The relationship between inflation and farmland returns

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INTRODUCTION

Farmland is receiving significantly increased attention by owners and investors seeking to make sense out of the scrambled economic signals of the recent past. Historically, the conventional narrative around farmland as a financial asset is that the returns are positively correlated with inflation, have low or negative correlation with equities, and have positive portfolio benefits in well-diversified holdings due to the relative lack of response to short-term broad market movements. Farmland has also had high relative returns when evaluated in portfolio models, but is a complex asset to acquire, manage and dispose of due to thin markets and asset heterogeneity.

Against the received understanding, the past decade included massive realignments of interest rate markets around the world, rebuilding of capital in financial institutions, compressed capital rates and associated equity market multiple expansions, and substantially lower inflation than had been experienced during much of the history over which farmland returns data are often evaluated. Agricultural commodity markets also have been disrupted by trade disputes, realignments in supply channels following the coronavirus shutdown, global changes in production patterns for livestock, and governed by strength-of-dollar impacts. In response to ag-sector income pressures, U.S. agricultural markets have been supported by federal support programs including Market Facilitation Program payments, as well as by indirect and direct payments from programs stemming from coronavirus related stimulus. Questions about inflation's potential return and other "cap rate" effects that often occur after recessionary periods have been highlighted by the quantity of monetary support that has been already distributed, and that is expected to be further distributed under stimulus and relief programs for the duration of the pandemic. Finally, these and related concerns about the return of higher inflation were punctuated by recent Federal Reserve statements that indicate moves toward empirical guidance and targets for inflation that would represent increases against the previous decade's experience.

Given the issues briefly introduced above, it seems timely to provide a direct empirical analysis of the relationship between farmland investments and inflation, and to examine the impact of inflation regime changes on that relationship, if any. Understanding the relationship between inflation and farmland returns necessitates the inclusion of the impact on other assets as well to provide a sense of the relative responsiveness across alternative asset classes and holding periods.

HISTORIC INFLATION AND INTEREST RATE INDEX RELATIVES

Figure 1 below shows the Bureau of Labor Statistics (BLS) Consumer Price Index (CPI) as a measure of inflation along with the 10-year Treasury Constant Maturity (CMT-10) interest rate overlaid on a time scale with periods of recession shaded in grey. There is a reasonably strong relationship between nominal interest rate movements and inflation with a simple correlation of

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about 67% from 1970 to present, with the weakest statistical relationship centered in the 1980s.   Importantly, the same patterns occur with alternate measures of inflation, the Producer Price Index (PPI), and measures of inflation expectations including the widely-used University of Michigan inflation expectation series. The CMT-10 is used herein as it is the most commonly used index of a risk-free capitalization rate reference around which relative credit spread and duration differences can be built to represent different asset cases and time periods.

