FARMLAND: IS IT CURRENTLY PRICED AS AN ATTRACTIVE INVESTMENT?

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Farmland prices have risen dramatically in recent years, which has attracted interest from the broader investment community. At the same time, concern is being expressed regarding another bubble in farmland prices. This paper studies and compares the farmland price to cash rent ratio (P/rent) with the price to earnings (P/E) ratio of stocks. We find that the farmland P/rent ratio has reached historical highs and is currently at the level of the P/E ratio of the S&P 500 during the tech bubble. Data from 1911 to 2012 are used to estimate the beta of farmland, a measure of the risk that farmland adds to a diversified portfolio. The beta is found to be very low over this period. Farmland returns are also regressed against expected and unexpected inflation, and we find that farmland moves relatively close to one-to-one with inflation. We also report 10- and 20-year holding period returns for farmland and find that the relationship between return and the cyclically adjusted P/rent ratio is strongly negative. Moreover, the current cyclically adjusted P/rent ratio is extremely high, indicating a reason for caution when investors are considering farmland purchases.

Key words: Beta, cyclically adjusted P/E ratio, farmland prices, inflation hedge, S&P 500 returns.

JEL codes: Q14.

Farmland comprises the vast majority of farmers' asset bases and personal wealth; USDA balance sheet data indicate that in 2012 the value of farmland accounted for 82% of total assets in production agriculture (USDA 2014). This percentage has been increasing during the past decade in large part because of the dramatic increase in farmland prices. Farmland prices in the United States have increased 37% during the last 5 years, and in real terms, prices have risen 7–10% annually in Corn Belt states like Iowa and Illinois (Gloy 2012). The recent dramatic increase in farm real estate prices has attracted interest from the broader investment community in farmland as a component of their investment portfolio, as illustrated by financial services company TIAA-CREF's recent acquisition of the farmland portfolio of Westchester, a large farmland realtor and investment company with properties throughout the United States. Similar investment interest is reflected by numerous articles on farmland investing found on banking and financial websites (Gustke 2013; Robinson 2013; Forbes 2013; Lube 2013).

Concern is being expressed by many investment analysts that farmland prices will become higher than justified by the fundamentals, and will result in what we will later recognize as a bubble (Bowman 2013; Watts 2013). One justification for this concern is that previous research has established the tendency of the farmland market to overshoot (Burt 1986; Featherstone and Baker, 1987; Featherstone and Baker, 1988). Thus, from the standpoint of the literature and of history, another bubble in farmland prices would not be a surprise.

Numerous previous studies of farmland prices and values have been completed as summarized by Moss and Katchova (2005). This article builds on and extends earlier

work by positioning the farmland investment decision as an investment portfolio choice, with a focus on the financial attractiveness of farmland as an investment. We will not attempt to assess the numerous noneconomic arguments often made by farmers (and others) to justify the purchase of a particular parcel of farmland. Thus, our discussion will emphasize the risk, return, portfolio, and inflation hedge characteristics of farmland compared to other common financial investments that one might make. It is also important to note that we will not focus on the operational details of managing and maintaining farmland, both of which present significant challenges (and opportunities) that require specialized farm management expertise.

To frame farmland as an investment choice analysis, the commonly accepted income capitalization model of asset valuation is used. The constant growth present value model provides the theory behind this analysis procedure. In this model the return to an asset at the current time (R_0) is expected to grow at rate g indefinitely, and the required rate of return is r (also constant into perpetuity), leading to the following present value equation:

$$(1) \qquad Value = \sum_{n=1}^{\infty} R_0(1+g)^n(1+r)^{-n}.$$

The solution to the infinite series of equation (1) yields the constant growth model (2):

$$(2) \qquad Value = R_1\left[\frac{1}{r-g}\right].$$

From equation (2) we can derive the common investment analysis metrics of cap rate (R_1/*Value*) and the inverse of the cap rate, which is the value (or price) to earnings (P/E) ratio. In equation (2), the capitalization rate is the difference between the required rate of return (r) and the anticipated constant growth rate (g). The P/E multiple will increase as the difference between $r - g$ declines, which means that reducing the required rate of return, or increasing the expected long-term growth in earnings, are the two factors that will increase the multiple.

The P/E ratios for stocks are compared to the price to earnings multiple (P/rent) for farmland in this paper. The P/E ratio is computed by dividing market value per share for a particular stock or group of stocks by the appropriate earnings per share (EPS). Historical or expected earnings per share can be used in the computation. The reported P/E ratios typically use historical earnings per share to compute the ratio. The average market P/E ratio for stocks is 15 to 20; however, it is important to note that the average P/E ratio does vary across industries. In addition, we create a cyclically adjusted P/E ratio for farmland and compare this to Robert Shiller's data for the S&P 500. These results are augmented by econometric estimates of the beta (β), a fundamental relative risk metric for farmland, gold, and housing assets, as well as the relationship between farmland values and expected and unexpected inflation.

