Trends and Determinants of US Farmland Values Since 1910: Evidence from the Iowa Land Value Survey

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Valued at 2.31 trillion US dollars in 2016, farm real estate (land and structures) accounted for 85% of total US farm assets; in addition, farm real estate also represents the largest single item in a typical farmer's investment portfolio. As a result, changes in its values have been a perennial interest to policy-makers, farmers, researchers and investors alike. Focusing on Iowa, a Midwestern state at the heart of the Corn Belt, and using annual data since 1950 from the Iowa Land Value Survey, this article analyses what drives the changes in land values in Iowa and across the Midwest over time from 1910 to 2016, assesses the return and profitability of farmland as an alternative of investment, and also compares the current downturn in US farmland values with the 1920s and 1980s farm crises.

There have been three major 'golden' eras in US modern agriculture over the last 100 years: 1910 to 1920, 1973 to 1981, and the most recently from 2003 to 2013. The first two ended in a farm crisis, and many worry the third one is in the making. While the declining farm income and land values are alarming, this article argues that it is very unlikely that we will see a replay of 1980s farm crisis or a sudden collapse of US farm sector. The significant farm income accumulation during 2003–13, the stronger government safety net, and historically low interest rates should help agricultural producers withstand the downturn pressures.

This article also compares the relative return of investment in Iowa farmland and S&P 500 by taking both the income generation and capital gains of these two assets into consideration. The results show that the investment timing and holding period are key in determining the relative return of the investment.

Introduction

Representing the most valuable asset of both farm sector and farm households' assets in the United States (US), farmland and changes in its values have been a perennial interest to policy-makers, farmers, researchers and investors alike. Valued at 2.31 trillion US dollars in 2016, farm real estate (land and structures) accounted for 85% of total US farm assets (USDA ERS 2016a). As it comprises such a significant portion of the balance sheet of US farms, changes in the value of farm real estate have an important bearing on the farm sector's financial performance. Farm real estate also represents the largest single item in a typical farmer's investment portfolio; as a principal source of collateral for farm loans and a key component of many farmers' retirement funds, changes in its value can affect the financial wellbeing of landowners.

Starting from the economic theory of rent by David Ricardo in early 19th century (Ricardo 1817), economists have long been studying the trends and determinants of farmland value and its changes (Nickerson & Zhang 2014). In particular, many studies have examined the marginal value of both farm and non-farm characteristics of farmland, including soil erodibility (eg Palmquist & Danielson 1989),
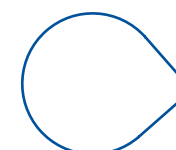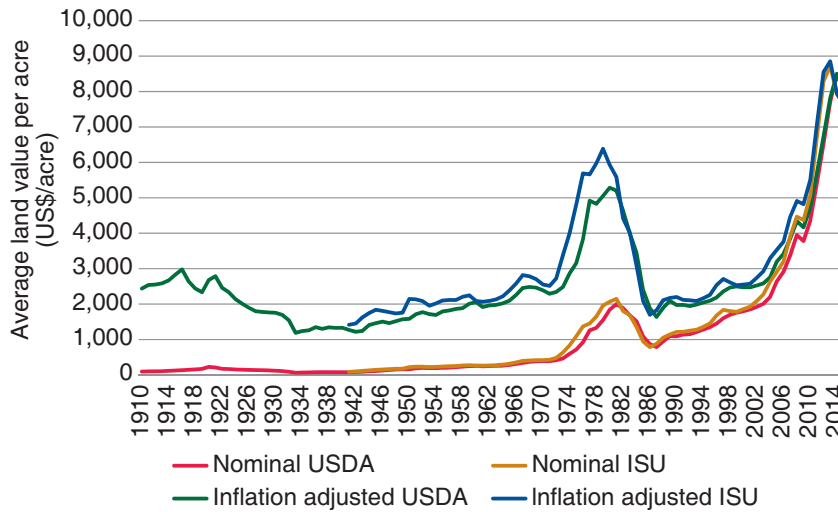
Figure 1: Nominal and inflation-adjusted Iowa average farmland values 1910–2015.