Figure 1: U.S. Consumer Price Index (CPI) versus 10-Year Treasury Constant Maturity Rate, 1963 to 2020[1]
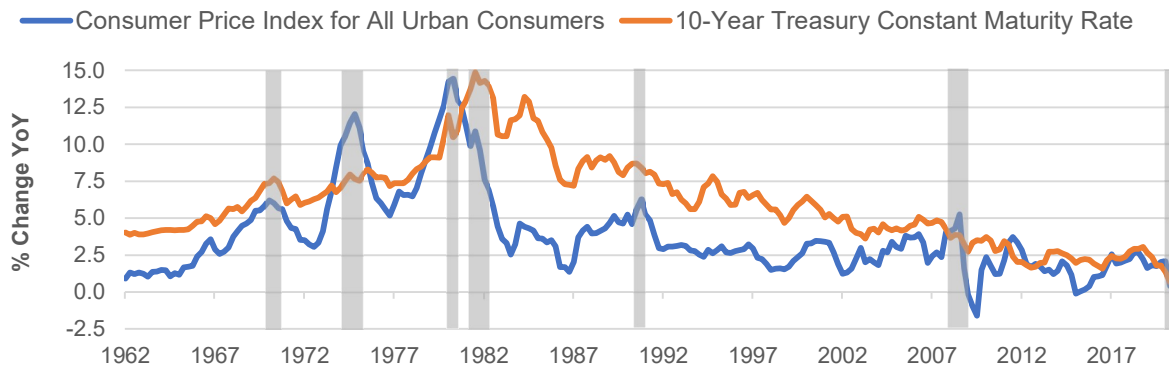
Importantly, historic recessions tend to include reductions in inflation rates and concomitant declines in nominal interest rates, though at a slightly lower rate as real rates tend to increase during expansions. What some refer to as the monetary experiment in 2020 is being conducted as interest rates are being held at target levels through infrequently-used direct intervention by the Federal Reserve in corporate debt and in assets other than Treasury securities. The CMT-10 nominal rate has been below 1% since March 2020 around the start of the coronavirus containment period, and held low by multiple events including two rarely used off-cycle rate cuts to a target rate bounded by zero. In any case, the history displayed could be reasonably divided into periods of increasing inflation through 1980-81 with a precipitous fall through 1985-86, followed by reasonably stable inflation rates averaging somewhat about 3% until the housing crisis in 2008, and averaging about 1.5% (inclusive of 2009) since. Nominal interest rates follow suit, but with a slower decline in the 1980s, and a declining real rate spread steadily shrinking throughout the same period.

A basic understanding farmland returns is first important to assess the relationship to these proxies for aggregate economic activity and macro features. Farmland is a large asset class with about $3 trillion in aggregate value as of 2020, (USDA). However, farmland still represents a somewhat specific asset class with soil and crop types that depend on location, and limited directly observable data on long-term returns. The National Council of Real Estate Investment Fiduciaries (NCREIF) farmland index has grown to about $12 billion and represents a broad mix of professionally managed properties that are accounted and reported under common conventions, but with a history limited to 1991 to present. This period is long enough for meaningful statistical analysis, and in many cases the data can be disaggregated by region, property type, and management type, but meaningful differences in inflationary regimes often require a longer period of analysis covering periods of higher and more variable inflation than has been experienced in the past 30 years. Thus, much of the basis analysis will use a set of returns data at the state level and in various agricultural regions throughout the U.S. from 1969 to present based on USDA data maintained at the TIAA Center for Farmland Research at the University of Illinois. In simplest form, annual returns as used herein are defined as rental income plus appreciation less estimated property taxes, divided by initial value. All series presented are converted to geometric annual returns for consistency. Importantly, the returns

to farmland actively managed in the NCREIF membership funds outperforms the USDA aggregate data by about 2% percent per year, and thus performance based on USDA data will generally represent a conservative measure of the level of returns to farmland investments, though will also be somewhat smoother than the return in funds with less diverse properties.

The USDA-based data are first used to create a representative measure of diversified agricultural farmland returns by aggregating the top 32 states as ranked by agricultural activity into an aggregate return series. This approach allows an examination to be extended back into the 1970s, and which can later be compared to the available NCREIF data in the latter time intervals. Individual state returns are also examined as proxies for types of agriculture and regional cases of interest. As shown in figure 2, the farmland returns series displays some remarkable characteristics. First, the only period of meaningful loss occurred in the early 1980s in the period generally referred to as the "farm crisis". That period represented the veritable perfect storm for agricultural producers with multiple foreign crises culminating in a grain embargo, oil market turmoil, and with fixed interest rates on farm mortgage loans peaking at nearly 18% following annual inflation that peaked at over 10%. Farmland had been appreciating rapidly when interest rates began falling, and was caught in a credit-induced crisis in the early 1980s. Importantly, there are few similarities in either the macro market, or the farm financial economy that make that period even remotely similar to any other in modern history. The only other negative annual return recorded was in 2009, largely thought to be sympathetic response to broad market uncertainty emanating from the housing crisis.