Data

We used the following 12 data series: owner-operator returns for Tippecanoe County, Indiana (1960 to 2013); farmland prices for West Central Indiana (1960 to 2013); farmland cash rent for West Central Indiana (1960 to 2013); ten-year treasury interest rates (1960 to 2013); S&P 500 P/E ratio (1960 to 2013); the general price level as measured by the implicit price deflator for personal consumption expenditures (PCE) (1960 to 2012); Iowa farmland prices (1911 to 2012); Iowa farmland cash rent (1911 to 2012); S&P returns (1911 to 2012); consumer price index (CPI) (1911 to 2012); gold prices (1911 to 2012); and housing prices (1911 to 2012).

In the first section of our analysis we use data on owner-operator returns, cash rent, and farmland prices. While our paper focuses more on the farmland price to cash rent multiple, we think it is important to include in our analysis owner-operator returns, which is the most important factor driving the cash rental market, and perhaps the best indicator of the return to land. We have access to owner-operator returns starting with 1960. Owner-operator returns from 1960–1986 were created by Featherstone and Baker (1988), and these return calculations have been extended several times for the years up to 2013. A 50-50 corn-soybean rotation is assumed. Owner-operator returns are budgeted returns using Tippecanoe County,

Indiana average corn and soybean yields each year, season average prices of corn and soybeans, as well as costs taken from the Purdue Crop Budget (e.g., Dobbins et al. 2013) that are updated annually. Government payments and set-aside are included for early years according to the details of the farm programs, and in later years (Environmental Working Group 2013) are used to estimate government payments.

Tippecanoe County is located in West Central Indiana, and we chose the farmland value and cash rent data that geographically matches best the owner-operator returns by using data for West Central Indiana from the annual Purdue farmland survey; the most recent survey is reported in Dobbins and Cook (2013). Since 1974, in June of each year Purdue University has conducted its statewide survey of opinions regarding farmland prices and cash rents for farmland (tillable, bare land) of different productivity levels (top, average, poor), as well as the price of transition farmland (moving out of agricultural production). Average survey values are published for six regions of the state. The survey respondents include "…rural appraisers, agricultural loan officers, FSA personnel, farm managers, and farmers. The results of the survey provide information about the general level and trend in farmland values," (Dobbins and Cook 2013). To obtain cash rent and farmland value from 1960 to 1973, the 1974 Purdue survey numbers were indexed backwards using the percentage change in USDA farmland value and cash rent data for the state of Indiana.

The USDA farm real estate value per acre for the State of Indiana is highly correlated (correlation coefficient of 0.989) with the Purdue survey's West Central Indiana farmland value over the 1974–2012 period. Since the USDA changed to the June Area Survey in 1994, the correlation has been even higher at 0.991. The Purdue farmland values for West Central Indiana are higher than the USDA values for most years. Our results would not change greatly if we used USDA survey data, but we think that the West Central Indiana farmland and cash rent data are the most consistent with our owner-operator data.

We deflate the West Central Indiana cash rent, owner-operator returns, and farmland prices with the PCE deflator (the PCE deflator and interest rates on 10-year Treasuries are gathered from the Federal Reserve

Bank of St. Louis www.research.stlouisfed. org/fred2/.). We believe that using an implicit price deflator or consumer price index is more appropriate than the producer price index (PPI) to deflate income streams such as cash rent and owner operator returns. The PPI is primarily used to deflate revenue to measure real growth in output, which is not our purpose. The CPI and PPI are not terribly different; for the most part the goods are substantially overlapping. The PPI measures what businesses receive for goods, while the CPI measures what consumers pay. The CPI does not include capital goods (as does the PPI) but the PPI does not include the prices of services. The PPI includes only domestic goods, whereas the CPI includes consumer goods regardless of where they were produced.

When it is available, such as it is from 1960 to 2013, we use the PCE deflator rather than the CPI because we feel it is the better measure.

> As Chairman Bernanke said, the PCE index is generally thought to be "the single most comprehensive and theoretically compelling measure of consumer prices." At the same time, Bernanke said that "no single measure of inflation is perfect, and the Committee will continue to monitor a range of measures when forming its view about inflation prospects," (Hakkio 2008).

For our long-run (101 year) analysis, we use what we think are the best data available; the PCE deflator is not available for that period. Instead of the PCE, we use the annual general price level data readily available on Robert Shiller's website, which is primarily based on the CPI. The S&P 500 returns (1911–2012) and P/E10, defined later, for the S&P 500 (1960–2013) are also from Robert Shiller's website.