Sources: USDA Census of Agriculture, USDA Land Value and Cash Rent Survey, ISU Iowa Land Value Survey; inflation-adjusted land values to 2005.

urban proximity (eg Zhang & Nickerson 2015), wildlife recreational opportunities (eg Henderson & Moore 2006), zoning (eg Chicoine 1981), and farmland protection easements (eg Nickerson & Lynch 2001). While many studies use farmland transactions in their analysis, these farmland parcels sold each year typically only represent 1% to 2% of all farmland stock in the US (Zhang et al. 2014) and are often difficult to obtain, which makes it sometimes difficult to rely on to provide up-to-date and consistent information on farmland values and trends for a region smaller than a state, such as a county.

Alternatively, many state universities across the Midwest, the US Department of Agriculture (USDA), the Federal Reserve Bank system, and many agricultural professional associations conduct annual or quarterly opinion-surveys to gauge the pulse of the farmland markets. Initiated in 1941, the Iowa Land Value Survey represents the longest running annual opinion survey of farmland markets in the US and is widely used by agricultural stakeholders in Iowa, the Midwest and across the country (Zhang 2015a). Focusing on Iowa, a Midwestern state at the heart of the Corn Belt, and using annual data since 1950 from the Iowa Land Value Survey, this article analyses what drives the changes in land values in Iowa and across the Midwest over time and across space, and also assesses the return

and profitability of farmland as an investment alternative.

Sponsored annually by Iowa State University (ISU) Extension and Outreach and ISU Center for Agricultural and Rural Development (CARD), the Iowa Land Value Survey is intended to provide information on general land value trends, geographical land price relationships, and factors influencing the Iowa land market. The survey is not intended to provide an estimate for any particular piece of property. The survey is based on reports by licensed real estate brokers, farm managers, appraisers, agricultural lenders, and selected individuals considered to be knowledgeable of land market conditions. The Iowa Land Value Survey is the only consistent data source that will provide an annual land value estimates for each of the 99 counties in Iowa (Zhang 2015a).

Participants in the survey are asked to estimate the value of high, medium, and low quality land in their county as of November 1st each year. These individual land value responses are used to calculate not only average land values at the crop reporting district[1] level and state-level, but also district- and state-level estimates for high, medium and low quality land. However, the county level estimates are not just relying on the survey itself, but rather derived from a procedure

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1 Iowa has nine crop reporting district with each district roughly covering nine neighbouring counties.
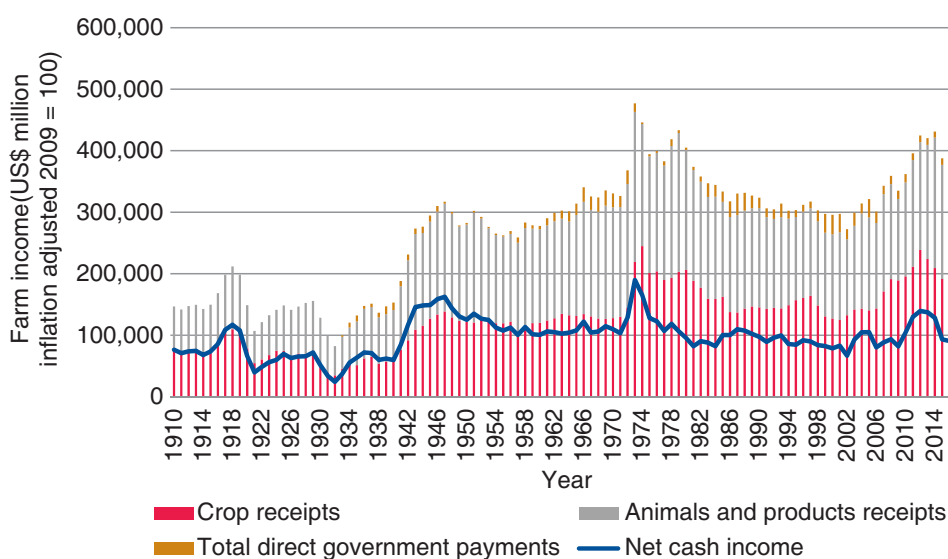
Figure 2:   Inflation-adjusted US gross and net farm income 1910–2016.

that combines the ISU survey results with data from the US Census of Agriculture. Specifically, the ISU survey responses are first used to derive an unadjusted average for one county, which will then be adjusted using the ratio of land values for that county relative to the district average from the last five rounds of US Census of Agriculture (Harris et al. 1980). This procedure also takes into account of effects of neighbouring counties from districts delineated using similar spatial land quality patterns following the work by Walker (1976).