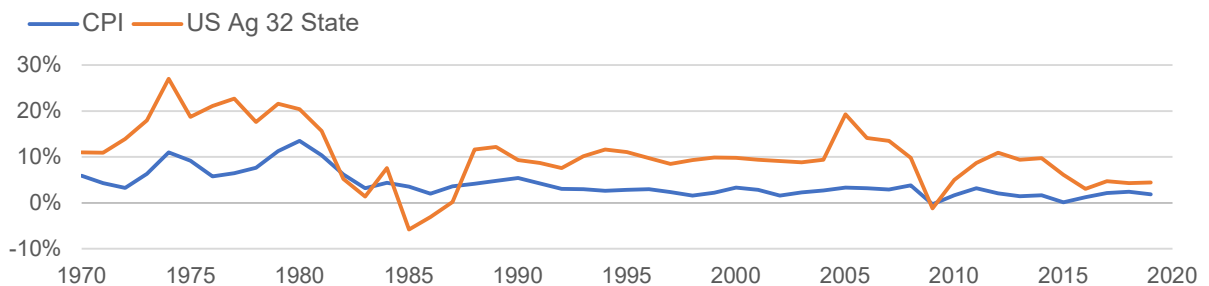**Figure 2: Farmland returns and inflation (CPI), 1970 to 2019[2]**

Figure 3 provides similar information where each ten-year period is averaged and spreads to CMT and/or inflation provided. In this case, the sample period is limited to 1991 to present so that NCREIF Total Farmland returns including both row and permanent crop can be included.

Figure 3: Farmland return spread to inflation, 1990 to 2019[3]
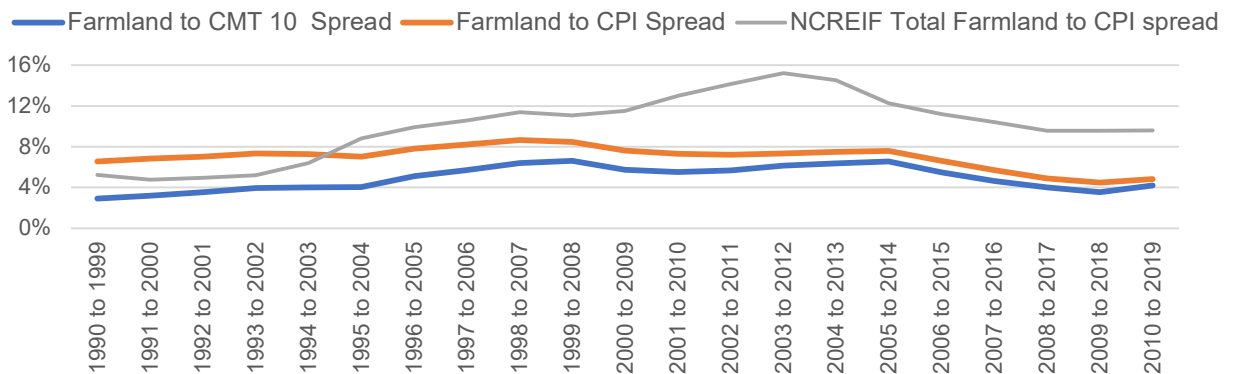
Table 1 summarizes the information in the graph above into decades allowing a bit more direct comparison to the generally described epochs of inflation by decade as well. In the 1970s, farmland's price boom was the most important feature of returns. In the 1980's the income returns were still positive to farmland, but the capital losses were greater than current income in two specific years (1985 and 1986 with total returns of -5.8% and -3.1% respectively). All other years in the 50-year period show total positive returns except 2009. Regional losses concentrated in the Midwest were much larger. Again, the results shown are for a broadly diversified portfolio across 32 agriculturally important states. Individual state level returns have similar patterns but greater volatility on both the maximum return and maximum drawdowns. It is also important to recognize that the majority of the variation of returns is due to appreciation; and that annual rental income is a very smooth component of total returns on a relative basis.