The USDA has surveyed state-level farmland and cash rent data since 1911 and earlier. We found gaps and inconsistencies in the cash rent data for Indiana, and the data for Iowa are the most consistent of the Midwest states from 1911–2012. Thus, we use Iowa farmland price and cash rent data from USDA survey reports and from Iowa State extension. For a point of comparison to farmland over the 101-year period, we use data for housing prices from Robert Shiller's
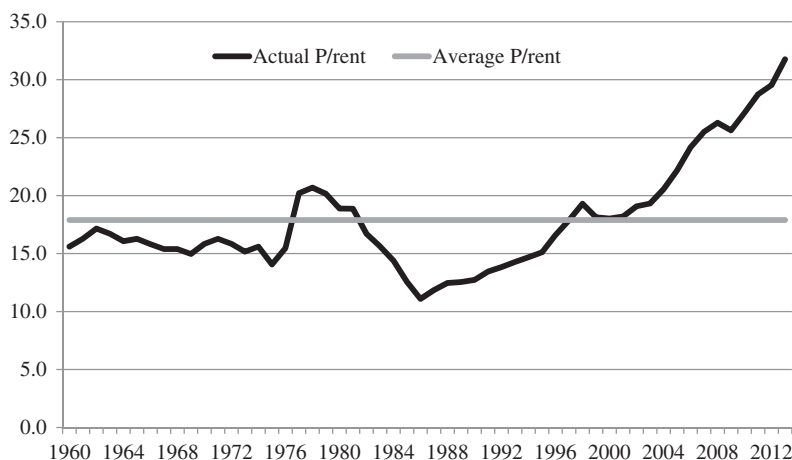
Figure 1.   Farmland price to cash rent muliple for West Central Indiana, 1960 to 2013

website, and gold prices from Bloomberg London gold fixing price from the London bullion market.[1]

Results

The P/rent ratio for West Central Indiana has an average value of 17.9 over the 53-year period from 1960 to 2013, with a high of 31.8 reached in the last year of data (2013) and a low of 11.1 in 1986, which was perhaps the bottom of the valley after the bubble of the 1970s and 1980s (figure 1). At the peak of this bubble, the P/rent multiple reached a high of just over 20 from 1977 through 1979. The P/rent multiple subsequently dropped to the teens in the early 1980s, and reached its low in 1986. The rise from around 15 in 1976 into the 20s and down to 11.1 in 1986 corresponds exactly to what is viewed as the bubble in farmland prices, and one of the more difficult periods for agriculture in modern history. It is within this historical context that the rise in the P/rent ratio from the upper teens in the late 1990s to the 2013 survey value of 31.8 is of alarm.

Interest Rates

Falling interest rates help explain the recent rise in the P/rent ratio. Ten-year U.S. Treasury average annual interest rates have fallen steadily from a peak of 13.1% in 1981 to approximately 2.0% in 2012 and 2013. The required rate of return by farmland investors would be higher than the 10-year U.S. Treasury interest rate due to a risk premium, which is expected to be at least as large as the premium of the farm borrowing rate over the 10-year U.S. Treasury rate, which is currently 1.99%.[2] If farmland market participants have required rates of return for farmland that follow the 10-year treasury rate (plus a constant risk premium), then the time series pattern shown by the 10-year treasury rate provides an indication of the direction of change in the discount rate in the constant growth model.

The reciprocal of the 10-year treasury interest rate tracks the increase in the farmland P/rent ratio from 1985 to 2010 (figure 2). From 1960 to 1985 there is no obvious connection between the P/rent ratio and the 10-year treasury interest rate. Also, in the last several years the reciprocal of the 10-year treasury rate has risen much faster than the P/rent ratio. If the recent very high P/rent ratios are caused by the recent extremely low interest rates (which results in a high reciprocal), then the implication is that the market expects relatively low rates to continue over the long term. Interest rate futures markets and a positive slope in the treasury yield curve have been predicting rising interest rates for the last two years, and even though

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[1] London gold fixing price from the London bullion market were retrieved from the Bloomberg database, Purdue University, Parrish Library, December 3, 2013.

[2] The average difference between the U.S. Federal Reserve Bank of Kansas City's reported average interest rate paid on real estate loans and 10-year U.S. Treasuries from 1988 to 2012.
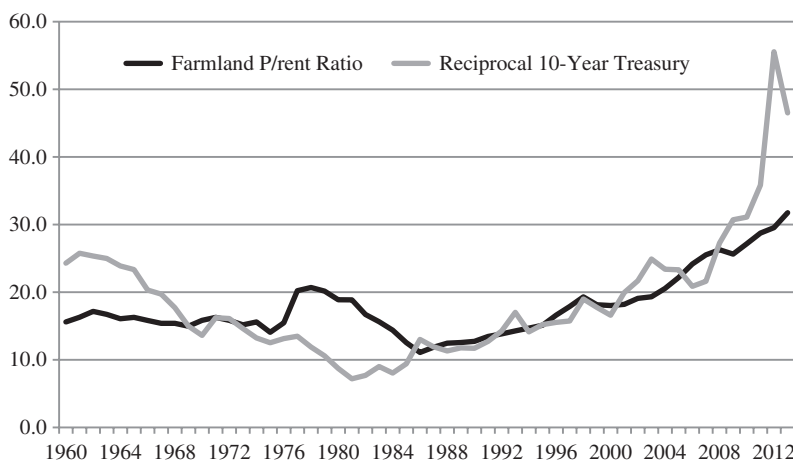
Figure 2. Farmland P/rent ratio and the reciprocal of ten-year treasuries, 1960 to 2013
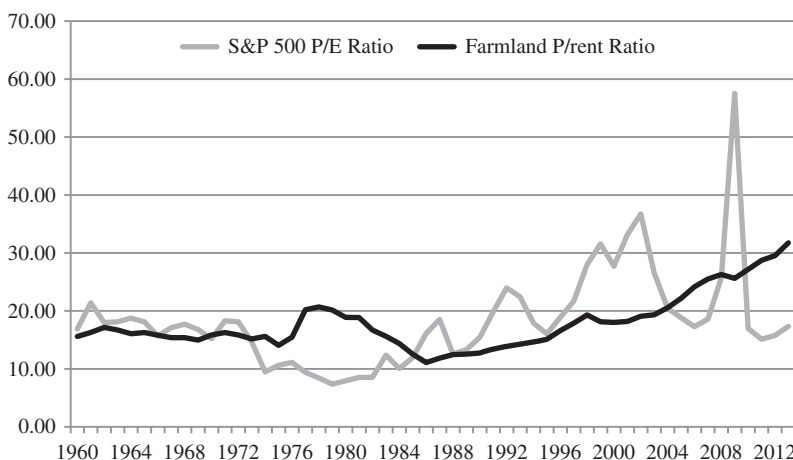