Previous research has shown that the state land value estimates from the ISU survey are consistent with the survey results from USDA, Federal Reserve Bank of Chicago, and Realtors Land Institute, which can be seen through a newly developed web-portal accessible at <www.card. iastate.edu/farmland/> (Zhang 2015b). Stinn and Duffy (2012) compared the ISU survey results with the arm's length[2] farmland sales prices from 2005 to 2011, and find that the sale prices in general are not statistically significantly different from the ISU survey averages. The Iowa Land Survey is a well-respected, widely-used, and consistent source of information for farmland values in Iowa and across the US Midwest.

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2   Arm's length means that the transaction occurs in which buyers and sellers of the farmland act independently and have no relationship to each other (eg they are not relatives).

'Golden' Era and Farm Crisis

There have been three major 'golden' eras in US modern agriculture over the last 100 years: 1910 to 1920, 1973 to 1981, and most recently from 2003 to 2013, fuelled by growing export demand from China, the historically low interest rates and the expanding biofuel market. Figure 1 shows the nominal and inflation-adjusted Iowa land values since 1910, and Figure 2 shows the inflation-adjusted gross and net farm income for the US in the same period. Both figures reveal that with these golden eras, farmland values, commodity prices, and farm income often reached record heights. It is also pronounced that shortly following the first two golden eras the agricultural sector has contracted heavily. The first one ended in a long, drawn-out decline in land values from 1921 to 1933, the second golden era ended with a sudden collapse from 1981 to 1986.

With the current corn price cut in half compared to the 2013 peak level of US$7 per bushel and the farm income declining more than 30% in less than three years, many agricultural lenders, academics, and other stakeholders in the US farm sector worry about another farm crisis. To either debunk or confirm the belief of a replay of the farm crisis, it is useful to closely investigate the previous two

farm crises in the 1920s and 1980s, and equally important, the golden eras before them.

The first golden era started at the turn of the century. Rising corn prices, beginning in the early 1900s, sent the price of farm land and buildings on an upward path. The US$43/acre level of 1900 was the highest experienced to that date (Murray 1967). Almost each year in the 1900–14 period brought a new alltime high record for land values. With the continuous gains in Iowa farm revenue, the demand for more acreage increased. For instance, a farmer who bought a quarter section (160 acres) for US$7000 in 1900 saw the value of his farm rise steadily until it reached a value of US$20,000 in 1914 (Murray 1967). Returns such as these caused non-traditional agricultural land buyers to enter the market. This increased demand for rural property led to land speculation and increased investment activity.

During this time, the non-traditional investors would buy the land with a minimum down payment and then wait until the market value for the property reached a point where they would then sell for profit. This eventually led to exuberant speculation and over-valuation of the farmland, causing a land boom. At the height of this agricultural land boom, there was a sharp decline in prices of farm products. Corn, which had been selling for US$2 a bushel in the summer of 1919, plunged to 41 cents in 1921 (Murray 1967). This reduced the overall value of the farmland and virtually halted all investment activity. A majority of farmers who bought land during this boom relied heavily on mortgages, and subsequently found it more difficult to pay these mortgages off (Rajan & Ramcharan 2015). The number of farm mortgage foreclosures in Iowa rose from non-existent from 1910–20 to 2000 in the 1920s and more than 6000 following the Great Depression in 1933. In summary, the 1920s farm crisis featured a long, drawn-out decline in farmland values which was further dampened by the economy-wide Great Depression from 1929–33.

Much like the farm crisis prior to the Great Depression, the farm crisis in the 1980s had some similarities. Several important factors have

fueled the 1970s land boom and ever-increasing investment in US agriculture (Barnett 2000): intentional devaluation of the US dollar designed to reduce an overall trade deficit which led to massive increases in agricultural exports; various tax codes, especially substantial income tax deduction for interest expenses that encouraged borrowing; below-market-rate farm loans available to producers through the Farmers Home Administration; and lastly, a very strong demand for US agricultural exports in part due to the Nixon's visit to China and the crop failures in the Soviet Union in 1973. All these factors generated a boom atmosphere, a rise in production, farm products' prices and net farm income from 1970 to 1973, which led to massive investment in agricultural assets, especially farmland.