Table 1: Farmland returns relative to CPI by decade, 1970 to 2019[4]

| Decade	Average farmland to CPI Spread
1970 to 1979	11.1%
1980 to 1989	1.0%
1990 to 1999	6.6%
2000 to 2009	7.6%
2010 to 2019	4.8%

Focusing further on inflation regimes, it could be argued that the Federal Reserve (Fed) underwent regime shifts of their own with a few key historic decisions that largely defined separate periods of inflation management. First, the end of the gold standard in 1971 is associated with the beginning of an inflationary period that continued until at least 1979 when Fed Chairman Volcker announced policies targeting money supply controls to end inflation. The 1980s included additional activism by the Fed to control inflation and balance employment targets, but without transparency on actions or targets. In 1994 under Alan Greenspan, the Fed adopted a policy to eliminate "surprise actions", to publish guidance, and to promote monetary targets and interest rate stability. The ensuing decade and a half of "normal" Fed actions was unexpectedly ended by the housing crisis of 2008, and the massive balance sheet expansion by the Fed to stem widespread corporate and banking sector defaults. The relatively low short-term rates and nearly constant and low inflation have lasted since. The interest rate normalization efforts that began in 2015 with the first of a series of rate hikes was again abruptly ended in 2020 with reversal cuts back to near zero fed funds target rates. However, the most recent set of indications from the Fed under Chairman Powell has begun to signal stronger prospects for inflation, and moreover, for targeted higher inflation, perhaps in response to uncertainty about the balances of the stimulus packages relative to lost production. It would be seen as inflationary to have expanded monetary supply by more than lost productivity, or by more than gains in future productivity can accommodate. Thus, the current concern is primarily over the prospect of future inflation initially driven largely by a monetary expansion.

It is therefore interesting to examine whether there are periods of differential reaction to inflation that exist in historic data at least and to see what guidance that might offer to anticipate reactions should inflation recur, or accelerate in the future. Figure 4 below shows the same 50-year history of annual farmland returns and inflation as above but converted to a spread relationship as farmland returns minus inflation (so negative spreads are reflective of returns that are less than inflation). Since the early 1990s, the relationship has been remarkably stable, even when returns and inflation were both driven to roughly zero at the height of the housing crisis in 2009. The graphic might also suggest a regime effect that has a spread that is proportional to interest rates which are in turn strongly correlated with inflation. An explanation is that the relative gap of earnings spreads over treasuries or some other constant term zero risk index should reflect duration and credit risk differences. At lower rates,

the price multiple effect becomes more pronounced and tighter nominal spreads reflect the same relative multiple difference that should be paid for future income. Additionally, credit spreads on farmland investments did not expand relatively as much as for other asset classes during the rapid rate declines in Treasury rates in the first half of 2020. In other words, it appears that agricultural investments were viewed as relatively less affected by the macro shocks that resulted in widening spreads for virtually all other investments. Farmland has relatively few idiosyncratic loss or massive gain events like equities tend to have in response to broad market events.

Figure 4: Farmland return and spread over annual inflation, 1970 to 2019[5]
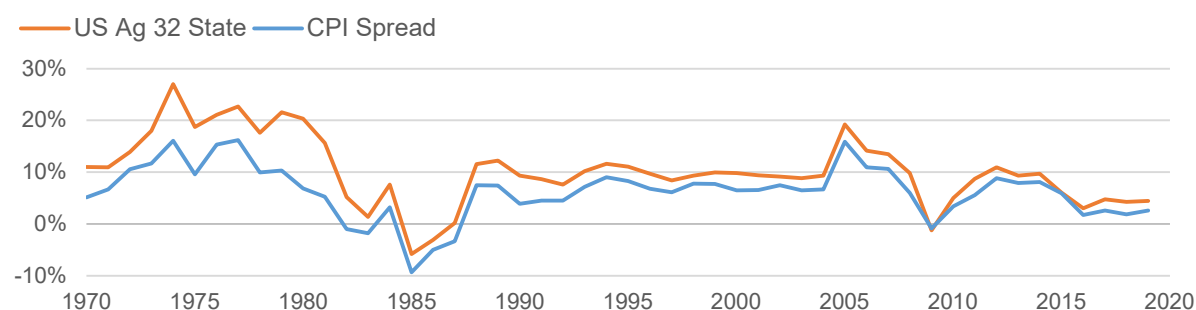
It is also important to consider the relative performance and reaction of farmland to inflation and capitalization rate changes across other asset classes. To do so, table 2 below provides standardized annual returns and risk measures across a few representative equity indexes, fixed income, real asset, and inflation related asset groups along with the summary correlation with farmland's return, and maximum and minimum annual returns. Importantly, these data series cover at least three periods viewed as having elementally different inflation characteristics, and the more recent portion of the sample period has lower variation in inflation, but the results are interesting nonetheless. Average and standard deviation of returns on one-year annual bases are provided along with the coefficient of variation simply to provide relative risk/return context for this long period. The correlation column contains values with respect to the U.S. Ag 32 States series. Maximum returns and drawdowns are also provided. Over the combined inflation regime periods, the results conform with most general descriptions that ag returns have low or negative correlation with equities, around zero correlation with fixed income assets and positive correlation with inflation measures (here including PPI and gold for reference only).