Figure 3. Farmland P/rent ratio and S&P 500 P/E ratio, 1960 to 2013

this has not occurred, it is reasonable to question the long-run persistence of low interest rates required as the fundamental to justify high P/rent ratios.[3]

Equity Investment Comparisons

We compare the P/rent ratio to stock market indices to gain insight into the comparative attractiveness of farmland as an investment. Figure 3 shows the P/E ratio for the S&P 500 and the P/rent ratio. The average P/E ratio for the S&P 500 for the period at 18.2 is relatively close to the 17.9 average for the

P/rent ratio for farmland. With the exception of 1995 and 1997, the P/E ratio was higher than the P/rent ratio from 1986 to 2003. Since 2003, except for 2009 which exhibited a very high P/E ratio for stocks,[4] the P/rent ratio for farmland has been higher than the P/E ratio. In addition to being relatively high, the P/rent ratio has exhibited an upward trend in the last ten years. The current P/rent ratio of 31.8 is well above the average P/E multiple, and very unattractive compared to the 2004 to 2013 P/E ratio.

There are shortcomings in comparing the P/rent and P/E ratios. Cash flow received by a stock investor is the dividend on the stock,

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[3] At the time of writing, interest rates on 10-year and longer U.S. Treasuries had started to increase.

[4] The high P/E ratio for 2009 was an anomaly caused by very low S&P earnings during the financial crisis.
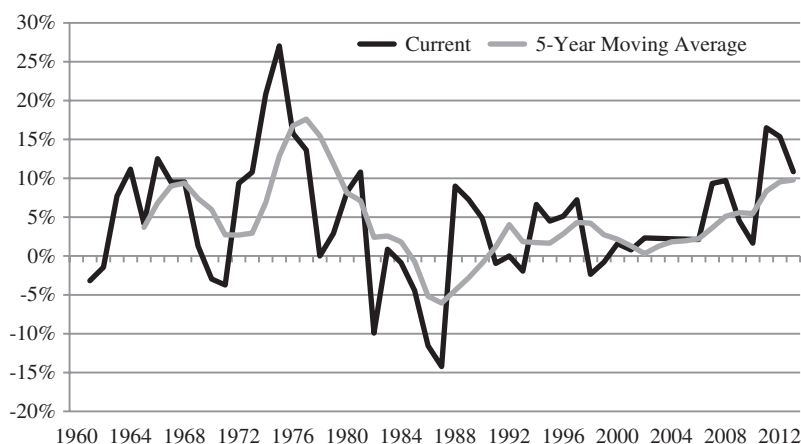
Figure 4. Current growth rate and five-year moving average of cash rent in West Central Indiana, 1960 to 2013

not the earnings. The percentage of earnings per share (EPS) paid out as dividends varies from company to company, ranging from zero to over 100%. Historically, the dividend payment ratio for the S&P 500 has averaged about 55%. In recent years, this ratio has been closer to 30%. An alternative metric would be to compare the P/rent ratio for farmland to the price/dividends (P/D) ratio for stocks. Dividends are of course smaller than earnings, so price/dividend (P/D) ratios are higher than P/E ratios. The prices of shares of stock in companies reflect both the dividend payout and the effect of retention on expected growth. The effect of changing payout and retention rates is masked when looking at the P/E ratio at different times and comparing different companies. Because of these confounding factors, comparing P/D ratios of individual companies or even stock indices to farmland is probably of limited value because of the extreme variation in dividend payout policies.

Growth in Farmland Returns

As previously indicated, the expected long-run future growth rate in farmland returns is one of the key variables in the constant growth model and is a major determinant of the P/rent ratio. Farmland market participants likely examine past growth in rent when anticipating future growth because it is human nature to use past experience when assessing the future. Thus, one would expect participants in the farmland market to look

at past growth in returns, along with current information about drivers of that growth to form their expectations.

