



PURDUE AGRICULTURAL ECONOMICS REPORT

August 2021 Issue Contents

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Indiana Farmland Prices Hit New Record High in 2021

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Summary: Indiana farmland prices hit a new record high in 2021. Farmland price growth is driven by a combination of high expected incomes, low interest rates, and limited supply to satisfy demand.

It is safe to say that the last year was unlike any other in recent memory. The COVID-19 pandemic caused significant disruption to our lives and the global economy. Surprisingly, many of the current economic forces put upward pressure on farmland prices. As one respondent noted, “short supply of farms for sale, investors and institutional buyers, farmers flush with money and equity, continued historic low interest rates and fear of increasing rates, an influx of government assistance, higher than anticipated commodity prices, fear of tax policy changes, and a willingness to accept lower required returns on investments... *all equal a new historic land value.*” This unique combination of economic forces led to new record high farmland prices in 2021, according to the recent *Purdue Land Values and Cash Rent Survey*.

Statewide, top quality farmland averaged \$9,785 per acre, up 14.1% from June 2020 (Table 1). The high growth rate for top quality farmland was closely followed by the growth in average and poor quality farmland prices, which increased by 12.5% (to \$8,144) and 12.1% (to \$6,441),

respectively. Across all land quality classes, 2021 per acre farmland prices exceeded the previous record set in 2014.

Many areas of the state experienced particularly high farmland price appreciation (Figure 1). The highest growth rates were observed in the Southwest region, ranging from 20% for average and poor quality land to nearly 28% for top quality farmland. High appreciation rates were also observed across all land quality classes in the Central and West Central regions. The West Central and Central regions also exhibited the highest value or cost per unit of productivity (per bushel of corn). In 2021, the highest per acre price for high quality farmland was in the Southwest portion of the state, and the highest per acre prices for average and poor quality farmland were in the West Central region.

The 2021 *Purdue Land Values and Cash Rents Survey* respondents are optimistic that the current land price growth will continue through the end of the year, yet at a slower pace than observed since December 2020. Statewide, respondents expect farmland prices to increase by 3.9% (top and average quality) to 4.2% (poor quality) by December 2021.

Figure 1: County clusters used in Purdue Land Values survey to create geographic regions

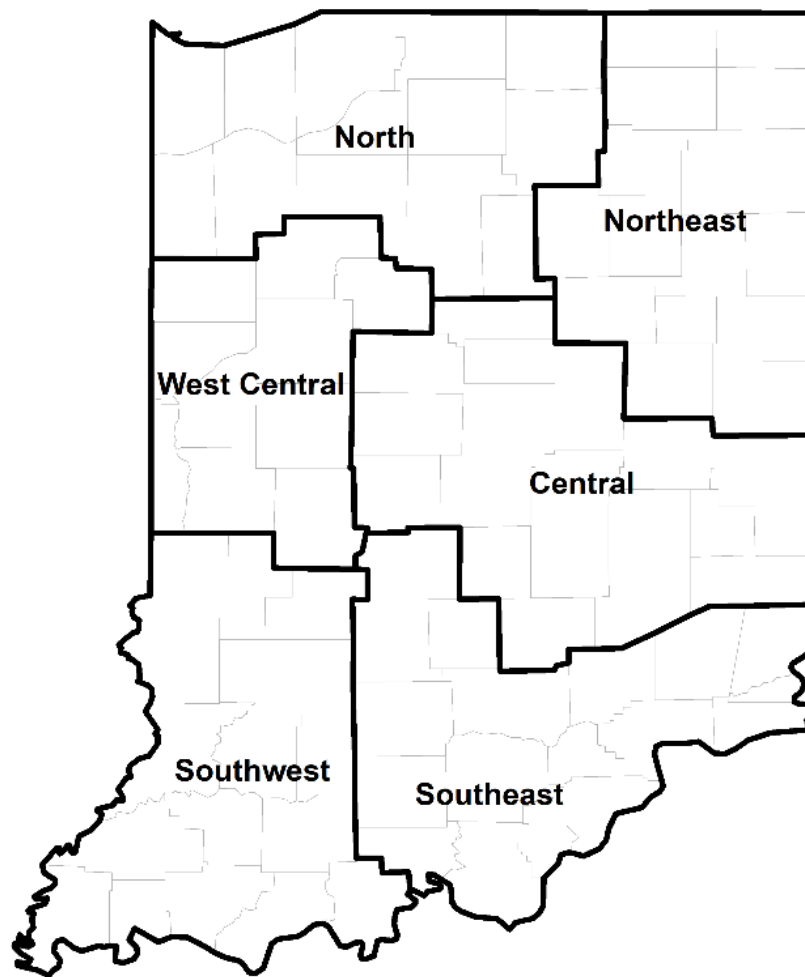


Table 1: Average estimated Indiana land value per acre (tillable, bare land), per bushel of corn yield, and percentage change by geographic area and land class, selected time periods, Purdue Land Value Survey, June 2021¹

Area	Land Class	Corn bu/A	Land Value						Projected				
			Dollars per Acre			Land Value/Bu			Land Value				
			June	Dec	June	% Change			Amount	Amount	% Change	Dec	% Change
			2020	2021	2021	6/20-6/21	6/20-12/20	12/20-6/21	2020	2021	6/20-6/21	2021	6/21-12/21
\$/A	\$/A	\$/A	%	%	%	\$	\$	%	\$	%			
North	Top	214	8,478	8,295	9,073	7.0%	-2.2%	9.4%	40.76	42.40	4.0%	9,636	6.2%
	Average	178	6,731	6,618	7,205	7.0%	-1.7%	8.9%	37.60	40.47	7.6%	7,709	7.0%
	Poor	146	4,914	5,018	5,559	13.1%	2.1%	10.8%	32.76	38.08	16.2%	6,068	9.2%
Northeast	Top	205	8,626	8,644	9,481	9.9%	0.2%	9.7%	42.92	46.25	7.8%	9,717	2.5%
	Average	178	7,586	7,464	8,083	6.6%	-1.6%	8.3%	43.1	45.41	5.4%	8,281	2.4%
	Poor	152	6,421	6,311	6,764	5.3%	-1.7%	7.2%	42.24	44.50	5.3%	6,908	2.1%
W. Central	Top	217	9,308	10,061	10,970	17.9%	8.1%	9.0%	42.89	50.56	17.9%	11,220	2.3%
	Average	193	8,121	8,659	9,382	15.5%	6.6%	8.3%	42.97	48.61	13.1%	9,627	2.6%
	Poor	165	6,707	7,167	7,849	17.0%	6.9%	9.5%	41.14	47.57	15.6%	7,995	1.9%
Central	Top	212	8,809	9,377	10,195	15.7%	6.5%	8.7%	41.75	48.09	15.2%	10,743	5.4%
	Average	186	7,606	8,198	8,895	17.0%	7.8%	8.5%	41.34	47.83	15.7%	9,007	1.3%
	Poor	160	6,213	6,857	7,414	19.3%	10.4%	8.1%	39.57	46.34	17.1%	7,738	4.4%
Southwest	Top	219	9,150	11,104	11,696	27.8%	21.4%	5.3%	43.36	53.41	23.2%	12,217	4.5%
	Average	180	7,110	8,096	8,546	20.2%	13.9%	5.6%	39.72	47.48	19.5%	9,125	6.8%
	Poor	145	4,967	5,554	5,965	20.1%	11.8%	7.4%	33.56	41.14	22.6%	6,596	10.6%
Southeast	Top	198	6,069	6,454	6,675	10.0%	6.3%	3.4%	32.28	33.71	4.4%	6,845	2.6%
	Average	167	4,884	4,888	5,025	2.9%	0.1%	2.8%	30.15	30.09	-0.2%	5,382	7.1%
	Poor	133	3,653	3,650	3,675	0.6%	-0.1%	0.7%	27.67	27.63	-0.1%	3,986	8.5%
Indiana	Top	212	8,579	9,061	9,785	14.1%	5.6%	8.0%	41.44	46.16	11.4%	10,165	3.9%
	Average	182	7,236	7,570	8,144	12.5%	4.6%	7.6%	40.2	44.75	11.3%	8,461	3.9%
	Poor	153	5,746	5,978	6,441	12.1%	4.0%	7.8%	37.8	42.10	11.4%	6,715	4.2%
	Transition ²	XXX	15,127	16,131	17,759	17.4%	6.6%	10.1%				18,345	3.3%
	Recreation ³	XXX	3,876	5,228	7,486	93.1%	34.9%	43.2%				5,753	-23.2%

¹ The land values contained in this summary represent averages over several different locations and soil types. Determining the value for a specific property requires more information than is contained in this report and should include an evaluation by a professional appraiser.

² Transition land is land moving out of production agriculture into other, typically higher value, uses.

³ Recreation land is land located in rural areas used for hunting and other recreational uses.

In addition to agricultural production, farm real estate prices are greatly influenced by the potential to develop land to nonagricultural commercial or residential uses. As a result, the survey collects information about the price of land moving out of agricultural production. The statewide average value of transitional land was \$17,759 per acre, a 17% increase from June 2020. Rural land purchased for recreational purposes nearly doubled from \$3,876 per acre in 2020 to \$7,486 per acre in 2021. While respondents expect transitional land prices to continue to appreciate through December 2021, they expect recreational lands to decline in value.

The survey also collects information on the value of farmland moving into rural residences and subdivisions (Table 2). Respondents provide estimates of the value of rural home sites located on a blacktop or well-maintained gravel road with no accessible gas line or city utilities. These markets are characterized by a very wide range of values. As a result, responses are summarized by median values (the value dividing a series of ordered numbers in half). The median value of five-acre home sites also increase in 2021, with median values between \$10,375 (Southeast) to \$15,000 per acre (Northeast and Southwest). Similar values were observed for 10 acre home sites, ranging from \$10,000 (North and Southeast) to \$15,000 per acre (Northeast and Southwest).

