land values, cash rents, and interest rates were adjusted for inflation using 2010 as the base year.

Many have argued that land ownership is an excellent hedge against inflation. To understand the effects of inflation on land values, the growth stock model (Featherstone and Baker, 1987) can be used where expected cash rent is discounted to estimate land prices. The growth stock model suggests that price of land is:

1) $$P_0 = \frac{\text{Cash Rent}_1}{(r-g)}$$

where r is the expected nominal opportunity cost of capital or discount rate, *g* is the expected growth rate, and Cash Rent_1 is the expected income from the land investment. Growth can be determined by using expected changes in cash rent over time and is also related to inflation. This allows the determination of the price of land with regards to current expectations on future inflation and growth in cash rents.

To examine the effect of inflation in the denominator of equation 1, the following equations are needed:

2) $$r = (1+I)(1+r^*)-1$$

3) $$g = (1+I)(1+g^*)-1$$

where *g* and *r* are the expected nominal interest and growth rates, respectively, *I* is the inflation rate and the * converts the nominal rates to real rates.

Substituting equation 2 and 3 into 1, results in:

4) $$P_0 = \frac{\text{Cash Rent}_1}{\left(((1+I)(1-r^*)-1)-((1+I)(1+g^*)-1)\right)}$$

Rearranging 4 results in:

5) $$P_0 = \frac{\text{Cash Rent}_1}{\left((1+I)(r^*-g^*)\right)}$$

Thus, the denominator is a function of (1+I) and (r^*-g^*). Thus, unless inflation (I) is large, there is not a large difference in the denominator whether it is the subtraction of nominal rates or real rates. This would suggest that inflation changes may not have a large effect on the capitalization of the expected land return. Only the increase in cash rent due to inflation will affect the path of land prices over time. Rearranging 5) by dividing both sides by cash rent to get a Price/Earnings ratio, illustrates that an increase in the inflation rate should actually decrease the P/E ratio slightly and not increase it, according to market fundamentals.

Table 3 illustrates the correlation among variables in the land value model. The nominal land value is highly correlated with cash rent in both Kansas and Illinois (92.8% and 92.3%, respectively). Land values are less correlated with the inflation rate in Kansas and Illinois (-30.1% and -30.9%) indicating inflation rates move opposite land values. The inflation rate has a stronger effect on cash rent than on the value of land in both Kansas (-34.1%) and Illinois (-35.1%).

Correlation alone can sometimes provide misleading results when compared to a regression model. Table 4 shows the results of a regression model for estimating nominal land values. Nominal land values are estimated as a function of nominal cash rent, real interest rates, and inflation. The regression for Kansas has an R-squared of 0.94 and the regression for Illinois has an R-squared of 0.95. With a t-test on the inflation estimate for Kansas of -0.42 and for Illinois of -0.93, there is a strong probability that inflation rates do not affect land values. While the sign on inflation is not statistically significant, the sign is negative as expected in equation 5. Equation 5 would also suggest that the amount would be small economically, thus it would not be surprising to see a statistically insignificant effect. The cash rent and the real interest rate variables are statistically significant in predicting nominal land values and have the expected sign. Thus, the effect of inflation on land values occurs through the cash rent variable. As cash rent moves up, the price of land does also.

Concluding Comments

Evaluation of historical relationships between income, interest rates and land values suggest that, while land prices have increased substantially in Kansas in recent years, the average USDA reported values appear to be in line with calculated values, and the land price divided by per acre farm earnings (P/E) ratio of 21 is not significantly out of line with historical ratios. However, Illinois data show some divergence between calculated values and USDA values, and the P/E ratio for Illinois does appear to be high (35.8) relative to historical levels. There also appears to be some divergence between sales data prices and prices reported by USDA in Kansas with sales prices increasing more rapidly than USDA prices. In addition, there are a small number of extremely high prices in the sales data that raise concern about the potential emergence of an asset bubble in Kansas.