Two things are worth pointing out for this period. One, the US agricultural sector was (and still is) heavily integrated to the larger national and global economic systems and thus increasingly vulnerable to outside economic and political influences (Barnett 2000). Second, the overall inflationary environment largely affected farmland investment activities and farmland values: during the high-inflation era of 1970s, many agricultural producers and investors tried to 'index' their wealth to inflation by purchasing farmland as a store of wealth as a hedging tool (Barnett 2000), which further intensified the land boom.

The most striking aspect of this period in American agricultural history is that debt capital largely financed the massive investment in agricultural assets. With both the nominal interest rates and the rate of inflation very high in the 'stagnation' period of the 1970s, in real (inflation-adjusted) terms, debt financing for investment purchases were unbelievably inexpensive. Additionally, the loan requirements by lenders like FHA were very lenient. By 1978, the debt incurred averaged 76% of the purchase price. Between 1970 and 1980, the amount of farm mortgage debt outstanding in the US grew from US$71.4 billion to US$113.2 billion in constant 1982 US dollars, an increase of 59%. This was the first time debt had been used to finance a capital formation at this scale. This resulted in a highly leveraged agricultural sector, which was hit hard
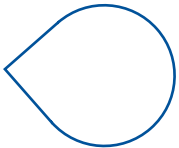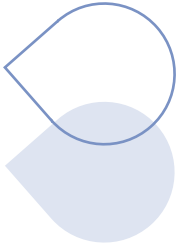
by the sharp rise in nominal and real interest rates in early 1980s, a substantial increase in the US dollar, a significant drop in US commodity prices due to the plummeting of the export market and record-level agricultural production.

Are We Going to See a Replay of 1920s or 1980s Farm Crises?

With the farmland values and cash rent in Iowa and across the Corn Belt declining three years in a row, many worried about a replay of the 1980s farm crisis which is still vivid for many producers and lenders who witnessed the collapse of the farm sector and many farm businesses. However, it is more important to put today's problems into perspective by comparing across the previous boom-bust cycles of US agriculture.

Table 1: Average annual percentage change in inflation-adjusted Iowa land values and farm income.

| Average % change in inflation-adjusted values per year		
Golden eras		
Land	Gross income	Net income
1910–20	1.2%	0.8%	0.2%
1973–81	9.7%	0.9%	-3.2%
2003–13	11.1%	4.5%	8.1%
Crises and declines		
Land	Gross income	Net income
1921–33	-5.8%	-1.9%	-1.0%
1981–87	-15.0%	-2.5%	2.6%
2013–16	-6.0%*	-2.7%	-9.5%

Note: The average land value change from 2013 to 2016 is approximate because the 2016 land values are unknown yet. The 1910–33 gross and net farm income changes are for the whole US due to limited data at the state level. The land values are based on USDA Census of Agriculture and USDA NASS Land Value and Cash Rent Survey, while the data on farm income is from the USDA Economic Research Service Farm Income and Wealth Statistics database.

Table 1 presents the average annual percentage change in inflation-adjusted Iowa land values, gross and net farm income. While it is concerning to see that since 2013, the gross and net farm income has decreased 2.7% and 9.5% per year respectively, it is equally important to note that throughout 2003 to 2013, the gross and net income had consistently grown 4.5% and 8.1% every year, reaching almost record-high levels in

both farm income and land values. A comparison between this third golden era and the previous two reveal that farmers accumulated much more income, especially cash, during the most recent decade than what they had in the 1910s and 1970s before those farm crises. The net cash income before the 1980s farm crisis was actually much smaller, even though land values skyrocketed during the same time. In other words, the high commodity prices in the 2000s seem to position agricultural producers nowadays to withstand the current headwinds.

Another useful aspect is to investigate how agricultural financial ratios and agricultural delinquency rates of the previous farm crisis periods compare to current levels. Figure 3 (over page) shows the agricultural liquidity and solvency ratios for the US since 1960, and Figure 4 (over page) shows the agricultural loan delinquency rates since 1970. In particular, the debt service ratio measures the share of value of production used for debt payments, and a higher value suggests a lower liquidity. Although the current rate is rising, it is still well below the 1980s farm crisis level. The profitability ratio, such as rate of return on farm assets, is now inching down, but is also higher than the 1980s levels. It is likely that with the current stagnation of commodity prices and continued decline in farm income, the debt service ratio will continue to rise and the profitability ratio remain flat or even further decrease. However, it is more likely a liquidity and working capital problem, as opposed to a solvency problem. The balance sheet of the US farm sector is still very strong, which can be seen from the low level of the debt to asset ratio in Figure 3 (over page). Similarly, although we see the loan repayment index continued to decline, but the delinquency rates for both agricultural loans in general, as well as farmland loans, are still at very low levels, which is likely the result of more stringent loan terms than what the agricultural lenders offered in the 1970s and 1980s.