Table 2: June median value of unimproved five-acre or less home sites and ten-acre or more subdivisions

Area	Median value, \$ per acre							
	5 Acres or less for home site				10 Acres & over for subdivision			
	2018	2019	2020	2021	2018	2019	2020	2021
	\$/A	\$/A	\$/A	\$/A	\$/A	\$/A	\$/A	\$/A
North	10,000	10,000	10,000	11,000	10,000	8,250	10,000	10,000
Northeast	10,000	10,000	10,000	15,000	10,000	10,000	12,000	15,000
West								
Central	10,000	10,000	11,500	12,000	10,000	10,000	10,000	12,000
Central	10,000	10,000	12,000	12,000	11,000	10,000	10,000	14,000
Southwest	10,000	9,000	12,500	15,000	10,000	15,000	10,000	15,000
Southeast	9,000	10,000	10,000	10,375	7,250	10,000	8,000	10,000

Farmland Market Forces

Respondents were asked to evaluate the importance of ten market forces that may potentially influence the farmland market: (1) current net farm income, (2) expected growth rate in farm returns, (3) crop price level and outlook, (4) livestock price level and outlook, (5) current and expected interest rates, (6) returns to alternative investments, (7) outlook for U.S. agricultural export sales, (8) U.S. inflation rate, (9) cash liquidity of buyers, and (10) current U.S. agricultural policy. Respondents rate each market force on a scale of -5 to +5, with -5 being the strongest negative influence. A positive influence is given a value between 1 and 5, with 5 representing the strongest positive influence. A score of 0 indicates the force was not influential. An average for each item was calculated, and averages for 2019, 2020, and 2021 are included in Figure 2. The horizontal axis shows the item from the list above.

In contrast to recent years, all ten market forces put positive pressure on farmland prices. The most influential market forces include net income, expected income growth, crop prices, and farmers' liquidity. Many of these forces, particularly crop prices, were also highlighted in respondents comments. As one respondent notes, "land prices have risen dramatically since November 2020, following grain prices."

While a number of respondents note the limited supply of land for sale this year, the share of respondents reporting more land for sale increased relative to 2019 and 2020 (Figure 3). The share of respondents reporting more land for sale increased to 12%, while 47% reported a smaller share of land for sale.

Figure 2: Influence of drivers of Indiana farmland values

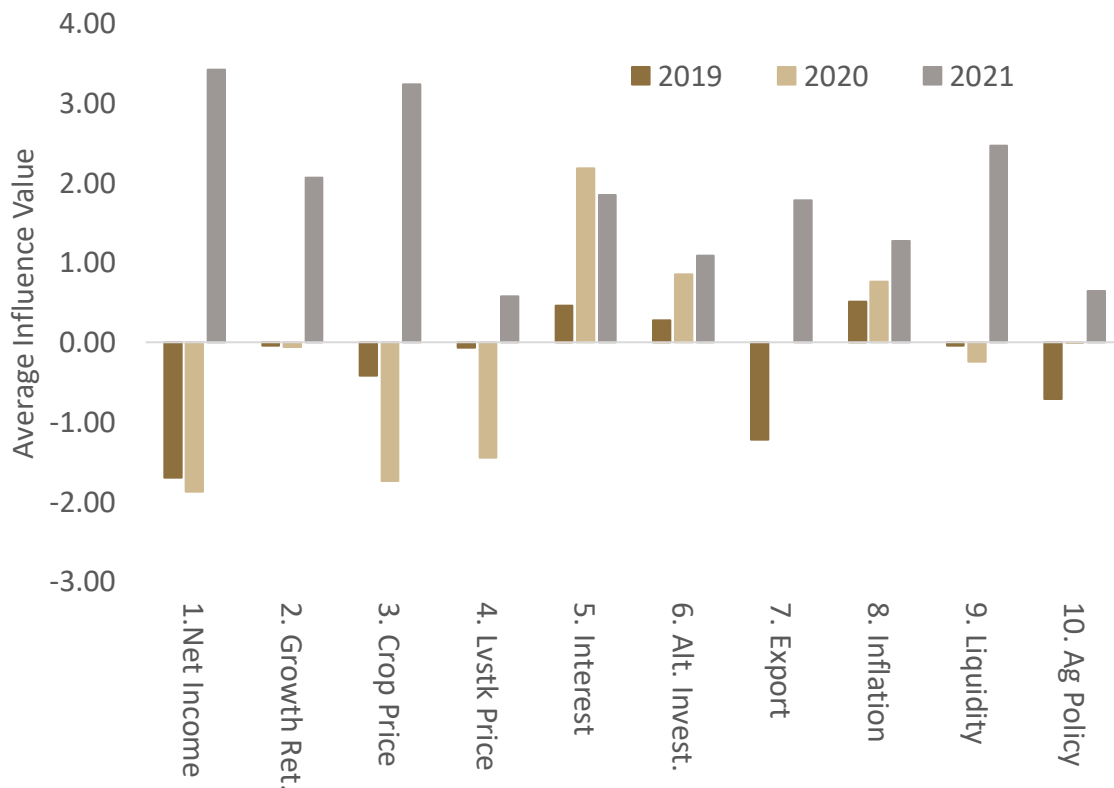
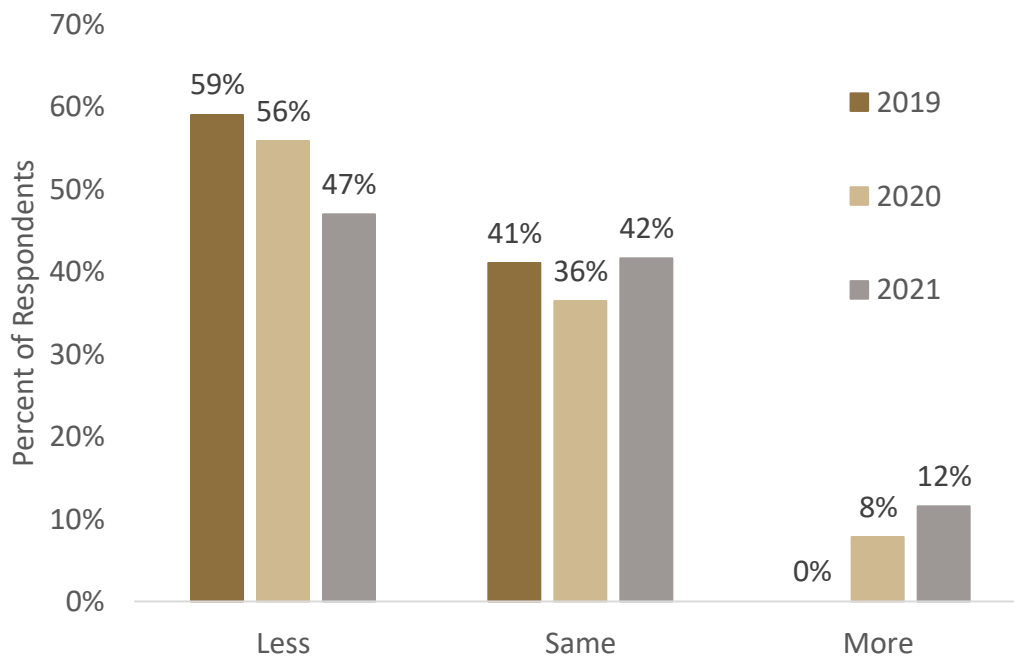


Figure 3: Percentage of respondents indicating less, same, or more farmland on the market than in the previous June



Five-Year Forecasts

Respondents were asked to forecast the five-year average corn price, soybean price, mortgage rate, and inflation rate (Table 3). Respondents estimated the five-year average per bushel average price of corn to be \$4.66, an \$0.89 per bushel increase from the 2020. The five-year per bushel soybean price was estimated to be \$11.15, a \$2.08 per bushel increase from 2020. In both cases, the respondents were much more optimistic compared to recent years.

As the economy continues to recover from the COVID-19 pandemic, respondents also expect a marked increase in both farm mortgage rates and inflation. The expected mortgage interest rate of 4.9% is higher than that of 2020 but still below average value expected over the last five years. The expected inflation rate of 3.4% is nearly a full percentage point higher than the average of the last five years. Many respondents also noted concerns of inflation risk in the survey comments.

Table 3: Projected five-year average corn and soybean prices, mortgage interest, and inflation

Year	Price, \$ per bu.		Rate, % per year	
	Corn	Soybeans	Interest	Inflation
2017	3.79	9.34	5.1%	2.2%
2018	3.97	9.99	5.5%	2.5%
2019	4.15	9.01	5.5%	2.4%
2020	3.77	9.07	3.9%	2.1%
2021	4.66	11.15	4.9%	3.4%
Average	\$4.07	\$9.71	5.0%	2.5%

Cash Rents

Statewide cash rental rates increased across all land quality classes in 2021. Statewide average rental rates increased by 3.9% for top quality land, from \$259 to \$269 per acre. The cash rental rates for average and poor quality lands both increased by 4.6% to \$227 and \$183, respectively. At the regional level, the largest rental rate increases for top and average quality land were both in the Southeast region (11.5% and 6.4%), and the largest rental rate increases for poor quality land were in the North region (5.5%). Across all three land quality classes, the highest per acre cash rent was observed in the West Central region.