Many are concerned that interest rates will increase and incomes will decrease, both of which would put downward pressure on the fundamentals that support the price of land. Both of these could change rapidly, thus resulting in current land prices at an unsustainable level. A rapid change in the fundamentals that support the high prices may make the market in hindsight look like a bubble.

Some are convinced that we are in a new era of higher incomes from land. This provides the basis for moving into Kindleberger's first stage. The second stage is increased confidence that we are truly in a new era. This stage occurs when leverage increases due to confidence that we are indeed in a new era. Belief that land is good protection from inflation could increase confidence that land is indeed a good investment, which could encourage the land market into the second stage in the development of a crisis. Herding behavior is the final state that results in a bubble that can have serious consequences. However, it is important to recognize that the herding behavior that could follow is not consistent with economics unless farm income or cash rent increase to a level that supports the higher land values at expected interest rates.

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Table 1. Average land price in Kansas from USDA surveys and the average from sales data

Year	USDA	% Increase	Sales Data	% Increase
2007	$980	----	$965	----
2008	1,020	4.1%	1,086	12.5%
2009	1,030	1.0%	1,099	1.2%
2010	1,100	6.8%	1,265	15.1%
2011	1,250	13.6%	1,431	13.1%

Source: Farms, Land in Farms, and Livestock Operations Summaries: Released by National Agricultural Statistics Service (NASS), U.S. Department of Agriculture. http://www.nass.usda.gov/ and Kansas Society of Farm Managers and Rural Appraisers www.agecon.ksu.edu/ksfmra

Table 2. Summary statistics for inflation adjusted interest rates, inflation rates, and Kansas and Illinois nominal and inflation adjusted land values and cash rents, 1967-2010

	Average	Standard Deviation	Minimum	Maximum
Inflation Adjusted Interest Rate	5.14%	2.55%	-1.40%	9.86%
Inflation Rate	3.99%	2.51%	0.31%	11.03%
Kansas Nominal Land Value	$516	$241	$144	$1060
Kansas Inflation Adjust Land Value (2010 $)	$906	$226	$658	$1447
Kansas Nominal Cash Rent	$30.30	$8.37	$13.00	$40.50
Kansas Inflation Adjusted Cash Rent (2010 $)	$57.65	$14.28	$42.40	$88.49
Illinois Nominal Land Value	$1,852	$1,099	$449	$4650
Illinois Inflation Adjust Land Value (2010 $)	$3,124	$970	$2032	$5085
Illinois Nominal Cash Rent	$96.01	$35.87	$29.69	$169.00
Illinois Inflation Adjusted Cash Rent (2010 $)	$173.45	$37.21	$135.79	$254.48

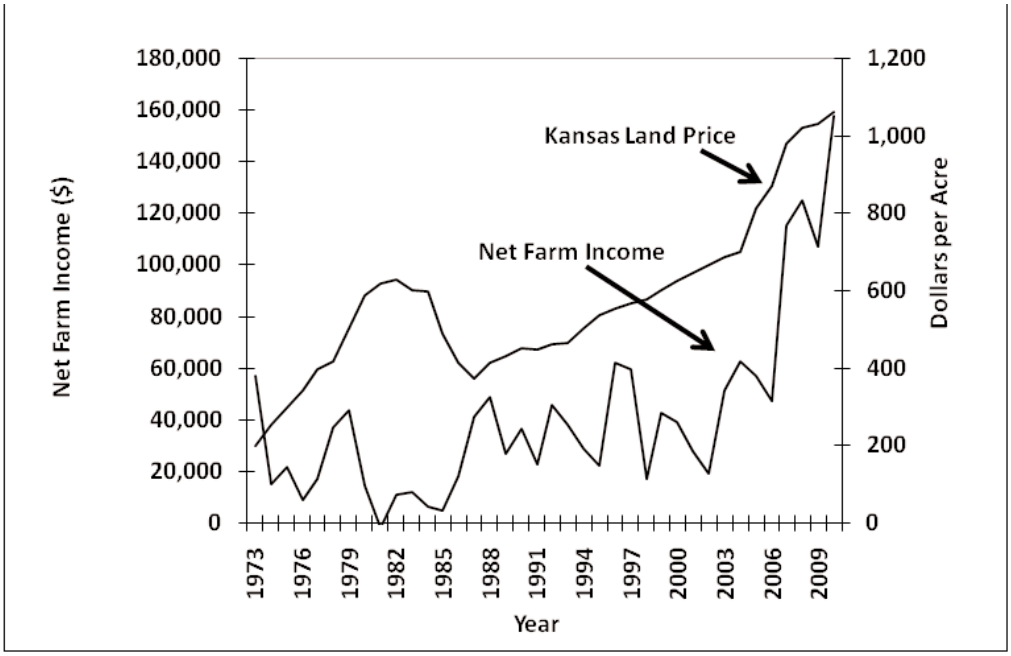
Table 3. Nominal land value correlation for Kansas and Illinois