Table 2: Asset return characteristics, 1970 to 2019[6]

Asset/Index	Annual average return	Standard deviation	Coefficient of variation	Correlation	Minimum return	Maximum return
	------------ *1970 - 2019* ------------					
U.S. ag 32 states	**10.2%**	**6.5%**	**0.64**	**1.00**	**-5.8%**	**27.0%**
U.S. equities	7.1%	16.5%	2.31	-0.25	-48.6%	29.3%
European equities	6.1%	20.3%	3.35	-0.23	-59.9%	51.2%
U.S. corporate bonds	7.5%	2.6%	0.35	0.09	3.4%	14.2%
U.S. 10 year bonds	6.3%	3.0%	0.48	0.15	1.8%	13.9%
U.S. 30 year mortgages	7.7%	3.6%	0.46	0.14	0.0%	16.6%
U.S. listed real estate	10.9%	16.8%	1.53	-0.08	-47.4%	38.9%
Gold	7.53%	22.2%	2.95	0.28	-39.5%	90.2%
PPI	3.40%	4.9%	1.44	0.60	-7.4%	19.0%
CPI	3.84%	2.8%	0.73	0.65	0.1%	12.5%

U.S. Equities: S&P 500 index; **European equities**: MSCI EAFE Index; **U.S. corporate bonds**: Moody's Seasoned Corporate AAA rated bonds; **U.S. 10 year bonds**: U.S. 10 year Treasury Constant Maturity Rate; **U.S. 30 year mortgages**: Average rate on 30 year fixed rate mortgage; **U.S. listed real estate**: FTSE NAREIT All Equity REITS Index; **Gold**: London Bullion Market Association Gold Price; **PPI**: Producer Price Index; **CPI**: Consumer Price Index.

An alternate comparison is provided below using NCREIF data from 1991 to present (longest period available with NCREIF data) to provide a sense of the returns relative to periods including the 1970s and 1980s, and to highlight the relationship between the USDA aggregate returns and NCREIF returns. The patterns are qualitatively identical, though exclusion of the periods of highest inflation and most rapid deceleration in inflation do mute the relationships. The comparison between the two periods does further strengthen the interpretation though of the positive relationship between inflation and farmland returns, and the margin over USDA returns experienced in the NCREIF data.

**Table 3: Asset return characteristics including NCREIF Farmland Index, 1991 to 2019[7]**

Asset/Index	Annual average return	Standard deviation	Coefficient of variation	Correlation	Minimum return	Maximum return
	------------ 1991 - 2019 ------------					
NCREIF Total Farmland	**11.2%**	**6.6%**	**0.58**	**1.00**	**2.0%**	**33.9%**
U.S. ag 32 states	8.8%	3.7%	0.42	0.66	-1.2%	19.3%
U.S. equities	7.9%	17.1%	2.17	0.00	-48.6%	29.3%
European equities	3.3%	19.2%	5.88	0.14	-59.9%	30.2%
U.S. corporate bonds	5.8%	1.6%	0.27	-0.32	3.4%	8.8%
U.S. 10 year bonds	4.4%	1.8%	0.40	-0.23	1.8%	7.9%
U.S. 30 year mortgages	5.6%	2.4%	0.44	-0.08	0.0%	9.2%
U.S. listed real estate	11.2%	17.4%	1.56	-0.02	-47.4%	31.6%
Gold	4.7%	14.0%	2.98	0.09	-31.9%	27.7%
PPI	1.8%	4.0%	2.23	0.29	-7.4%	8.2%
CPI	2.3%	0.9%	0.39	0.15	0.1%	4.0%