Rent as a share of June land value decreased slightly in 2021, suggesting that cash rental rates appreciated slower than farmland prices. Some portion of the difference in appreciation rates may reflect changes in expectations between fall 2020, when 2021 rents were negotiated, and the 2021 growing season. However, at least one respondent suggests that “fear of input prices for 2022 is going to restrict cash rents going up sharply” in the coming year.

Table 4: Average estimated Indiana cash rent per acre, (tillable, bare land) 2020 and 2021, Purdue Land Value Survey, June 2021

Area	Land Class	Corn bu/A	Rent/Acre		Change 20-21 %	Rent/bu. of corn		Rent as % of June Land Value	
			2020 \$/A	2021 \$/A		2020 \$/bu.	2021 \$/bu.	2020 %	2021 %
North	Top	214	272	273	0.4%	1.31	1.28	3.2%	3.0%
	Average	178	219	222	1.4%	1.22	1.25	3.3%	3.1%
	Poor	146	165	174	5.5%	1.10	1.19	3.4%	3.1%
Northeast	Top	205	242	242	0.0%	1.20	1.18	2.8%	2.6%
	Average	178	205	211	2.9%	1.16	1.19	2.7%	2.6%
	Poor	152	174	181	4.0%	1.14	1.19	2.7%	2.7%
W. Central	Top	217	293	302	3.1%	1.35	1.39	3.1%	2.8%
	Average	193	252	262	4.0%	1.33	1.36	3.1%	2.8%
	Poor	165	212	222	4.7%	1.30	1.35	3.2%	2.8%
Central	Top	212	261	272	4.2%	1.24	1.28	3.0%	2.7%
	Average	186	222	235	5.9%	1.21	1.26	2.9%	2.6%
	Poor	160	185	192	3.8%	1.18	1.20	3.0%	2.6%
Southwest	Top	219	269	288	7.1%	1.27	1.32	2.9%	2.5%
	Average	180	216	225	4.2%	1.21	1.25	3.0%	2.6%
	Poor	145	161	164	1.9%	1.09	1.13	3.2%	2.7%
Southeast	Top	198	200	223	11.5%	1.06	1.13	3.3%	3.3%
	Average	167	171	182	6.4%	1.06	1.09	3.5%	3.6%
	Poor	133	131	133	1.5%	0.99	1.00	3.6%	3.6%
Indiana	Top	212	259	269	3.9%	1.27	1.27	3.0%	2.7%
	Average	182	217	227	4.6%	1.24	1.25	3.0%	2.8%
	Poor	153	175	183	4.6%	1.19	1.20	3.0%	2.8%

Looking Ahead

Statewide farmland prices established a new record high in 2021, expanding on the growth from 2019 to 2020. The growth in farmland prices is driven by complex combination of economic

forces, including high commodity prices, low interest rates, and low supply of land. While respondents are optimistic that these forces will continue to support farmland growth for the remainder of 2021, many of the respondents' comments signal challenges on the horizon. Many of these challenges are related to economic adjustments as we continue to recover from the COVID-19 pandemic, but others include changing demand for land use through development in the form of housing or solar energy production. A closely related set of uncertainties are driven by agricultural, environmental, and economic policies, including discount rates, land use restrictions, and tax policy. Thus, while many farmland market participants are encouraged by the growth in land values in the first half of 2021, most recognize that the combination of economic forces driving current farmland price growth are not likely to remain for the long term.

Purdue Farmland Value and Cash Rent Survey

The Purdue Farmland Value and Cash Rent Survey is conducted each June. The survey is possible through the cooperation and contribution of numerous professionals knowledgeable of Indiana's farmland market. These professionals include farm managers, rural appraisers, land brokers, agricultural loan officers, farmers, and Farm Service Agency (FSA) county office directors. These professionals were selected because their daily work requires they stay well informed about farmland values and cash rents.

These professionals provide an estimate of the market value for bare poor, average, and top quality farmland in December 2020, June 2021, and a forecast for December 2021. To assess productivity of the farmland, respondents provide an estimate of long-term corn yield for top, average, and poor productivity farmland. Respondents also provide a market value estimate for land transitioning out of agriculture and for recreational land.

The data reported here provide general guidelines regarding farmland values and cash rent. To obtain a more precise value of an individual tract, contact a professional appraiser or farm manager that has a good understanding of the local market.

Prior reports are located at: https://purdue.ag/paer_archive



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AGRICULTURAL ECONOMICS REPORT

2021 Indiana Pastureland, Hay Ground, and On-Farm Grain Storage Rent

Author: Todd H. Kuethe
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Estimates for the current rental value of pastureland, hay ground, irrigated land, and on-farm grain storage in Indiana are often difficult to locate. For the past several years, questions about these items have been included in the *Purdue Land Values and Cash Rent Survey*. These tables report the values from the June 2021 survey.

Table 1 reports averages and the number of responses for pasture rent. The number of acres required to support a cow, animal unit, is also presented.

Table 1: Pastureland: Number of responses, annual cash rent, and carrying capacity, June 2021

Region	Number of responses	Annual rent (\$/A)	Carrying Capacity (acres per cow)
North & Northeast	6	82	1.4
Central & West Central	13	53	1.9
Southeast & Southwest	9	100	2.1
State	28	70	2.3

Table 2 reports the average per acre rental rates and the number of responses for established alfalfa/grass hay and grass hay.

Table 2: Rental of established alfalfa hay and grass hay ground, June 2021

Region	Alfalfa/Alfalfa-Grass Hay		Grass Hay	
	Responses	Rent	Responses	Rent
North & Northeast	6	161	6	129
Central & West				
Central	10	108	11	67
Southeast & Southwest	8	174	7	132
State	24	133	24	95

Table 3 provides information about the value and rental rate for irrigated farmland. These rates are associated with the production of corn and soybeans. When producing speciality crops, such as see corn or tomatoes, rent is frequently higher.

Table 3: Irrigated Indiana farmland: Number of responses, long-term corn yields, estimated market value, annual cash rent, and rent as a percent of farmland value, June 2021

Region	Responses	Corn Yield (bu/A)	Market Value (\$/A)	Cash Rent (\$/A)	Rent as % of Land Value	Responsible for Repair and Maintenance	
						Well	Water Distribution
State	17	239	9,588	291	3.0%	24% tenant 76% landlord	82% tenant 18% landlord

Table 4 provides information about on-farm grain storage rental rates. The rental rate for grain bins includes the situation where the bin is rented and the person renting the bin pays utility expenses, where the bin is rented and the bin owner pays the utility bills, and where the producer rents a system that includes dryer, legs, and bins. These rates are annual rates.

Table 4: On-Farm grain storage rental: Number of responses and annual per bushel rent, June 2021

Region	Bins only		Bins and electric utilities		Grain system	
	Responses	Rent (\$/bu.)	Responses	Rent (\$/bu.)	Responses	Rent (\$/bu.)
North & Northeast	25	\$0.16	23	\$0.19	20	\$0.27
Central & West						
Central	18	\$0.18	17	\$0.23	15	\$0.22
Southeast & Southwest	28	\$0.16	24	\$0.21	22	\$0.29
State	71	\$0.17	64	\$0.21	57	\$0.26

The first year for reporting this information was 2006. Past reports are in the *Purdue Agricultural Economics Report* archive: https://purdue.ag/paer_archive.



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AGRICULTURAL ECONOMICS REPORT

Trends in Farmland Price to Rent Ratios in Indiana

Author: Michael Langemeier
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Tags: Farmland prices

Despite increasing by 15.5% in 2021, farmland prices in west central Indiana are still 2.4% below their peak in 2014. Compared to historical prices, however, farmland prices in west central Indiana are 88% higher than they were in 2010 and 410% higher than they were in 2000 (for current land values see Kuethe in this edition of PAER). Concerns are periodically expressed by many investment analysts that farmland prices are higher than justified by the fundamentals. One justification for this concern is that previous research has established the tendency of the farmland market to over-shoot its fundamental value.

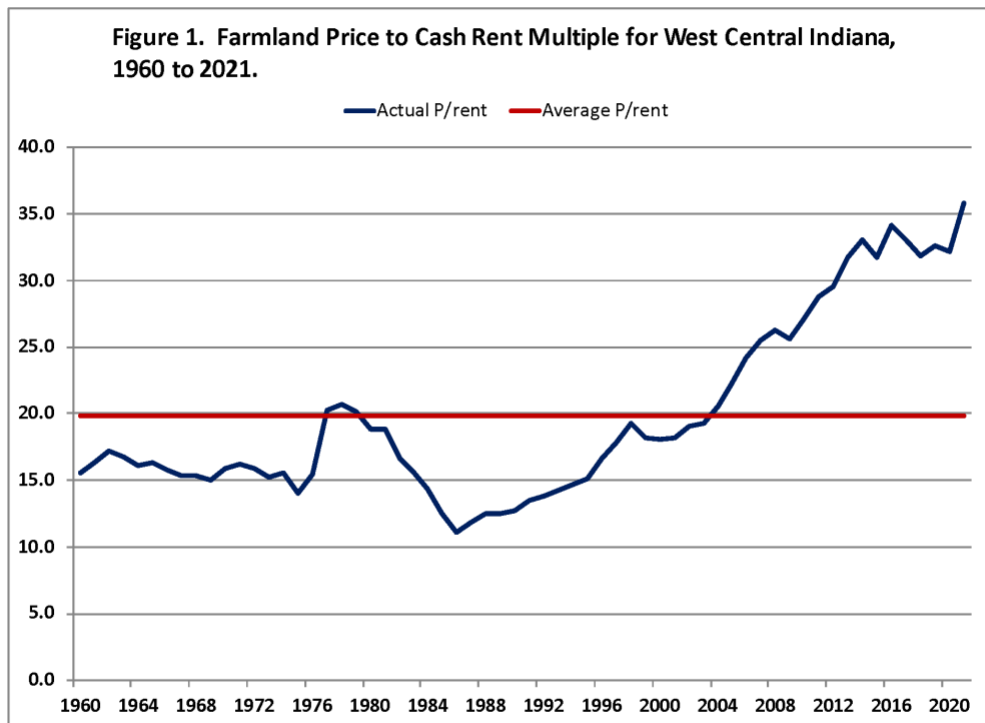
A standard measure of financial performance most commonly used for stocks is the price to earnings ratio (P/E). A high P/E ratio sometimes indicates that investors think an investment has good growth opportunities, relatively safe earnings, a low capitalization rate, or a combination of these factors. However, a high P/E ratio may also indicate that an investment is less attractive because the price has already been bid up to reflect these positive attributes.