Growth in cash rent (year-over-year continuous percentage change)[5] and the 5-year moving average growth rate are shown in figure 4. The mean growth in returns to land over the last 50 years has been 4.6%. The 5-year and 10-year moving averages of growth rates in cash rent have movements that are similar to the patterns shown in the farmland P/rent ratio (figure 5). Extremely high growth rates in cash rent were experienced in the mid 1970s, but fell through the mid 1980s. The 5-year moving average smooths the year-to-year changes in annual growth and lags substantial increases and decreases in growth, but generally follows the same pattern as the current growth rate in cash rent. While the 5-year moving average might be a good indicator of the optimism or pessimism of those in agriculture, it is hard to believe that farmland market participants expected long-term growth in the −5.0% range in the late 1980s, but surely the anticipated growth in the 1980s was lower than what it was in the mid 1970s. If market participants did have expectations following a moving average it would explain the market's tendency to over and under shoot. If recent growth in rent has been high, the moving average increases, and if the expectation of higher growth rate in rent follows, then the P/rent ratio would

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[5] The continuously compounded rate of change is calculated by considering the difference in the logarithms of consecutive cash rents. The continuous rate is a better measure when summing across positive and negative growth rates.
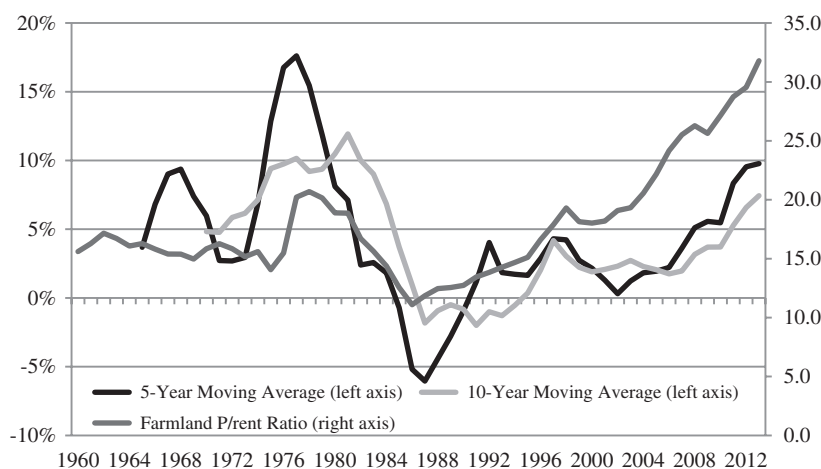
Figure 5. Farmland P/rent ratio and five- and ten-year moving average growth rates for cash rent inWest Central Indiana, 1960 to 2013

increase. The reverse would happen when rents fall. Thus, land values would be increasing or decreasing both because rents increase or decrease, and because the P/rent multiple increases or decreases.

The logic of farmland market participants' expectations of growth following a moving average pattern is troublesome. When returns grow it is generally due to high crop prices. Long-run supply response might suggest that slower growth would follow high growth, which is a contrarian view of growth, rather than believing that good times beget further good times.

Cyclically Adjusted P/Rent

Shiller (2005) uses a 10-year moving average for earnings in the P/E ratio (often labeled either P/E10 or cyclically adjusted P/E (CAPE)) to remove the effect of the economic cycle on the P/E ratio. When earnings collapse in recessions, stock prices often do not fall as much as earnings, and the P/E ratios based on the low current earnings sometimes become very large (e.g., in 2009). Similarly, in good economic times P/E ratios can fall and stocks look cheap, simply because the very high current earnings are not expected to last, so stock prices do not increase as much as earnings do. By using a 10-year moving average of earnings in the denominator of the P/E ratio, Shiller (2005) has smoothed out the business cycle by deflating both earnings and prices to remove

the effects of inflation. Shiller (2005) uses the CAPE to determine if there is information in the CAPE in relation to future rates of return. That is, when the CAPE is high, do subsequent returns turn out to be low, and vice versa? Shiller (2005) finds a negative relationship between CAPE and resulting 10- and 20-year cumulative returns for the S&P 500.

Similar to stock earnings, farmland returns are subject to cycles. If farmland returns are cyclical, high rents are likely to eventually be followed by lower rents and vice versa. If expectations over-respond to changes in returns, either directly as higher/lower expected returns or indirectly as a change in the expected growth rate of returns, then there would be a relationship between the farmland CAPE and resulting returns on farmland investment.

The P/rent ratios reported thus far are the current year's farmland price divided by cash rent for the same year. The P/rent10 is modeled after Shiller's (2005) cyclically adjusted P/E ratio. Cash rent and farmland prices are deflated, and then 10-year moving averages of real cash rent are calculated. The P/rent10 ratio is computed by dividing the real farmland price by the 10-year moving average real cash rent. A similar computation is done for 10-year owner-operator returns (P/00-10).