It is very important to point out the strength of the agricultural safety net: in 1987, the total acres insured in the Federal Crop Insurance program was only 50 million acres for the entire US, and now just total cropland insured in Iowa already
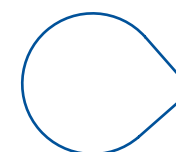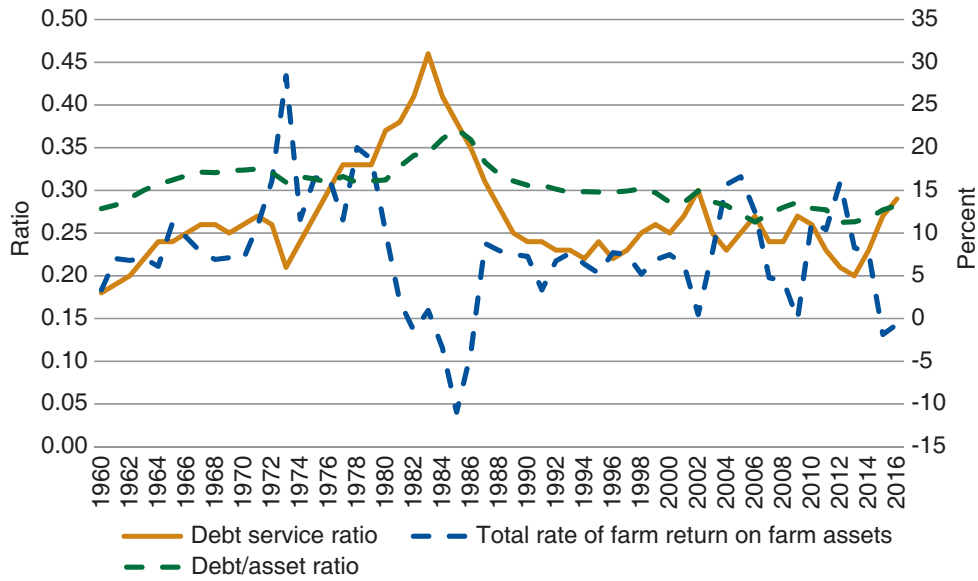
Figure 3 The agricultural liquidity, profitability and solvency ratios for the US 1960–2016.

Source: USDA Economic Research Service Farm Income and Wealth Statistics. Please use the right y-axis titles for the two dashed lines: total rate of return on farm assets, and debt to asset ratio.
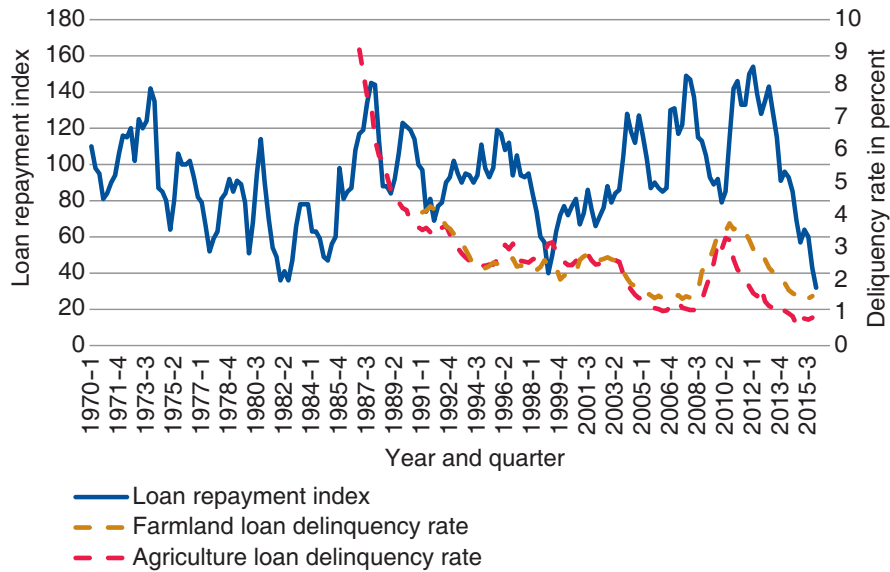

Figure 4: The agricultural loan repayment index and delinquency rates 1970–2015.