This paper computes a ratio equivalent to P/E ratio for farmland, the farmland price to cash rent ratio (P/rent), and discusses trends in the P/rent ratio. We use land value and cash rent data for the 1960 to 2021 period for west central Indiana to illustrate the P/rent ratio. Data from 1975 to 2021 were obtained from the annual *Purdue Land Value and Cash Rent Survey*. For 1960 to 1974, the 1975 Purdue survey numbers were indexed backwards using the percentage change in USDA farmland value and cash rent data for the state of Indiana.

Price to Rent Ratio

The P/rent ratio for west central Indiana averaged 19.8 over the 61-year period from 1960 to 2021 (Figure 1). The peak P/rent ratio before 1990 occurred during the 1977 to 1979 period. The P/rent dropped substantially from 1980 to 1986 reaching a low of 11.1 in 1986. The rise from around 15 in 1976 into the 20s and down to 11.1 in 1986 corresponds to what is viewed as

the bubble in farmland prices that was followed by one of the most difficult periods in history for production agriculture (i.e., the early-to-mid 1980s).



The P/rent ratio has been above the long-run average since 2004. From 2004 to 2014, the P/rent ratio increased from 20.6 to 33.0. Since the peak in land values in 2014, the P/rent ratio has ranged from 31.7 in 2015 to 35.8 in 2021. The current value of 35.8 is relatively high compared to the historic average of 19.8 and a previous high of around 20, and thus at least raises concerns that current farmland prices are overvalued in relationship to returns. Having said that, one of the reasons often mentioned as a major explanatory factor associated with the recently high P/rent ratio is low interest rates. The average interest rate on 10-year treasuries from 1960 to 2021 was 6.1%. The interest rate on 10-year treasuries has been below its long-run average since 1998. Moreover, the rate has not been above 4% since 2008 and has not been above 3% since 2011.

Over the 61-year period from 1960 to 2021, the P/E ratio for stocks is 19.8, which is similar to the long-run average P/rent ratio. Though the long-run averages are similar, the P/E and P/rent ratios do not necessarily track one another. The average correlation coefficient between these two measures is only 0.36. Though not the topic of this paper, diversification potential between the stock market and farmland is relatively high.

Cyclically Adjusted P/Rent

Shiller (2005; 2021) 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. By using a 10-year moving average of earnings in the denominator of the P/E ratio, Shiller has smoothed out the business cycle by deflating both earnings and prices to remove the effects of inflation. Shiller also uses the P/E10 to gain insight into future rates of return. That is, if an investor buys an asset when its P/E10 is high, do subsequent returns from that investment turn out to be low, and vice versa?

The P/rent ratios reported thus far are the current year's farmland price divided by current year cash rent. Here we are modeling our P/rent10 after Shiller's 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 operator net returns (P/NR-10).

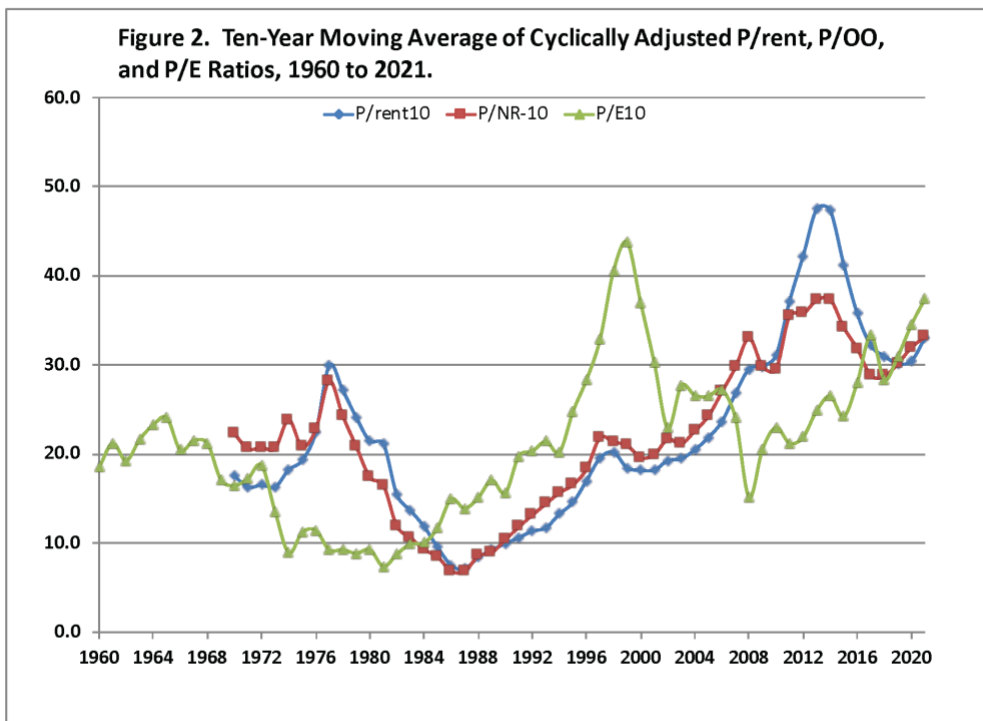


Figure 2 shows all three of these ratios: P/rent10; P/NR-10, and Schiller's P/E 10. The P/rent10 ratio reached a peak in 2013 at 47.5. The ratio then steadily declined, reaching a level of 30.1 in 2019. The ratio increased to 30.5 in 2020 and 33.0 in 2021. The current P/rent10 ratio is still relatively high compared to the long-run average (using 1960 to 2021 data) of 22.0. Does the current P/rent10 ratio signify a bubble or is something else going on? With regard to this question, we would like to make two points. First, interest rates have been very low compared to long-run averages during the last ten years. The average rate on 10-year treasuries averaged only 2.2% during the last ten years. Second, as we note below, the P/rent10 and P/NR-10 ratios appear to be in equilibrium.

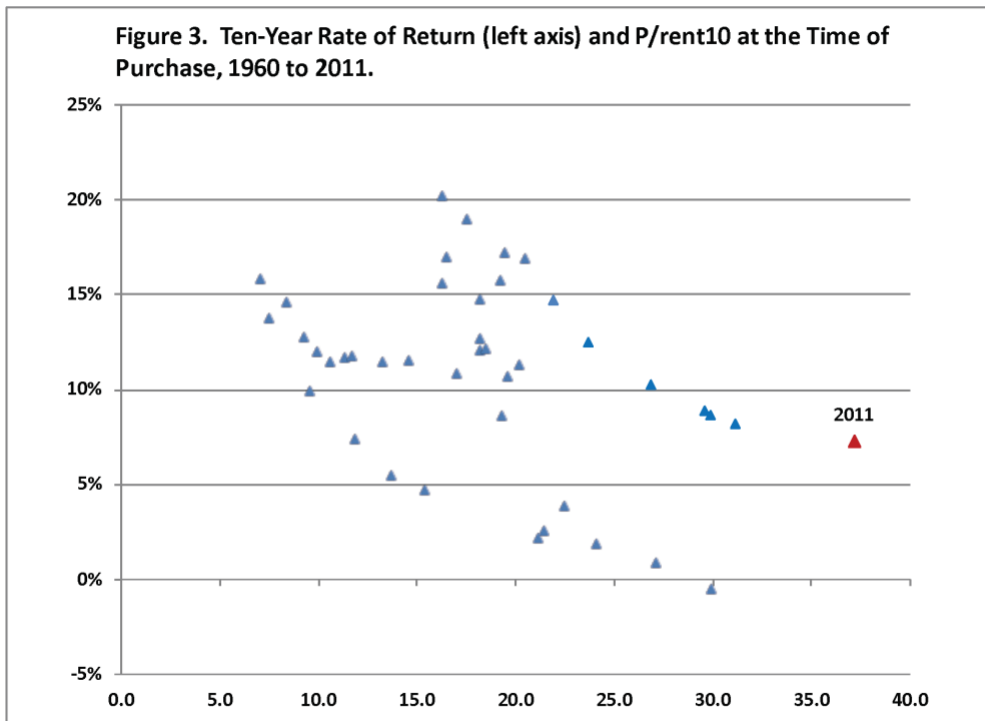
The P/NR-10 ratio fell through the first half of the 1970s when real returns grew faster than land values, increased from around 20 in the mid 1970's to 28.2 in 1977, and then fell to 6.8 in 1987. The P/NR-10 then increased steadily until it reached a peak of 37.3 in 2014. The P/OO-10 ratio has ranged from 28.7 to 34.2 since 2014. From 2015 to 2018, the P/OO-10 ratio was smaller than the P/rent10 ratio, indicating that ten-year average cash rents were smaller than ten-year average operator net returns. In 2019, the P/rent10 and P/NR-10 ratios were similar. For the last two years, the P/NR-00 ratios have been slightly higher than the P/rent10 ratio. In the long-run, you would expect the two ratios to be similar. In fact, the average P/rent10 and P/OO-10 ratios for the 1960 to 2021 period were 22.0 and 21.9, respectively. The current ratios (33.0 for P/rent10 and 33.1 for P/NR-10) are very close to equilibrium.