Figure 6 presents real land prices divided by 10-year moving average real cash rents and real owner operator returns, as well as Shiller's P/E10 ratio. The P/00-10 fell through the first half of the 1970s when real returns grew faster than land values, increased from
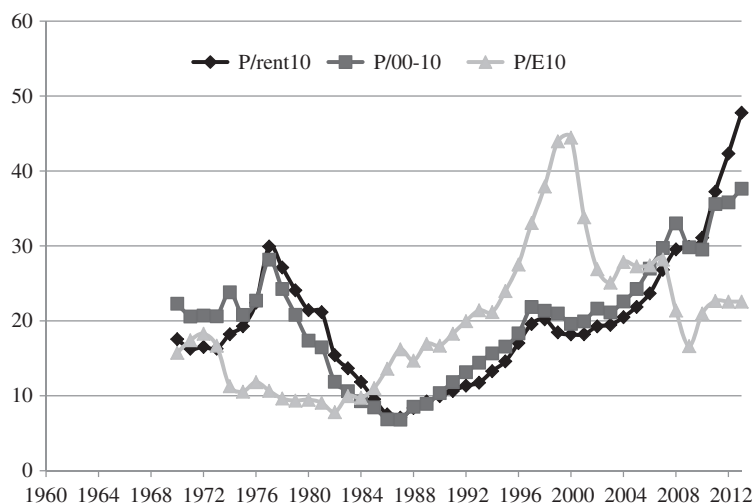
Figure 6.   Ten-year moving average of cyclcally adjusted P/rent, P/00, and P/E ratios, 1960 to 2013

the high teens in the mid 1970s to 28.2 in 1977, and then fell to 6.8 in 1987. The P/00-10 then increased steadily until it reached 37.6 in 2013. In 2011 and 2012 the P/rent10 ratio rose substantially above the P/00-10 ratio. The following two points are evident from figure 6. First, the P/rent10 ratio in 2013 exceeded the peak of the S&P 500 P/E-10 ratio during the dot-com bubble. Second, the relationship between the P/rent10 ratio and the P/00-10 ratio suggests that producers are not bidding all of the increases in owner/operator returns into cash rents. Producers may be expecting owner/operator returns to decline, which would make it difficult to maintain high cash rents. However, this relationship could also be explained if one expects cash rents to adjust slowly to changes in operator returns. Historically, there have been times when cash rents were slow to adjust.

Shiller (2005) shows the relationship between the P/E10 ratio and the annualized rate of return from holding S&P 500 stocks for long periods. In general, his results show that the higher the P/E10 ratio at the time of purchase, the lower the resulting multiple year returns. The West Central Indiana farmland and cash rent data from 1960 to 2013 are used to compute 10- and 20-year annualized rates of return (computed as the sum of the average of cash rent as a fraction of the farmland price each year, plus the annualized price appreciation over the holding period). The results for farmland

show a negative relationship similar to that exhibited in Shiller's stock data. The 10-year holding period returns for farmland show a strong negative relationship (figure 7). That is, the higher the P/rent10 (farmland price divided by 10-year moving average of cash rent) at the time of purchase, the lower the resulting 10-year rate of return. The 10-year holding returns range from a slightly negative rate of return to 20%. The 20-year holding period returns also exhibit a strong negative relationship with the P/rent10 ratio (figure 8). The 20-year holding returns range from 6–14%.

The highest historical P/rent10 in our data for which a 10-year holding period return can be calculated is 30 in the late 1970s, resulting in the only negative 10-year holding period return in our data. The P/rent10 levels in 2009 through 2012 have grown to values well above 30, which is literally off the chart (horizontal axis of figure 7). In this recent period, cash rents have increased substantially, but farmland prices have increased more. Farmland prices in 2013 were at a historically high multiple of moving average rent, even higher than the level seen in the late 1970s prior to the agricultural crisis of the 1980s.

The high P/rent10 in 2009–2012 could be partially explained by market participants incorporating the current high rents into future expectations faster than they are incorporated into a 10-year moving average. Biofuel demand appears to be a step up in
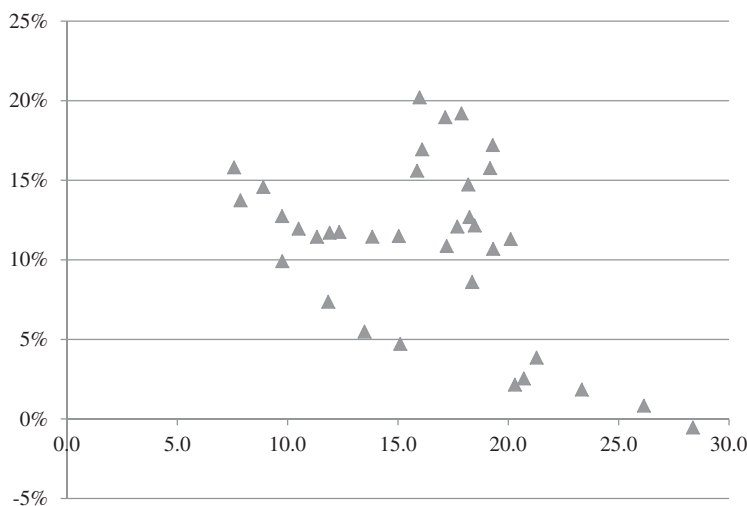
Figure 7. Ten-year rate of return (left axis) and P/rent10 at the time of purchase, 1960 to 2013
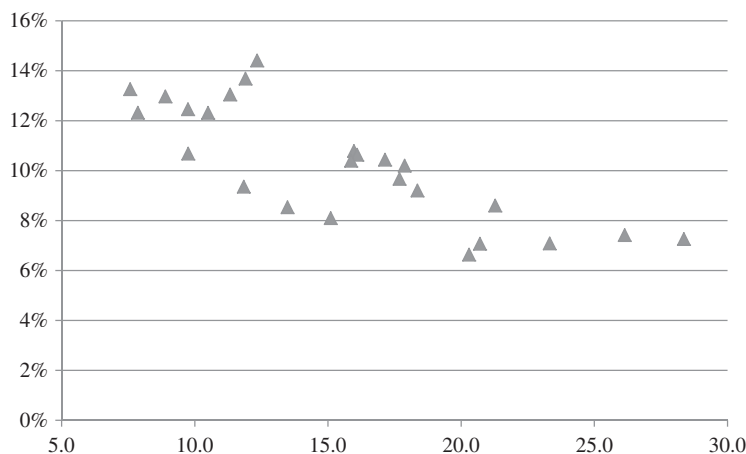