Source: Federal Reserve Bank (2016).

exceeded million acres, representing 93% of Iowa's corn and soybean production acres (USDA RMA 2015). If the 1980s farm crisis represents the failure of the government's safety test in the 'stress test', now agricultural producers and the farm sector in general have a much stronger safety net compared to the 1980s.

Many people are concerned about a potential farmland bubble burst, or a replay of the 1920s economic depression or 1980s farm crisis. There are legitimate reasons to be cautious, especially with the slowing Chinese economy and potential rise in interest rates. However, Iowa farmland values do not appear to be in a speculative bubble like those that caused dramatic declines in the
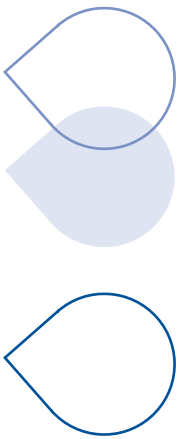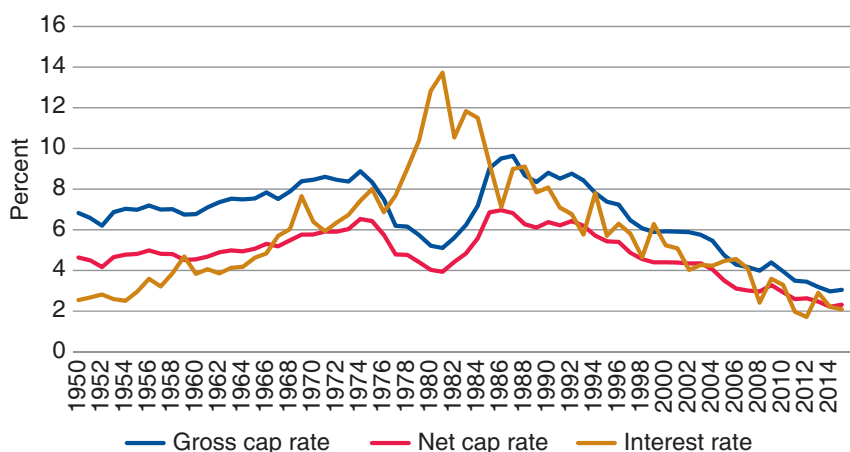
Figure 5: The capitalisation rate for Iowa farmland investment and nominal 10-year CMT interest rate.

Source: The gross and net cap rate is calculated using USDA cash rent, land value, and property tax data; and the interest rate is from the Federal Reserve Bank database.

1980s farmland values or the urban real estate market in the mid-2000s. In the 1970s, there wasn't steady growth in farm income before the sudden collapse of farmland values. Farmers now have accumulated substantial income during the last decade thanks to high commodity prices, and the current farmland values don't seem to diverge too much from the economic fundamentals. There wasn't irrational buying and selling in a panic and the demand for US crop and livestock products is still very strong. The downward pressures on farmland values likely will continue and play out next year and beyond, but it will more likely be a rational and modest correction as opposed to a sudden change.

Farmland as an Alternative of Investment

The cap rate – return in farmland

Eves and Painter (2008) compared rural property values in Australia, US, Canada and New Zealand from 1990 to 2005. They found that New Zealand and Australian rural land has a relatively higher average annual return, taking into account both return from income generation but also capital gains through increases in land values. In particular, they noted that income yield ranges from 2.3% in Canada to 3.8% in Australia. Income yield used in Eves and Painter

(2008) is also known as the capitalisation rate or cap rate in the US, which is the observed ratio of net cash rental income to the sale price of recent comparable sales. The cap rate shows the rate of return before land ownership costs are paid and indicates rate of return to farmland bought for agricultural production.

Figure 5 proxies the cap rate in two different ways: the gross cap rate by dividing the state-average cash rent by the state-average farmland value, and the net cap rate using net cash rent which has the management fee, property tax, and insurance expenses deducted. Note that both the gross and net cap rate have been declining since 1990, and the current levels are roughly 3% and 2%, respectively. This decline is mainly driven by the lower interest rate, that is, investors are willing to accept a lower rate of return (ie pay more) for land because the cost of borrowed capital is low and potential returns from other investments are also low (Edwards 2015). This can be seen from the close relationship between the interest rate trends and the cap rates in Figure 5.