U.S. Equities: S&P 500 index; **European equities:** MSCI EAFE Index; **U.S. corporate bonds:** Moody's Seasoned Corporate AAA rated bonds; **U.S. 10 year bonds**: U.S. 10 year Treasury Constant Maturity Rate; **U.S. 30 year mortgages:** Average rate on 30 year fixed rate mortgage; **U.S. listed real estate:** FTSE NAREIT All Equity REITS Index; **Gold:** London Bullion Market Association Gold Price; **PPI:** Producer Price Index; **CPI:** Consumer Price Index.

As noted earlier, farmland remains a complicated asset to acquire, manage and dispose, and thus tends to be held over longer periods of time to dilute the transactions costs, and to take advantage of longer term tax advantages that typically exist with appreciating assets. To assess the impact of holding period effects in relation to inflation and rate spreads, hypothetical holding periods were constructed from 1 to 10 years and returns recast both as rolling average geometric, and as non-overlapping interval returns. Figure 5 below shows the correlation of U.S. 32 Ag States farmland returns with various asset groupings (also on 3-year geometric average bases), along with the total U.S. aggregate to help scale the possible interval to 1.0 as the maximum. In general terms, if two series are statistically integrated or stationary relative to each other, a moving average relationship becomes more stable by averaging sequential observations. In the case of farmland and inflation, the strength of the calculated correlation increases due to averaging out some periodic "noise" in the data series and displaying a strong long-run average co-movement tendency, but potentially obscures lags.

Figure 5: Three-year rolling geometric correlations with U.S. 32 state farmland returns, 1970 to 2019[8]
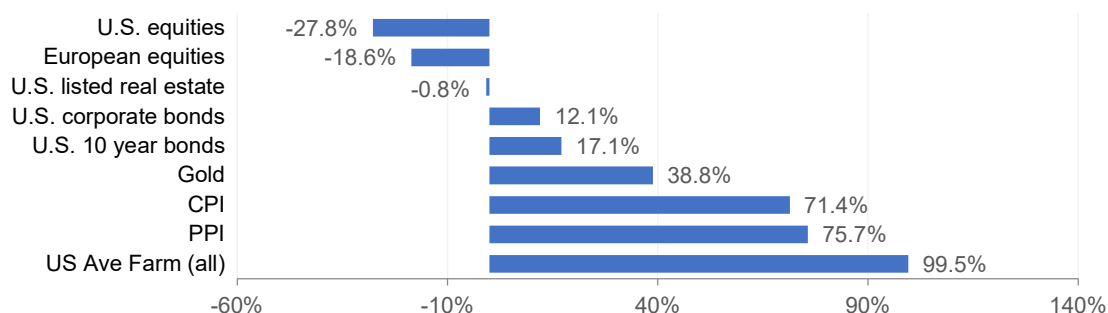
U.S. **Equities**: S&P 500 index; **European equities**: MSCI EAFE Index; **U.S. corporate bonds**: Moody's Seasoned Corporate AAA rated bonds; **U.S. 10 year bonds**: U.S. 10 year Treasury Constant Maturity Rate; **U.S. 30 year mortgages**: Average rate on 30 year fixed rate mortgage; **U.S. listed real estate**: FTSE NAREIT All Equity REITS Index; **Gold**: London Bullion Market Association Gold Price; **PPI**: Producer Price Index; **CPI**: Consumer Price Index.