Figure 8. Twenty-year rate of return (left axis) and P/rent10 at the time of purchase, 1960 to 2013

demand that is not very likely to decline substantially. Similarly, increased export demand, mainly soybean demand by China, could be seen as likely to hold rather than decline. However, even if one considers the average of only the highest two years of cash rent, one still requires a combination of growth expectations and cost of capital that yields a historically large P/rent ratio to justify the current price; current extremely low interest rates combined with modest growth expectations must continue, or if interest rates are expected to rise, higher growth expectations are needed to offset it to maintain the historically high P/rent ratio.

Long-term Risk, Return, and Inflation Hedge

Finally, the risk, return, and inflation hedge characteristics of Iowa farmland are presented to investigate the attractiveness of farmland as a portfolio investment. The means, range, and correlation of the key variables used in the econometric estimation are shown in table 1. Iowa farmland has a mean return of 10.7%, which is comparable to the S&P 500 mean return of 9.0%. The 1.7% higher mean rate of return is not significant given that landlords normally have to pay some expenses out of cash rent (landlords usually pay property taxes

Table 1. Summary Statistics and Correlations, 1911–2012

Variable	Mean (%) (Min., Max.)	Correlation Coefficients				
		Iowa Farmland	S&P 500	Inflation	Expected Inflation	Unexpected Inflation
Iowa Farmland Return[a]	10.7	1.000	0.166	0.541	0.335	0.438
	(−24.9, 38.3)					
S&P 500 Return[b]	9.0		1.000	0.570	−0.046	0.094
	(−59.7, 44.7)					
Inflation	3.1			1.000	0.650	0.760
	(−11.7, 17.9)					
Expected Inflation	3.2				1.000	0.000
	(−7.1, 14.0)					
Unexpected Inflation	0.0					1.000
	(−10.7, 14.0)					

Notes: Iowa farmland and S&P 500 returns are in nominal U.S. dollars.
[a] Iowa farmland had a mean cash rent rate of return of 6.5%, and a mean capital gain of 4.2%.
[b] The S&P 500 had a mean dividend rate of return of 4.2% and a mean capital gain of 4.8%.

Table 2. Regression Results of Iowa Farmland Returns, Gold Price Percentage Changes, and Housing Price Percentage Changes against S&P 500 Returns, 1911-2012

Dependent Variable	Independent Variable		
	Intercept	S&P 500 Return	R^2
Iowa Farmland	9.8207	0.1069	0.068
Gold	4.6302*	−0.0285	0.108
Housing	0.0316*	0.0003	0.325

Notes: Yule-Walker estimates, correcting for autocorrelation, are provided.
*Indicates statistical difference from zero at the 1% level of significance.

and sometimes pay other expenses such as tile upkeep and lime). The conventional wisdom that farmland has a competitive rate of return comparable to stocks appears to be supported by the 101 years of data.

Annual returns for the S&P 500 range considerably lower on the negative side (−59.7%) than those for Iowa farmland (−24.9%). Inflation ranges from −11.7% to 17.9%, with a mean of 3.1%. Correlations in table 1 show that farmland has a much higher correlation with inflation (0.541) than the S&P 500 return has with expected inflation (−0.046).