	Cash Rent	Inflation Rate	Real Interest Rate	Land Price
	Kansas Correlation			
Cash Rent	1.0000			
Inflation Rate	-0.3413	1.0000		
Real Interest Rate	0.3054	-0.3260	1.0000	
Land Price	0.9280	-0.3005	0.1332	1.0000
	Illinois Correlation			
Cash Rent	1.0000			
Inflation Rate	-0.3508	1.0000		
Real Interest Rate	0.2633	-0.3260	1.0000	
Land Price	0.9234	-0.3089	0.0224	1.0000

Table 4. Nominal Land Price Forecast Model for Kansas and Illinois

Kansas Model				
R Squared	0.94			
Adjusted R Square	0.89			
Standard Error	85.16			
Observations	44			
	Coefficients	Standard Error	t Stat	P-value
Intercept	-242.19	66.82	-3.62	0.00
Inflation adjusted cash rent	28.30	1.69	16.74	0.00
Inflation rate	-239.82	568.11	-0.42	0.68
Real interest rate	-1702.26	572.42	-2.97	0.00
Illinois Model				
R Squared	0.95			
Adjusted R Square	0.91			
Standard Error	347.37			
Observations	44			
	Coefficients	Standard Error	t Stat	P-value
Intercept	-345.93	238.75	-1.45	0.16
Inflation adjusted cash rent	29.77	1.60	18.61	0.00
Inflation rate	-2164.75	2332.65	-0.93	0.36
Real interest rate	-11150.84	2311.40	-4.82	0.00

Figure 1. USDA land price per acre and average net farm income for farms in the Kansas Farm Management Association



Source: Farms, Land in Farms, and Livestock Operations Summaries: Released by National Agricultural Statistics Service (NASS), U.S. Department of Agriculture. http://www.nass.usda.gov/ and Kansas Farm Management Association http://www.agmanager.info/kfma/.