It is evident from figure 2 that there is not a close link between the P/E10 ratio and the P/rent10 ratio. The P/E10 ratio was much higher than the P/rent ratio from 1995 to 2002. In contrast, the P/E10 ratio was quite a bit lower than the P/rent ratio from 1976 to 1981 and from 2011 to 2015.

Buy at a High Ratio: Get a Low Future Return?

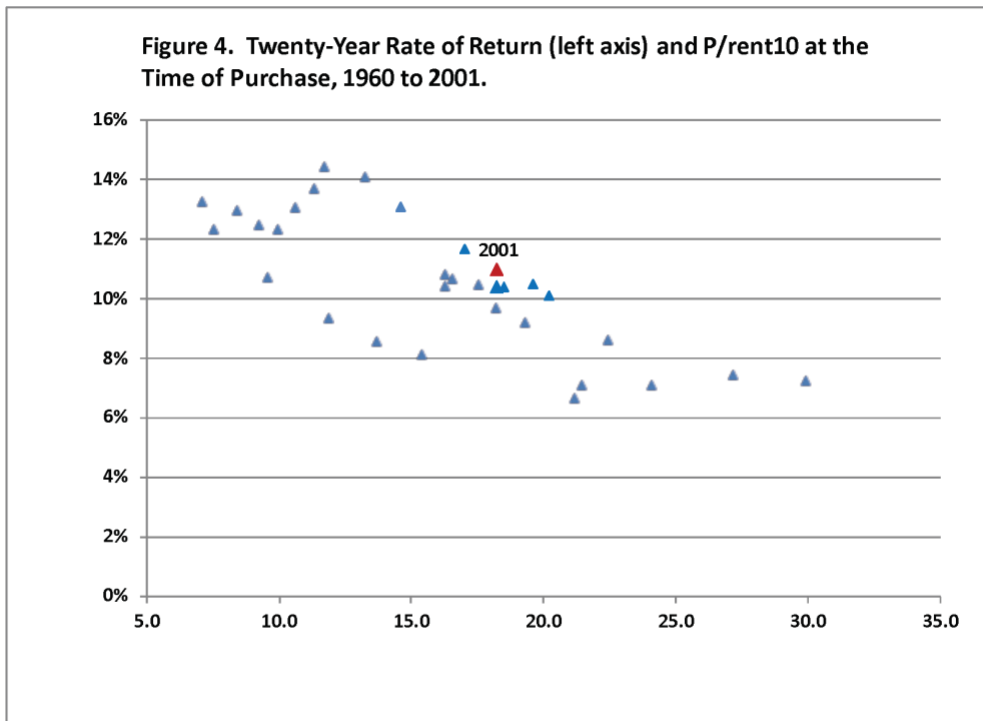
Shiller also discusses the relationship between the P/E10 ratio and the annualized rate of return from holding S&P 500 stocks for long periods. In general, his results show that the higher the P/E10 ratio at the time of purchase, the lower the resulting multiple year returns, like for the next 10 or 20 years. The west central Indiana farmland and cash rent data from 1960 to 2021 are used to compute 10-year and 20-year annualized rates of return. Returns are 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 3). That is, if one purchased farmland when the P/rent10 ratio was very high, like now, they tended to have a low 10-year rate of return. Alternatively, if one purchased farmland when the P/rent10 was intermediate or low, they tended to have moderate to high 10-year returns. The 10-year returns ranged from a small negative to 20%. The 20-year holding period returns also exhibit a strong negative relationship with the P/rent10 ratio (figure 4). The 20-year holding returns range from 6 to 14%.



As noted above, figure 3 presents the ten-year rate of return for farmland and the P/rent10 ratio for land purchased in west central Indiana from 1960 to 2011. The P/rent10 ratio in 2011 (i.e., 37.2) was higher than any ratio experienced since 1960. Despite this fact, the ten-year rate of return for farmland purchased in 2011 was still 7.3%. The P/rent10 ratios for land purchased in 2012 through 2015 are literally off the chart (horizontal axis of Figure 3). P/rent10 ratios for this time period range from 41.2 in 2015 to 47.5 in 2013. From 2016 to 2021, the P/rent10 ratios range from 30 to 36. Will rates of return for land purchased since 2012 stay above 7%? The answer to this question depends on what happens to operator net returns and interest rates. If operator net returns remain strong and interest rates stay low, the answer to the question is probably yes.

The 20-year rate of return for land purchased in 2001 is 11.0 percent, which is in the middle of the range of 20-year rates of return illustrated in figure 4. It will be interesting to see if the 20-year rate of return declines as the P/rent10 ratio increases in the next few years. For land purchased in 2001 the P/rent10 is 18.2. In the next five years, this rate will increase to approximately 24, and then increase dramatically for land purchased in 2007 on.



Final Comments

Our analysis indicates that the P/rent ratio (price per acre divided by cash rent per acre) is substantially higher than historical values. In order to maintain the current high farmland values, cash rents would have to remain relatively high, and interest rates would also have to remain very low. Most agricultural economists expect crop returns to remain relatively strong in the next couple of years, mitigating downward pressure on cash rents, and for interest rates to remain similar to current levels in coming years, providing support for the current P/rent ratio.

We demonstrated that farmland values have tended to have a cyclical component in which farmland values move too high relative to the underlying fundamentals and then over time move too low relative to fundamentals. We use a cyclically adjusted P/rent ratio to show that a very high P/rent ratio, as we have now, tends to be associated with low subsequent returns. Simply stated this means that the historical relationships show that those who bought farmland when the P/rent ratio was high tended to have low subsequent returns. On the other hand, those who bought farmland when the P/rent ratio was intermediate or low, tended to have intermediate or high subsequent returns. The current record high P/rent ratio could be a warning to current farmland buyers that their odds of favorable returns on these purchases are probably not high.

Our reading from examining 61 years of history is that the current relationship between farmland prices and cash rents suggests that farmland prices are elevated. If we are correct, this means that those purchasing farmland at current prices may experience “buyer’s remorse” in coming years. But having said this, there remain some possible situations in which farmland values could be maintained or even increase. Positive influences on land include low interest rates, the

relatively small percent of land currently on the market, the attractiveness of farmland to pension fund managers, and the fact that land is a good hedge against inflation.

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PURDUE

AGRICULTURAL ECONOMICS REPORT

Indiana Farmland Transactions, 2016 – 2020

Authors: Todd H. Kuethe and Chad Fiechter

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Tags: Farmland prices

Summary: We compare measures of farmland supply and prices from transaction records and the Purdue Land Values and Cash Rent Survey. Our study shows important similarities and differences between the two sources of information.

The *Purdue Land Values and Cash Rents Survey* has been an important source of information for Indiana farmland market conditions since 1974. For many years, the survey was the only source of disaggregated farmland price information for the state, but among other sources, detailed transaction information has emerged in recent years. This article compares the information obtained from recent years from both the *Purdue Land Values and Cash Rents Survey* and a detailed transaction record. We highlight two pieces of information that are captured by both sources, transaction volumes and prevailing per acre prices, and highlight the relative strengths of each source.

Indiana farmland transaction records were obtained from [Land Sales Bulletin](#), which collects sales records from disclosure forms filed in all 92 Indiana counties. The sales disclosure forms include a number of attributes for each transaction, including acreage, date of sale, and price per acre. In addition, the transaction record includes comments that outline additional important features of the sale and parcel. In order to estimate the volume of sales, we screen the data on a number of characteristics outlined in the disclosure comments. First, we eliminate all sales between related parties, as transaction prices generated through non-“arm’s length” sales are often not reflective of broader pricing patterns. Second, we eliminate sales below \$100 per acre or above \$50,000 per acre to minimize the influence of statistical outliers or transactions that are not likely representative of the broader farmland market. Third, we remove all sales that include forests, wetlands, or wildlife uses so that the transactions represent bare crop or pastureland, consistent with the definitions used in the *Purdue Land Value and Cash Rent Survey*. In sum, we observe 26,430 transactions between January 1, 2016 and December 31, 2020.