To determine the risk of farmland when added to a well-diversified portfolio, we regressed Iowa farmland returns against S&P 500 returns (table 2). For comparison purposes, gold and housing price changes were also regressed against S&P 500 returns. The

results show a beta of 0.1069 for farmland. Barry (1980) published a similar regression for U.S. farmland with a larger but still relatively low beta of 0.19. Irwin, Forster, and Sherrick (1988) estimated one and two factor models for the sample periods 1950–1977 and 1947–1984, and found similar market betas to that of Barry, who used the data period 1950–1977. However, Irwin, Forster, and Sherrick's market betas are larger for the more recent period (.32 in the one-factor model and .25 in the two-factor model). On the other hand, our sample period starts considerably earlier and ends considerably later, and we find a beta smaller than Barry's. However, all of these betas are relatively small, indicating a systematic risk much smaller than an average stock. These results support the conventional wisdom that farmland adds little risk to a well-diversified investment portfolio, although the results

Table 3. Regression of Nominal Returns against Expected and Unexpected Inflation, 1911-2012

Dependent Variable	Intercept	Expected Inflation	Unexpected Inflation	R^2
Iowa Farmland Return	7.637	0.9585*	1.1761*	0.515
S&P 500 Return	10.12	−0.27	0.4740	0.011

Notes: Yule-Walker estimates, correcting for autocorrelation, are provided.
*Indicates statistical difference from zero at the 1% level of significance.

indicate that gold and housing add even less risk to a well-diversified portfolio with betas of −0.0285 and 0.00025 for gold and housing, respectively.

A substantial body of literature following Fama and Schwert (1977) measures the movement of returns for various asset classes with inflation by regressing returns against expected and unexpected inflation. The literature varies in the measures used for expected and unexpected inflation. Fama and Schwert (1977) used short-term interest rates as a proxy for expected inflation. However, since 2010 short-term government interest rates have been approximately zero and we do not believe that expected inflation has been zero. Also, with our data going back to 1911, we include periods in which expected inflation may have been negative, whereas treasury interest rates do not go significantly negative. Thus, we follow another major thread in the literature and follow Caporale and Jung (1997), who assume that economic agents predict inflation based on past values of inflation. Expected inflation is determined as the predicted value from regressing current inflation on past inflation with two lags.[6] Unexpected inflation is the residual from that regression.

Finally, we compared farmland to stocks as a hedge against inflation. Table 3 summarizes the results of regressing Iowa farmland and S&P 500 returns against expected and unexpected inflation. Our results show that Iowa farmland returns move nearly one for one with both expected and unexpected inflation. In contrast, S&P 500 returns move slightly in the opposite direction of expected inflation, and less than half (0.474 times) of unexpected inflation. The conventional wisdom that farmland is a good hedge against inflation is supported by these results.

Policy Implications

Although this analysis has focused on private-sector market behavior, two potential policy implications are relevant. The first potential policy issue deals with the consequences of policies that enhance the demand for agricultural products, as well as those that reduce the cost of capital for the sector. Biofuels policies have stimulated increased use of feed grains for energy production in the form of ethanol and biodiesel, resulting in increased commodity prices and returns to farmland. Changes in biofuels policies that alter that demand have potentially significant implications for commodity prices and returns to farmland and farmland values. Monetary policy focused on stimulating economic growth through low interest rates has reduced the cost of capital, resulting in a lower capitalization rate, which supports higher land values. A policy shift to increasing interest rates and consequently capitalization rates would be much less supportive of rising farmland values and may precipitate weakening land prices.

A second potential policy issue is the dominance of farmland in farmers' investment portfolios. This issue has two important dimensions. First, this asset/investment concentration means that farmers are more vulnerable in their retirement years to the risk of declining asset values, as well as the income from those assets. It is difficult to mitigate this risk since farmland is an asset that farmers acquire as part of their business, and diverting funds to other investments during their farming careers could impair the success of the farming business. Second, farmland is an illiquid asset, and markets to hedge against value changes such as futures/options, or tradable instruments,

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[6] Thus, $CPI_t = 1.6016 + 0.7842\ CPI_{t-1} - 0.2870\ CPI_{t-2} + e_{it}$; all coefficients are statistically significant at the 5% level, and the R squared is 0.43.

are not readily available. A potential public response to this concern would be to provide incentives for the private sector to develop such instruments or markets through tax or other policies.

Conclusions

In this paper we have attempted to provide evidence and insight into the attractiveness of farmland as an investment portfolio choice—the long-run risk, return, and inflation hedge characteristics of farmland compared to other financial/asset investments. Our analyses use standard financial metrics such as P/E ratios, rates of return, and beta (β) to inform these analyses. The results suggest that the current P/rent ratio for farmland is substantially higher than the historical ratio, and that this ratio is also high relative to the comparable P/E ratio on equities as measured by the S&P 500.

The analysis of historical rates of return for farmland indicates that it has returns comparable to that of stock investments. The risk of farmland as a component of a diversified portfolio as measured by the beta (β) is very low, suggesting that it adds little risk to a diversified portfolio. The inflation hedge results also suggest that farmland is a very attractive inflation (both expected and unexpected) hedge investment, and is much superior to stock investments.

We investigated historical cyclically adjusted P/rent ratios for farmland and found a negative relationship between 10- and 20-year holding returns and the cyclically adjusted P/rent ratio at the time of purchase. Given the extremely high value of farmland P/rent10 in 2013, we suggest caution. Even though our data confirms the conventional wisdom that farmland has high returns, low risk, and is a good inflation hedge, the current P/rent10 ratio suggests that this is not a good time to buy. That is, those purchasing farmland today should not ignore the very real possibility of "buyer's remorse."

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