Figure 2. USDA average land price in Kansas and long term interest rates

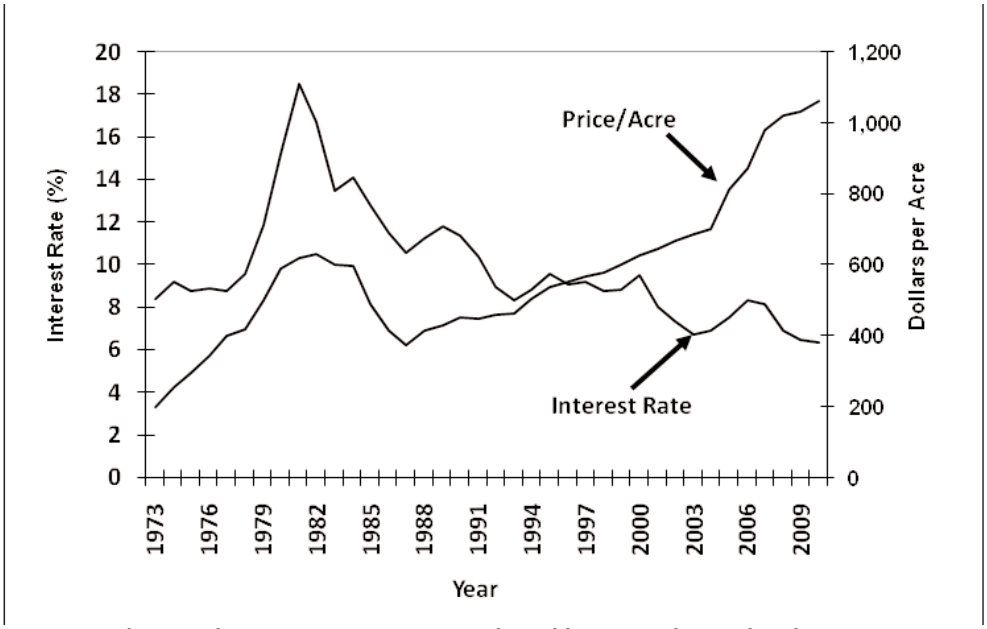


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Figure 3. USDA average land price in Kansas and land price calculated based on agricultural incomes in Kansas and interest rates