Farmland Turnover Rates

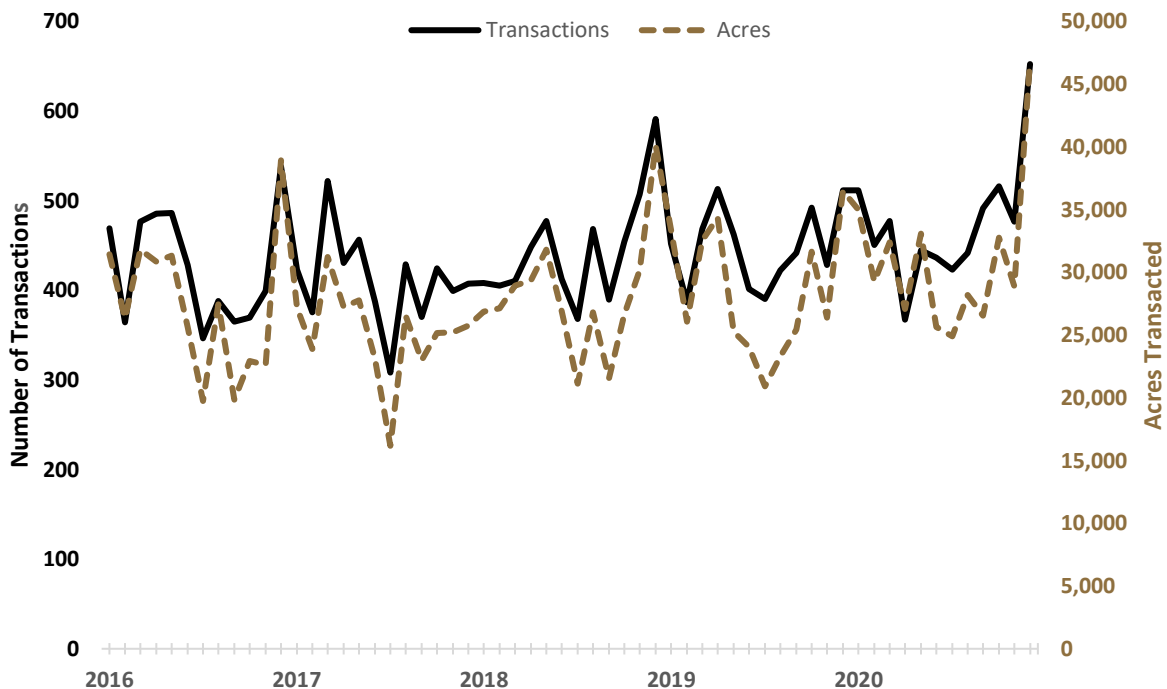
Between 2016 and 2020, the majority of *Purdue Land Values and Cash Rents Survey* respondents reported that less farmland was available on the market compared to the previous June, with the exception of 2018 (Table 1). Economic theory suggests that farmland prices should rise as the amount of land available to purchase declines, all else equal. And as a result, the reported decline in farmland available on the market has been credited with supporting farmland price growth in recent years.

Table 1: Share of Respondents Indicating Less, Same, or More Farmland on the Market than in the Previous June

	Less	Same	More
2016	56%	35%	8%
2017	57%	38%	5%
2018	45%	48%	7%
2019	59%	41%	0%
2020	56%	36%	8%

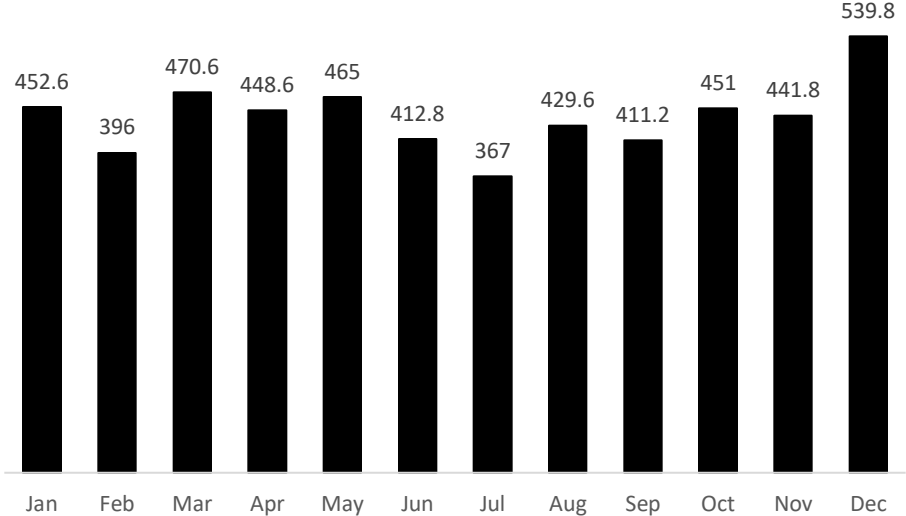
Figure 1 plots the number of transactions (solid line, left axis) and total acreage sold (dashed line, right axis) by month between January 2016 and December 2020. Contrary to the opinions expressed by *Land Values and Cash Rents Survey* respondents, Figure 1 suggests that farmland transaction volumes and acres sold were relatively stable throughout this period.

Figure 1: Monthly Number of Transactions and Transacted Acres, 2016 – 2020



The variability in Figure 1, however, suggests that farmland sales may be seasonal. Figure 2 similarly plots the mean number of transactions by month between 2016 and 2020. While transaction volume is relatively stable, December has the highest number of transactions on average, at 539.8. In addition, transaction volumes tend to be smaller in the summer months, with July (367) exhibiting the fewest average number of sales per month. This is likely driven by the fact that major Indiana crops are in the ground during the summer months, which complicates buying and selling the land.

Figure 2: Mean Number of Transactions by Month, 2016 – 2020

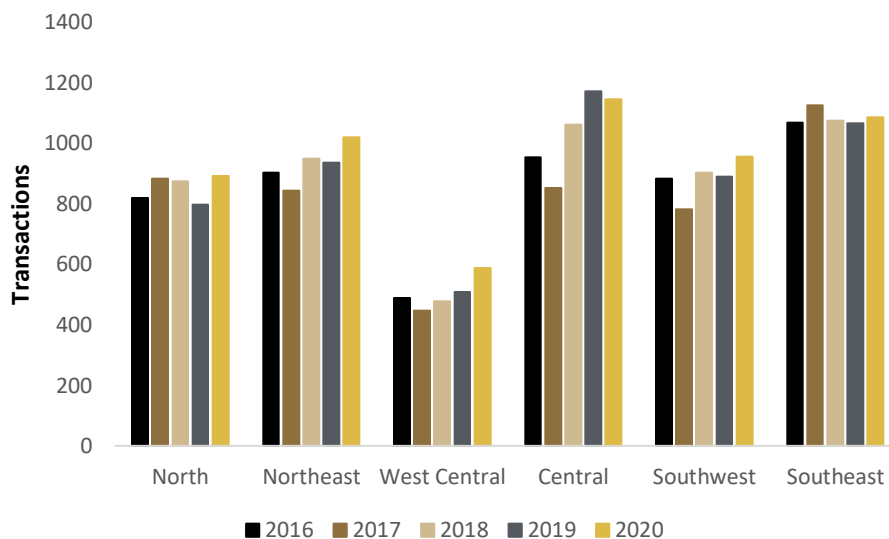


Figures 1 and 2 examine the transactions across all 92 Indiana counties, in aggregate. However, given that farmland, by definition, is tied to a specific location, farmland markets are often driven by localized economic forces, such as land development patterns or agricultural production volumes. Figure 4, therefore, plots the total number of transactions in each of the six regions of the *Land Values and Cash Rents Survey* (Figure 3). Figure 4 suggests that the Central region has the largest number of transactions in most years, and the neighboring West Central region has the fewest.

Figure 3: County Clusters used in the *Purdue Land Values and Cash Rent Survey* to create regions



Figure 4: Number of Transactions by Region, 2016 – 2020

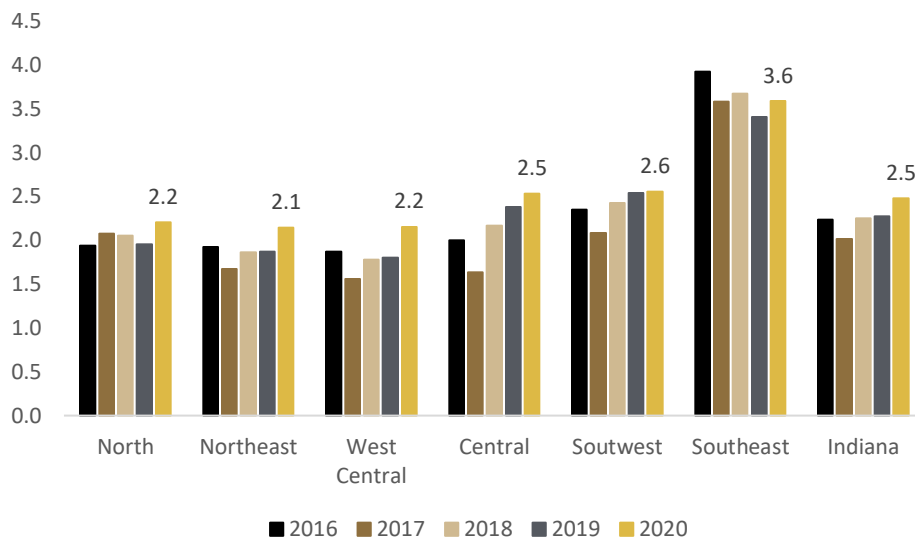


The number of transactions in a given region, however, is driven in large part by the amount of farmland in each region. Figure 4 similarly plots an estimate of the turnover rate for each region and for the state of Indiana as a whole. The aggregate stock of farmland in each region is difficult to measure. The turnover rates plotted in Figure 5 are calculated by dividing the

transacted acres in each region by the total farmland acreage obtained from the most recent USDA Census of Agriculture. Conducted every five years, the Census of Agriculture provides detailed measures of farmland acreage in 2012 and 2017. Thus, the estimated turnover rate considers the transactions in 2016 relative to the 2012 Census of Agriculture, but for all remaining years, we use the 2017 Census.

As shown in Figure 5, the statewide turnover rate was approximately 2.5% in 2020. The turnover rates are relatively stable at the state level and within each region. The Southeast region has the highest estimated turnover rate at 3.6%, while the Northeast region has the lowest estimated turnover rate at 2.2%. In sum, Figure 5 suggests that roughly 2% to 2.5% of farmland changes hands in a given year.