Comparing the Stock Market and Iowa Farmland Values

In November 2015, the Farmland Partners Inc spent 197 million US dollars purchasing 22,000 acres of prime farmland in seven counties in
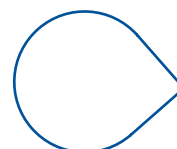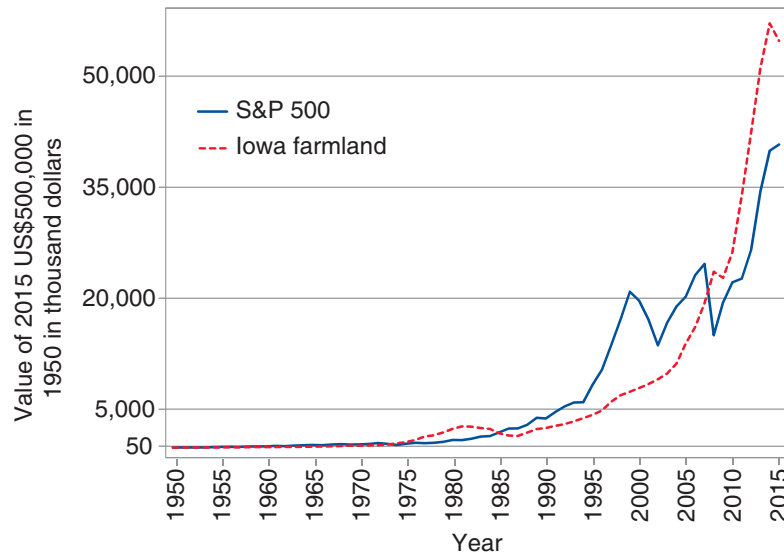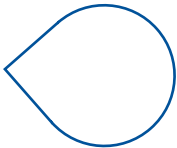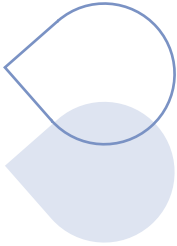
Figure 6:   Value in each year of US$51,318 invested in 1950 in Iowa farmland or the S&P 500.

Illinois, further sparking the renewed interest in investing in farmland as an alternative and/or incorporating farmland into the investment portfolio. This section of the article examines which is a better investment – the stock market or farmland. The methodology in general follows Zhang and Duffy (2016) which examined whether and how the same amount of money invested in the S&P 500 performs relative to that invested in Iowa farmland depending on the investment timing and holding period, but offers critical improvements.

The returns to land or stock shares are composed of two parts: the first component is capital gains or the increase in value in terms of cash rent for farmland or dividends for stocks. Obviously this also could be a capital loss if the values decrease. The second component is yearly returns. Please see Zhang and Duffy (2016) for more descriptions of the data sources for this analysis.

A few assumptions are necessary to determine which option provides the best investment. It is assumed a fixed amount that would be worth US$500,000 in 2015 is invested in each alternative at the end of the year before the analysis begins, this amount is selected to be large enough to buy at least a 40-acre farmland parcel. The amount of land or stock purchased will depend on the existing value. For example,

in 1949 the average farmland value in Iowa was US$158 per acre and the US$500,000 in 2015 would be worth US$51,318 in 1949. So, for US$51,318, 324.80 acres could have been purchased. A second assumption is that all the net land rent or the dividend earned in any year will be reinvested in the land or the stock market. This will increase the number of units held. Subtracting taxes, a 7% gross rent management fee and a 6% gross rent charge for insurance and maintenance, the net return per acre in 1950 was US$7.47.

The net rent in 1950 represented a 4.64% return. For the US$51,318 investment, this would be a net return of US$1507.06 to the investor. If the entire net return were invested back into land, 9.36 acres could have been purchased (US$1507.06/US$161 = 9.36) in 1950. So, at the end of 1950 the investor would have 334.16 acres worth US$53,795 in 1950 which translates into US$535,242 in 2015 dollars. This process is repeated each year in the analysis.