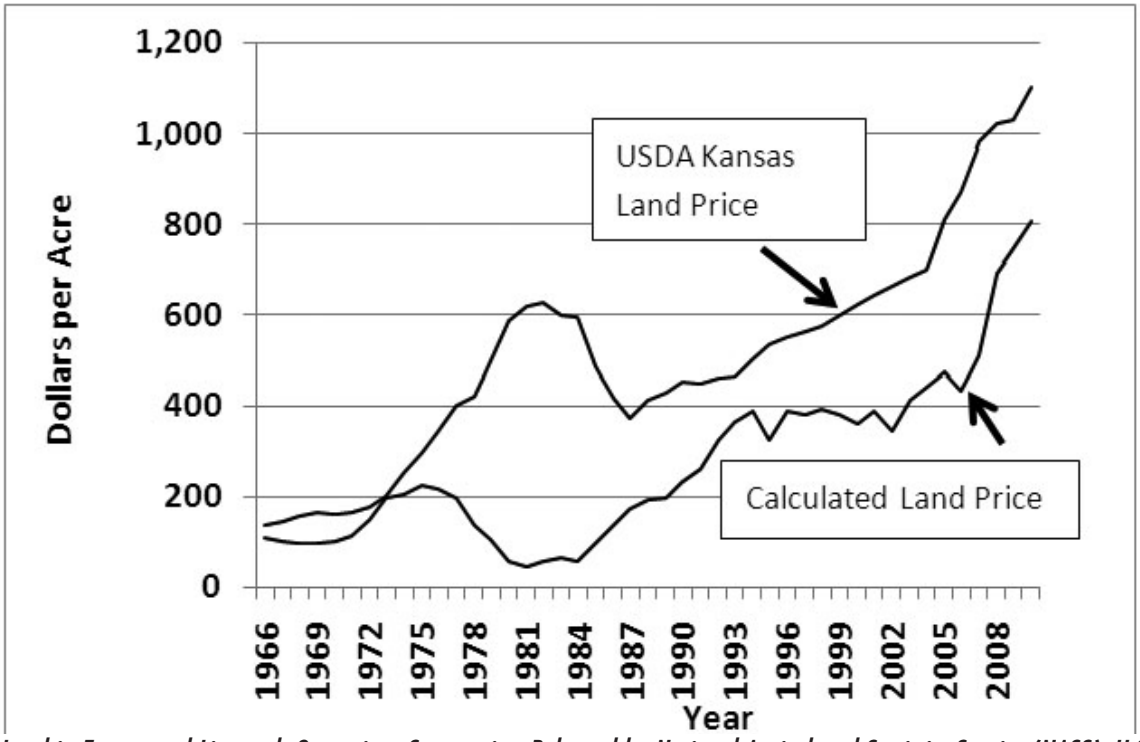

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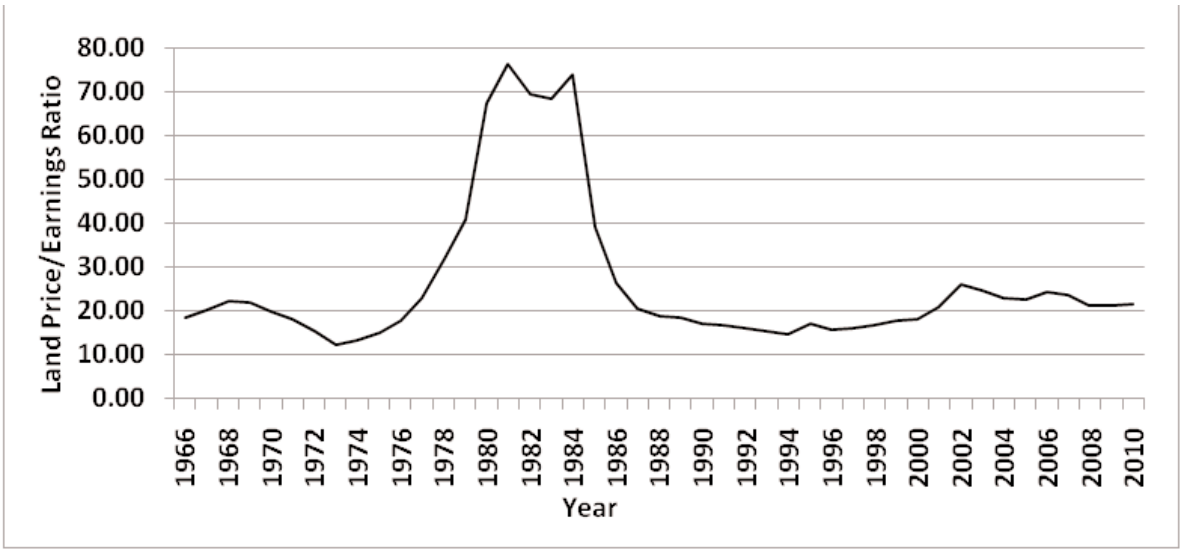
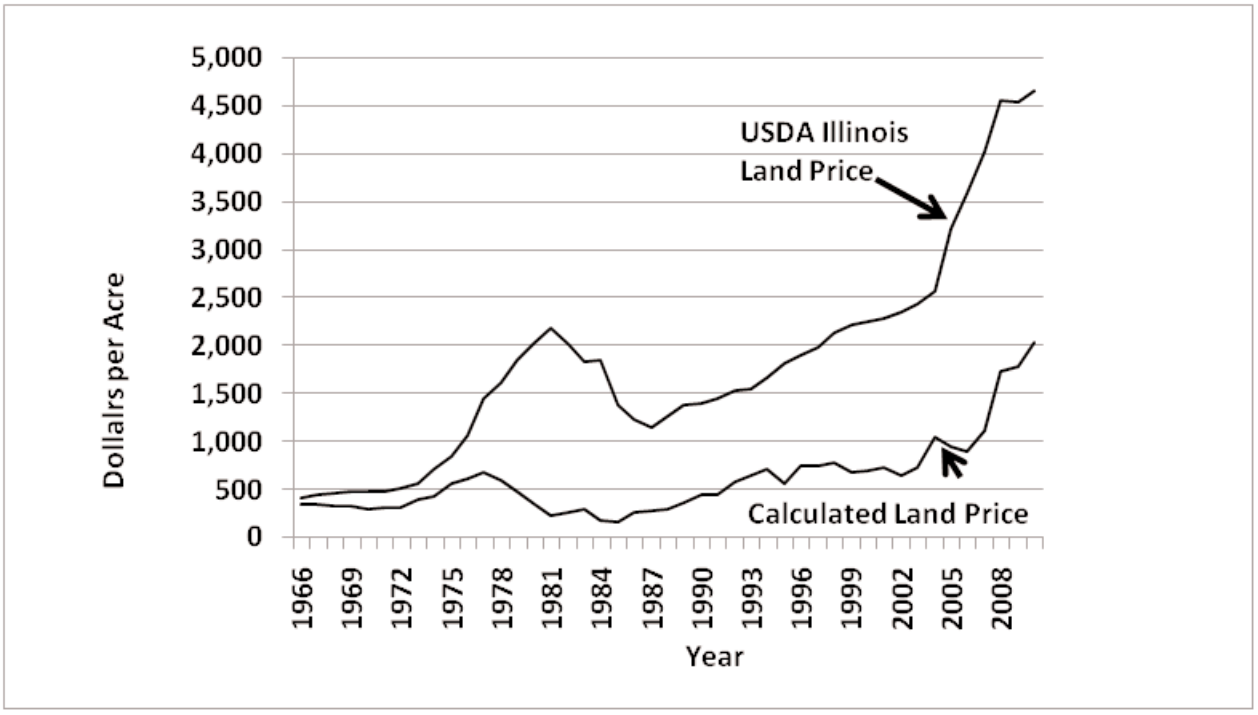
Figure 4. Kansas land price/earnings ratio