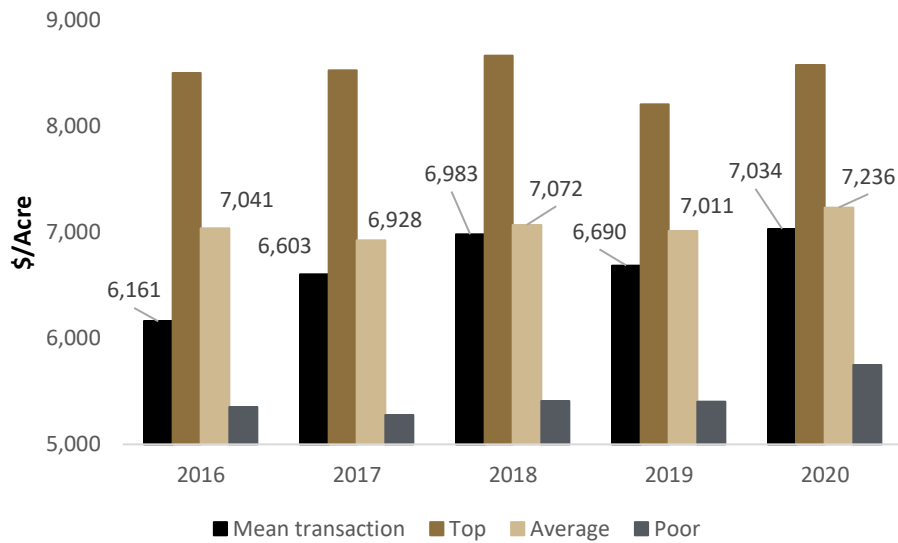
Figure 5: Approximate Turnover Rate by Region, 2016 – 2020



Average Farmland Prices

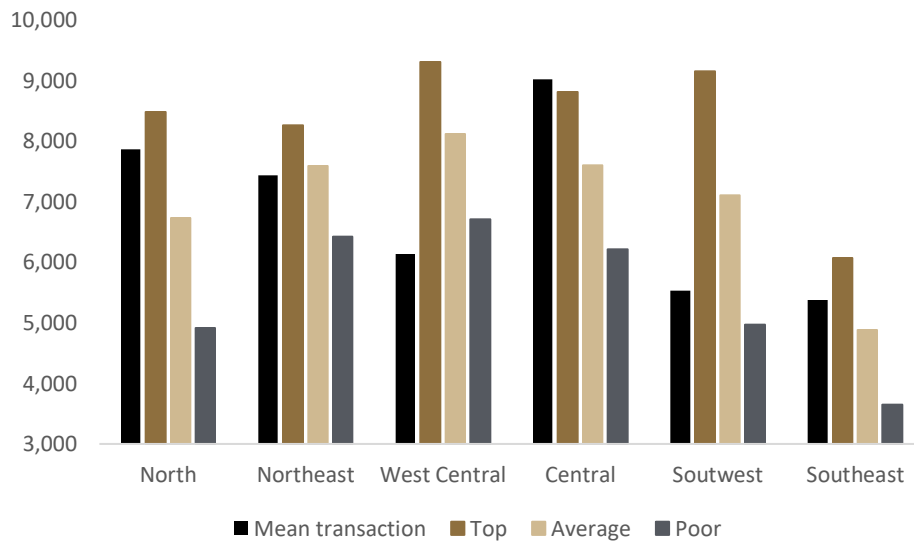
As previously stated, the transactions record also reports the price per acre for all transactions. Figure 6 plots the state-wide mean (average) per acre price for all farmland within our restricted dataset. While the transaction record provides a wealth of information on parcels sold, it is difficult to differentiate by land quality in a manner that is consistent with the *Purdue Land Values and Cash Rent Survey*. Figure 6 also includes the state-wide estimated per acre value of farmland across three land quality gradients: top, average, and poor. Figure 6 suggests that in most years, the mean transactions price per acre is similar to the average quality land value from the survey.

Figure 6: Transaction Prices and Survey Values, 2016 – 2020



Finally, Figure 7 similarly reports the mean per acre transaction price and the land value estimate for each land quality grade across the six regions for 2020. For most regions, the mean transaction price lies within the survey estimates for top and low quality farmland, with the exception of the Central region. The differences between transactions and survey values, however, may diverge for smaller geographic areas because of the limited number of observations or potential “outliers” far above or below the prevailing price.

Figure 7: Transaction Prices and Survey Values by Region, 2020



While the estimated turnover rates and transaction volumes diverge between the transaction records and Purdue survey responses, the estimated value of farmland per acre from the two sources is reassuringly similar at the state level. The differences between market transactions and opinion surveys are likely to emerge, however, at the regional level due to limited sample size or “outliers.”

Both the transaction record and opinion survey provide important information on current farmland market conditions, but each information source has relative strengths and weaknesses. Transaction records have the advantage of generating farmland values through “real world” market interactions. In other words, buyers and sellers provide concrete information on the value of a given parcel, which economists call “revealed preferences.” The *Purdue Land Values and Cash Rent Survey*, on the other hand, collects opinions of market professionals, which economists call “stated preferences.” The two sources can differ as the result of survey respondents’ biases, preferences, or relative information sets or measurement problems with transaction records. Transactions are generated by complex combination of buyers and sellers, and aggregate market trends can be difficult to observe. Or, as economists note, it can be difficult to disentangle the “signal from the noise.” It is difficult to classify land by quality using transaction records alone. In addition, it can be difficult to identify the relative influence of various factors using transaction records, such as economic conditions, aggregate agricultural production and trade, and the influence of policy. For these important forces, the stated preferences of the *Purdue Land Values and Cash Rent Survey* offer one of the few sources of information.



PURDUE

AGRICULTURAL ECONOMICS REPORT

Indiana Farmland vs. Alternative Investments

Authors: Todd H. Kuethe and Chad Fiechter

Issue ID: *PAER_2021-13*

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Tags: Farmland, Investments

Summary: This study compares the returns to farmland ownership relative to common investment alternatives, such as stocks, bonds, and gold. Farmland offers attractive risk adjusted returns and has a low correlation with other investments.

Farmland is the primary asset of agricultural production. According to the USDA, the U.S. has roughly \$2.6 trillion of farm real estate, which accounts for approximately 83% of the value of total farm sector assets ([USDA ERS](#)). As a result, farmland is typically the largest single investment and the primary store of farm sector wealth. In addition, farmland's historic performance for stable and predictable returns make it an attractive asset class for investors beyond farm operators. Given the significant financial commitment required for farmland ownership, it is important to understand how farmland, as an asset class, compares to other investment options. Our analysis shows that farmland offers relative stable set of returns across most investment horizons. Farmland offers total returns that approach those of equities but with substantially lower risk.

Table 1, below, provides a summary of several major investment options over four investment horizons: 1980 – 2020, 1990 – 2020, 2000 – 2020, and 2010 – 2020. Investments are evaluated according to three common measures. First, the mean represents the expected return over the investment horizon, in percentage points. For example, Table 1 shows that the Dow Jones Industrial Average had a mean return of 9.8% between 1980 and 2020 and a mean return of 11.0% in the recent decade from 2010 to 2020. Second, the standard deviation (St.D.) represents the variation in returns over the investment horizon. The standard deviation therefore measures the variability or riskiness of the investment. Again, the Down Jones Industrial Average had a standard deviation of returns of 15.6% between 1980 and 2020 and 8.3% from 2010 to 2020. Third, the coefficient of variation (CV) is a ratio calculated as the standard deviation divided by the mean return (St.D./Mean). Thus, the coefficient of variation represents the relationship between expected return and riskiness of an investment. Economic theory suggests that risk averse investors are only willing to take on additional risk if they are compensated by a higher

expected return. As a result, risk averse investors prefer investments with lower coefficient of variation. For example, between 1980 and 2010 the Dow Jones Industrial Average exhibited a coefficient of variation of 1.6, but over the same period, AAA corporate bonds had a coefficient of variation of 0.4. While the Dow Jones Industrial Average had a much higher mean return (9.8% vs. 7.2), the returns were substantially riskier (15.6 vs. 3.0). Thus, a highly risk averse investor would prefer to hold AAA corporate bonds over the equities represented by the Dow Jones Industrial Average.

The investments summarized include a mix of equities, bonds, and other asset classes. The equities include two common stock indices: the Dow Jones Industrial Average (DJIA) and the Standard & Poor's 500 (S&P500) indices. For each index, the returns are calculated as the percentage change in index value from the last trading day of June in one year to the last trading day of June in the previous year ($[(P_t - P_{t-1})/P_{t-1}] \times 100$). The next two investments are bond yields (in percentage points): ten year U.S. treasury bond (Treasury (10)) and AAA-rated corporate bonds (AAA). The bond yields are similarly based on end of June trading values. The final two investments include the Federal Housing Finance Agency all-transactions U.S. residential housing price index (Housing) and gold prices based on the London Bullion Market Association 3:00PM fixing price (Gold). The final row of Table 1 includes the Consumer Price Index (CPI) inflation measure. As a general rule, investors prefer assets with expected returns that exceed the rate of inflation in order to preserve the nominal value of an investment over time.

Table 1 shows that equities offer the greatest mean return across all investment horizons. However, equity investments also exhibit higher standard deviation of returns. As a result, the risk averse investors would prefer a portfolio with larger allocations to bonds which offer lower but more stable returns, as represented by the coefficient of variation.