The December 1949 S&P was priced at US$16.88 per share. This means 3040 shares could have been purchased for US$51,318. The September 1950 dividend was US$1.33 per share. This means an additional 226.84 shares and value of US$56,706 at the end of 1950. No ownership and transaction costs are assumed for the stock investment.
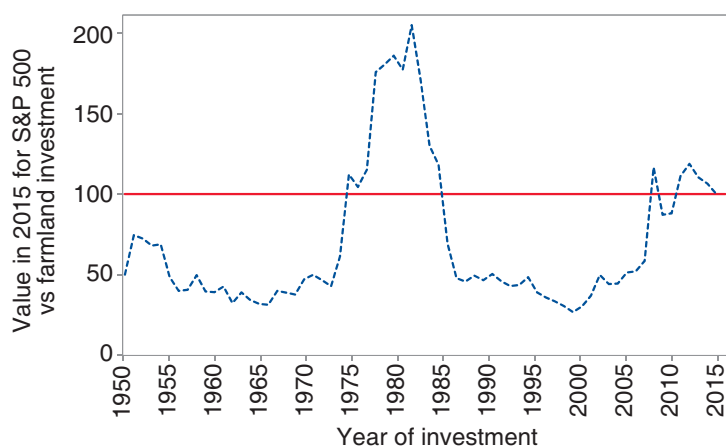
Figure 7: Return to an investment in the S&P 500 relative to an investment made in Iowa farmland by year of investment.

Figure 6 shows the return to US$51,318 invested in 1950. At that time, US$51,318 would have purchased 324.80 acres or 3040 shares of the S&P. Using the assumptions discussed previously, an investor at the end of 2015 would have 6712.51 acres worth US$55,042,588. Alternatively, they would have 19,976 shares of the S&P worth US$41,031,104. In other words, the value of the S&P investment would be 74.5% of the value of the land investment in 2015.

There have been periods since 1950 when the returns to the stock market have been higher. However, for the most part, land has shown higher returns over the past 50 years. Figure 6 shows the burst of the dotcom bubble in the early 2000s and the recent Great Recession in S&P as well as the dramatic increase in Iowa land values since the mid-2000s.

Figure 7 shows a comparison of the values in 2015 based on investing in each individual year. This figure presents the returns to S&P as a percent of the returns to Iowa farmland. In other words, the value for any year would be the present value of an investment in the S&P made in that year as a percent of an investment in farmland made that same year. In Figure 7 if the value is above 100% then the S&P would have a higher value; conversely, if the value is below 100%, then the farmland would have a higher value for funds invested in that year.

Figure 7 shows that the timing of the investment makes a difference in which appears to be a better investment. Land would have been the better investment in almost all years except the period from 1978 to 1984 and most recently. This period coincides with the rise in land values during the 1970s. Land values in Iowa began their rapid rise in 1973 and peaked in 1981. Due to historically low interest rates and strong agricultural demand, Iowa farmland values have been at record-high levels since 2003. However, due to declining commodity prices and farm income, Iowa farmland values have decreased following the peak in 2013. As a result, an investment in Iowa farmland in 2013 has not yielded a better outcome than the S&P.

Looking Ahead

Focusing on the Iowa Land Value Survey, the longest-running survey of its sort in the US, this article discusses the trends and determinants of Iowa farmland values since 1910, focusing on the three golden eras, and the 1920s and 1980s farm crises. In addition, this article compares the rate of return to investment in Iowa farmland vs the stock market.

With the decline in farm income and a possible increase in interest rates, we might see farmland values continue to recede if the forecasts for low commodity prices and the global stock recovery for grains and oilseeds are realised next year
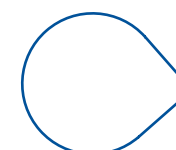
and beyond. The Iowa farmland market appears to have peaked for the foreseeable future, and we may expect to see the Iowa farmland market drifting sideways.

It is not possible to rule out the possibility of a collapsing US farm sector, however, the odds of commodity prices collapsing, a sudden stoppage of the Chinese economy, interest rates rapidly increasing, and/or land values collapsing are not high. The odds are not zero, but it doesn't appear these events will occur in the foreseeable future. The third golden era appears to have ended with an orderly adjustment as opposed to a sudden collapse.

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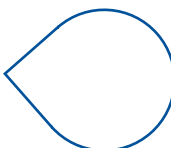
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About the Authors

Dr Wendong Zhang is an applied economist and extension farm management specialist interested in land use, land management, land values and land ownership in the agro-ecosystem, as well as the interplay between agriculture and the environment. Dr Zhang is also affiliated with Center for Agricultural and Rural Development (CARD).

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Dr Zhang received his PhD in Agricultural, Environmental and Development Economics from the Ohio State University in July 2015, and he also hold a BSc in Environmental Science from Fudan University in China.

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