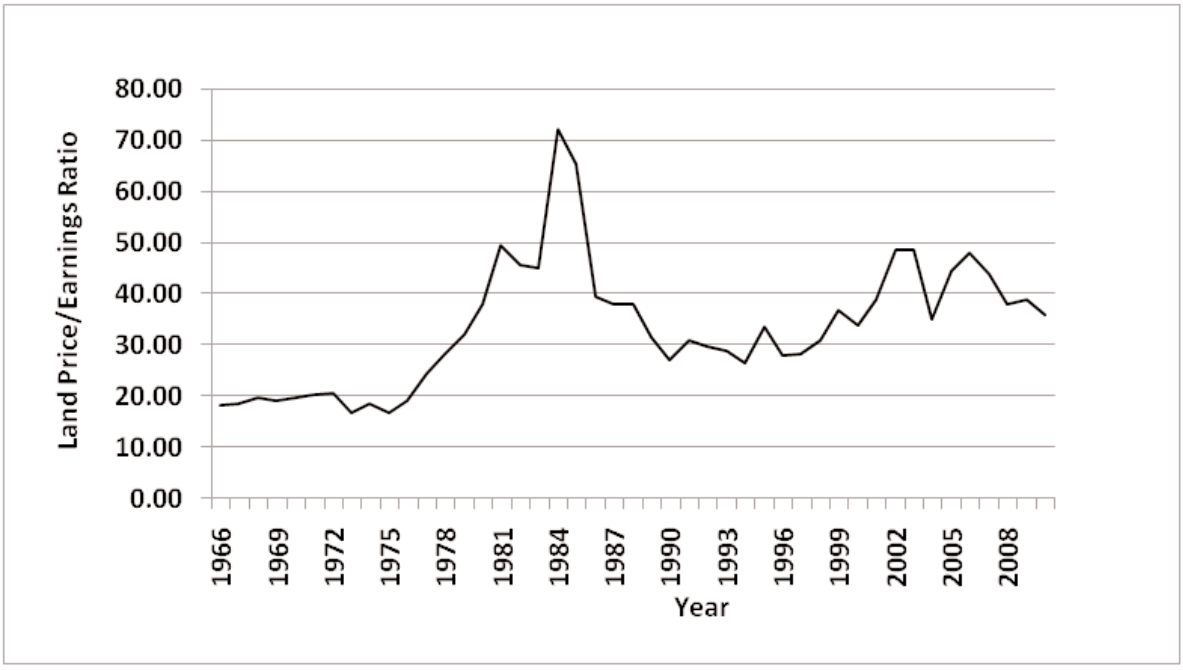
Source: Farms, Land in Farms, and Livestock Operations Summaries: Released by National Agricultural Statistics Service (NASS) http://www.nass.usda.gov/ and U.S. Department of Agriculture and Economic Research Service/USDA http://www.ers.usda.gov/data/FarmIncome/FinfidmuXls.htm

Figure 5. USDA average land price in Illinois and land price calculated based on agricultural incomes in Illinois and interest rates