This analysis was then repeated with rolling geometric returns from 1 to 10 years. The results are provided below in table 4 for a selected set of assets. As can be seen, the calculated correlations are reasonably indifferent to interval length used in the hypothetical holding period. And, it is important to recognize that these are again rolling averages in overlapping intervals.

Table 4: U.S. ag 32 state correlation in returns by rolling period intervals across asset classes[9]

Roll length	PPI	CPI	Gold	U.S. 10-year bonds	U.S. corporate bonds	U.S. listed real estate	European equities	U.S. equities
1	65.3%	59.6%	29.9%	15.1%	9.2%	-12.7%	-22.7%	-24.7%
2	70.3%	70.0%	31.6%	16.2%	10.5%	-11.8%	-19.7%	-23.9%
3	75.7%	71.4%	38.8%	17.1%	12.1%	-11.8%	-18.6%	-27.8%
4	80.4%	72.3%	45.6%	18.6%	14.3%	-14.5%	-20.6%	-35.5%
5	84.0%	72.9%	52.3%	20.9%	17.1%	-15.4%	-21.9%	-41.1%
6	86.2%	72.6%	57.5%	23.5%	20.2%	-13.8%	-21.1%	-46.9%
7	87.4%	72.1%	60.3%	26.3%	23.6%	-15.5%	-20.3%	-52.2%
8	86.9%	71.6%	60.1%	29.5%	27.4%	-17.4%	-18.7%	-55.2%
9	86.7%	71.1%	57.7%	33.0%	32.1%	-13.1%	-21.3%	-54.3%
10	86.3%	70.6%	54.9%	37.1%	36.6%	-8.8%	-21.7%	-52.5%

U.S. Eq**uities:** S&P 500 index; **European equitie**s: MSCI EAFE Index; **U.S. corporate bonds**: Moody's Seasoned Corporate AAA rated bonds; **U.S. 10 year bonds:** U.S. 10 year Treasury Constant Maturity Rate; **U.S. listed real estate:** FTSE NAREIT All Equity REITS Index; Gold: London Bullion Market Association Gold Price; **PPI**: Producer Price Index; **CPI**: Consumer Price Index.

SUMMARY

Uncertainty about the rate and nature of the economic recovery, and the remaining monetary actions during the pandemic have added noise to already complex signalling from economic aggregates and Federal Reserve actions. The recent posture and guidance from the Fed do signal possible accommodation or promotion of inflationary targets that, while pale in comparison to historic epochs of high inflation, at least begin to add pressure to capitalization rates and other derived return expectations.

Farmland returns are important to examine because of the somewhat countervailing theoretical issues – does inflation tend to register in the prices and incomes of commodities and the fixed factors of production producing them or are long-duration assets more "bond-like" and suffer asset value pressures without the income effect? Historically at least, farmland has maintained the wisdom that was observed perhaps 200 years earlier with Ricardian theory of rent and the conclusion that land should be among the greatest stores of real value in periods of inflation. In a broad set of empirical examinations presented herein, those relationships appear to still hold across a large set of conditions, time periods, and treatments of holding intervals.

For more information, please visit www.farmland.illinois.edu.

ENDNOTES

1 Federal Reserve Economic Data (FRED), U.S. Bureau of Labor Statistics (BLS)
2 BLS, USDA, TIAA Center for Farmland Research
3 BLS, USDA, NCREIF, TIAA Center for Farmland Research
4 BLS, USDA, TIAA Center for Farmland Research
5 BLS, USDA, TIAA Center for Farmland Research
6 USDA, MSCI, FRED, NAREIT, London Bullion Market Association/GoldHub, BLS
7 TIAA Center for Farmland Research, USDA, MSCI, FRED, NAREIT, London Bullion Market Association/GoldHub, BLS
8 TIAA Center for Farmland Research, USDA, MSCI, FRED, NAREIT, London Bullion Market Association/GoldHub, BLS
9 TIAA Center for Farmland Research, USDA, MSCI, FRED, NAREIT, London Bullion Market Association/GoldHub, BLS