Table 1: Expected returns and risk of alternative investments

	1980 - 2020			1990 - 2020			2000 - 2020			2010 - 2020		
	Mean	St.D.	CV	Mean	St.D.	CV	Mean	St.D.	CV	Mean	St.D.	CV
DJIA	9.8	15.6	1.6	8.8	13.2	1.5	5.0	12.7	2.5	11.0	8.3	0.8
S&P500	9.8	15.8	1.6	8.6	13.9	1.6	5.0	14.0	2.8	12.0	8.0	0.7
Treasury (10)	6.0	3.4	0.6	4.5	2.0	0.5	3.4	1.4	0.4	2.2	0.7	0.3
AAA bonds	7.2	3.0	0.4	5.9	1.8	0.3	4.9	1.3	0.3	3.9	0.7	0.2
Housing	4.0	3.7	0.9	3.5	4.0	1.1	3.6	4.8	1.3	2.8	3.9	1.4
Gold	7.2	26.6	3.7	6.2	15.3	2.5	10.7	16.0	1.5	7.3	16.2	2.2
CPI	3.2	2.5	0.8	2.4	1.3	0.6	2.1	1.4	0.7	1.7	0.9	0.5

Table 2 similarly reports the returns to Indiana farmland as captured by percentage change in values obtained from the *Purdue Land Values and Cash Rents Survey*. Across all potential investment horizons, Indiana farmland values appreciated at a rate below the mean returns to the equity indices but above the returns of government or corporate bond yields. For most horizons, Indiana farmland price appreciation rates were less volatile than the returns to equities yet were substantially riskier than bonds. Farmland owners were compensated by the riskiness of their

investment relative to other asset classes, as measured by the coefficient of variation, however, excluding the period that includes the 1980s Farm Financial Crisis.

Table 2: Expected returns and risk of farmland as measured by price appreciation

	1980 - 2020			1990 - 2020			2000 - 2020			2010 - 2020		
	Mean	St.D.	CV	Mean	St.D.	CV	Mean	St.D.	CV	Mean	St.D.	CV
Indiana												
Top	3.6	9.4	2.6	6.0	7.1	1.2	6.1	8.0	1.3	5.5	10.0	1.8
Ave.	3.8	9.6	2.5	6.3	7.0	1.1	6.4	7.7	1.2	5.5	9.4	1.7
Poor	4.0	10.1	2.5	6.7	7.4	1.1	6.7	7.8	1.2	5.4	9.3	1.7
North												
Top	3.5	10.0	2.8	6.1	8.0	1.3	6.2	9.5	1.5	5.0	11.3	2.3
Ave.	3.6	10.3	2.8	6.4	7.9	1.2	6.5	9.2	1.4	4.7	10.9	2.3
Poor	3.8	11.4	3.0	6.7	9.1	1.3	6.8	10.1	1.5	4.4	11.7	2.6
Northeast												
Top	3.9	10.7	2.7	6.2	8.6	1.4	6.5	9.2	1.4	6.0	10.4	1.7
Ave.	4.3	10.4	2.4	6.8	8.1	1.2	6.9	8.6	1.2	6.4	9.3	1.5
Poor	4.8	11.2	2.3	7.6	9.2	1.2	7.5	9.9	1.3	6.8	10.8	1.6
West Central												
Top	3.6	10.2	2.9	6.2	8.3	1.3	6.3	9.4	1.5	5.7	12.1	2.1
Ave.	3.9	10.3	2.7	6.5	8.0	1.2	6.6	8.7	1.3	5.8	10.9	1.9
Poor	4.3	11.2	2.6	7.0	8.5	1.2	7.2	8.9	1.2	5.9	11.2	1.9
Central												
Top	3.4	9.7	2.8	5.7	7.6	1.3	5.8	8.5	1.5	5.1	10.6	2.1
Ave.	3.4	9.8	2.8	6.0	7.5	1.2	6.0	8.0	1.3	5.2	9.8	1.9
Poor	3.6	10.1	2.8	6.3	7.4	1.2	6.2	7.7	1.2	5.0	9.1	1.8
Southwest												
Top	3.8	10.5	2.7	6.2	8.6	1.4	6.6	9.9	1.5	6.4	12.4	1.9
Ave.	4.0	11.1	2.8	6.4	8.9	1.4	6.9	10.4	1.5	6.4	12.8	2.0
Poor	4.3	11.7	2.7	6.6	10.0	1.5	7.3	11.2	1.5	6.4	12.3	1.9
Southeast												
Top	3.8	8.9	2.3	5.8	6.7	1.2	5.0	6.3	1.3	5.2	7.4	1.4
Ave.	3.9	8.7	2.2	6.2	7.2	1.2	5.2	7.0	1.4	4.5	8.0	1.8
Poor	4.2	9.7	2.3	6.2	8.8	1.4	5.2	7.7	1.5	3.4	8.7	2.6

Farmland price appreciation, however, is only one source of returns that accrue to farmland owners. In addition to price appreciation, farmland ownership includes the returns to agricultural production. Table 3 similarly reports the three measures of the risk and return to farmland ownership that includes both appreciation and the income component, as measured by average cash rental rates. When the income component is included in the measure of return, farmland offers a substantially higher expected return with a marginal increase in riskiness (as measured by standard deviation of returns). As a result, when one considers the total returns to farmland ownership, the asset represents a more attractive alternative to equities and bonds.

A third source of return is the potential to convert farmland to other land use types, such as residential or commercial uses. However, for the purposes of this research, we limit our analysis

to farmland that is held in agricultural production in perpetuity. Previous *Purdue Land Value and Cash Rent Surveys* suggest that farmland sold for development is typically associated with a sales price that is approximately twice that of top quality farmland.

Table 3: Expected returns and risk of farmland as measured by price appreciation and cash rents

	1980 - 2020			1990 - 2020			2000 - 2020			2010 - 2020		
	Mean	St.D.	CV	Mean	St.D.	CV	Mean	St.D.	CV	Mean	St.D.	CV
Indiana												
Top	8.6	9.1	1.1	10.5	7.2	0.7	9.9	8.1	0.8	8.7	10.2	1.2
Average	8.8	9.2	1.0	10.9	7.1	0.7	10.1	7.8	0.8	8.6	9.5	1.1
Poor	9.2	9.7	1.1	11.4	7.6	0.7	10.4	7.9	0.8	8.5	9.4	1.1
North												
Top	8.6	9.6	1.1	10.7	8.1	0.8	10.1	9.5	0.9	8.3	11.4	1.4
Average	8.8	10.0	1.1	11.1	8.1	0.7	10.3	9.3	0.9	7.8	11.0	1.4
Poor	9.1	11.1	1.2	11.5	9.3	0.8	10.7	10.3	1.0	7.6	11.6	1.5
Northeast												
Top	8.8	10.4	1.2	10.6	8.6	0.8	10.1	9.2	0.9	9.0	10.6	1.2
Average	9.2	10.0	1.1	11.1	8.1	0.7	10.4	8.6	0.8	9.3	9.4	1.0
Poor	9.8	10.8	1.1	12.0	9.2	0.8	10.9	9.8	0.9	9.6	10.8	1.1
West Central												
Top	8.8	9.9	1.1	10.9	8.4	0.8	10.3	9.4	0.9	8.9	12.2	1.4
Average	9.2	9.9	1.1	11.2	8.1	0.7	10.5	8.7	0.8	9.0	11.0	1.2
Poor	9.8	10.7	1.1	11.9	8.6	0.7	11.2	9.0	0.8	9.1	11.2	1.2
Central												
Top	8.4	9.4	1.1	10.2	7.7	0.8	9.6	8.5	0.9	8.3	10.6	1.3
Average	8.4	9.4	1.1	10.4	7.6	0.7	9.6	8.1	0.8	8.2	9.9	1.2
Poor	8.6	9.7	1.1	10.8	7.6	0.7	9.7	7.8	0.8	8.0	9.1	1.1
Southwest												
Top	8.6	10.3	1.2	10.7	8.6	0.8	10.4	9.9	1.0	9.5	12.4	1.3
Average	9.0	10.8	1.2	11.0	8.9	0.8	10.8	10.4	1.0	9.5	12.8	1.4
Poor	9.7	11.4	1.2	11.6	9.9	0.9	11.4	11.2	1.0	9.7	12.3	1.3
Southeast												
Top	9.0	8.5	0.9	10.5	6.8	0.7	8.9	6.3	0.7	8.8	7.5	0.8
Average	9.0	8.4	0.9	10.7	7.4	0.7	8.8	7.0	0.8	7.9	7.9	1.0
Poor	9.1	9.4	1.0	10.5	9.0	0.9	8.7	7.6	0.9	6.7	8.6	1.3

Farmland, as an asset class, is also lauded given its relationship to other investments in a diversified portfolio. A portfolio is well diversified if the returns of each investment are independent of the returns to other investments, or, in other words, if the correlation in investment returns is low. Alternatively, some asset classes can be a valuable addition to a well-diversified portfolio if the returns are *inversely correlated* with those of other investments. That is, the returns tend to move in opposite directions as the other investments, or as the returns to one asset increase, the returns to the others tend to decrease. Table 4 shows the correlation between farmland price appreciation and the other investments considered in Table 1. Table 4

suggests that farmland has low levels of correlation with many investment options, including equity indices and gold. In addition, farmland is inversely correlated with bond yields and housing. Thus, as bond yields fall, farmland prices tend to rise.

Table 4: Correlations between returns to farmland and other investment alternatives

	Farmland			AAA	CPI	DJIA	Gold	House	S&P500
	Top	Avg.	Poor						
Farmland									
Top	1.00								
Avg.	0.99	1.00							
Poor	0.97	0.99	1.00						
AAA	-0.37	-0.38	-0.39	1.00					
CPI	0.00	-0.01	-0.04	0.63	1.00				
DJIA	-0.05	-0.02	0.02	0.05	-0.06	1.00			
Gold	0.00	0.00	0.04	-0.11	0.40	-0.04	1.00		
Housing	-0.26	-0.24	-0.19	0.12	0.18	0.18	0.03	1.00	
S&P500	-0.01	0.01	0.05	0.04	0.01	0.94	0.01	0.21	1.00
Treasury	-0.35	-0.35	-0.36	0.99	0.65	0.06	-0.11	0.15	0.06