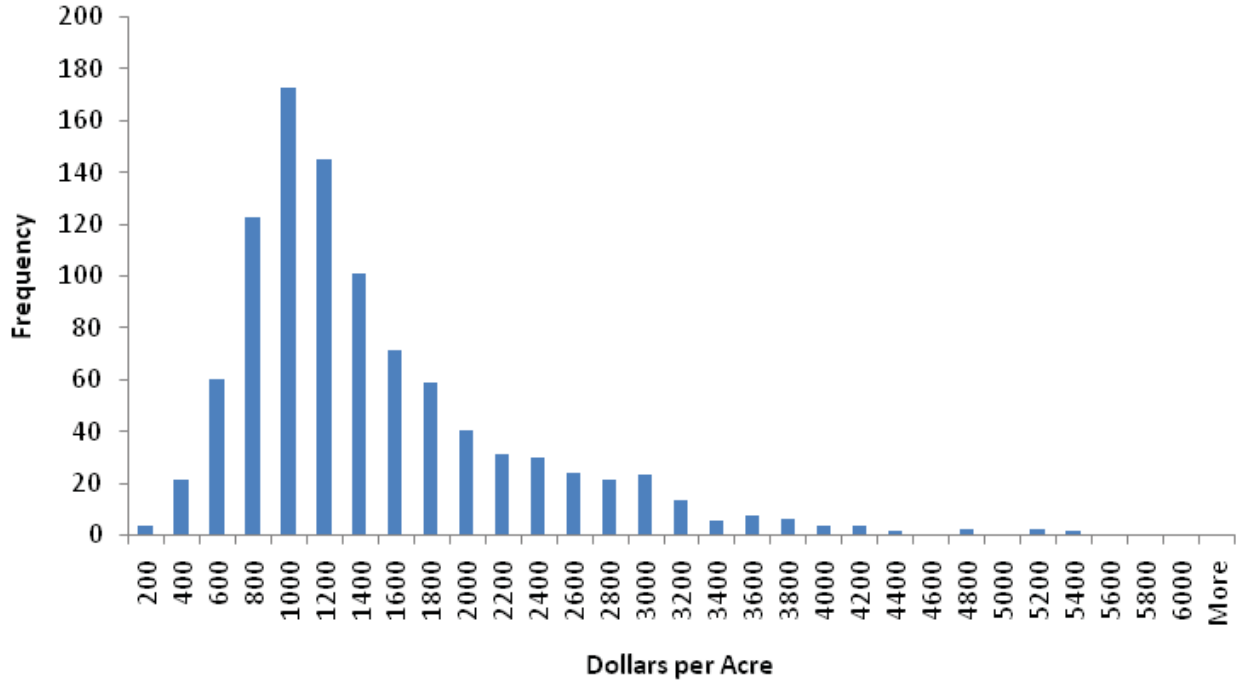
Source: Farms, Land in Farms, and Livestock Operations Summaries: Released by National Agricultural Statistics Service (NASS), U.S. Department of Agriculture. http://www.nass.usda.gov/ and Agricultural Interest Rates: Real Estate Loans Federal Reserve Bank of Kansas City-Tenth Federal Reserve District Quarterly Agricultural Credit Survey http://www.kansascityfed.org/research/indicatorsdata/agcredit/ and Economic Research Service/USDA http://www.ers.usda.gov/data/FarmIncome/FinfidmuXls.htm.

Figure 6. Illinois Land Price/Earnings ratio



Source: Farms, Land in Farms, and Livestock Operations Summaries: Released by National Agricultural Statistics Service (NASS) http://www.nass.usda.gov/ and U.S. Department of Agriculture and Economic Research Service/USDA http://www.ers.usda.gov/data/FarmIncome/FinfidmuXls.htm.

Figure 7. USDA average land price in Illinois and land price calculated based on agricultural incomes in Illinois and interest rates



Source: Kansas Society of Farm Managers and Rural Appraisers www.agecon.ksu.edu/ksfmra