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Inflation hedging ability of natural capital investments

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INTRODUCTION

Although inflation remained subdued in developed markets over the past three decades, the current inflationary environment poses a risk to investment portfolios. The consumer price index (CPI) in the U.S. rose by 8.6% year-over-year in June 2022, the largest increase in 40 years and well above the Federal Reserve's 2% target rate. In the face of heightened inflation risk, the real rate of return on investments is compromised, driving investors to consider repositioning their portfolios. Here we analyze the ability of timberland and farmland investments to provide an effective hedge against inflation.

Returns from traditional asset classes, like bonds and equities, tend to be more susceptible to rising inflation, while real assets are believed to protect against it.[1] Bond markets are most impacted when inflation surges unexpectedly as the inflation embedded in the yield makes prices fall.[2] Similarly, equity markets are impacted by an increased cost of capital and risk premiums, and the effects of aggressive monetary policies to bring rising prices under control that may lead to weaker economic growth.

In contrast, real assets have shown a strong ability to hedge against inflation, delivering returns that have far outpaced the inflation rate. This is in part driven by a "built-in" hedge – many commodities, such as food, fiber, and timber, are components of inflation measures, such as the CPI, and rising prices increase revenue and cash yields from land assets. Over time, as higher prices are baked into underlying land valuations, the capital appreciation component of return increases as well. As such, inflation hedging is often viewed as one of the most attractive features of natural capital investments, like timberland and farmland, to investors.[3]

Here we use historical data to analyze the ability of timberland and farmland investments to act as a hedge against inflation over time and even for different species and crop types. Our analysis

begins with a description of the data and historical spreads between inflation and investment performance. Next, we use the data to quantify the statistical relationship between inflation and returns. Correlation coefficients are calculated to test the strength and persistence of the relationship, and a linear regression is estimated to quantify the effect of inflation on returns. Finally, we highlight key results and explore what they mean for investors.

"Not only have returns from land-based natural capital investments consistently exceeded inflation over the last 30 years, even through periods of volatility, we find that increases in CPI are associated with more than proportional increases in timberland and farmland returns."

DATA

Historical inflation and return data for private equity timberland and farmland investments are the primary inputs to the analysis. Inflation data are from the U.S. Bureau of Labor Statistics (BLS); specifically, we use U.S. CPI because it is the most commonly used measure of inflation. The CPI reflects the change in the cost to the average consumer of acquiring a basket of goods and services.

Private equity timberland and farmland return data are from the National Council of Real Estate Investment Fiduciaries (NCREIF) Timberland and Farmland Indexes. Both indexes report a quarterly time series composite return measure of the performance of institutionally managed properties acquired in the U.S. private market for investment purposes only. Private timberland and farmland data are available starting in 1987 and 1991, respectively.[4]

Reported NCREIF performance captures the two main return components of private equity investments: 1) income return or net operating income (EBITDA); and 2) capital return or the change in the land's market value. NCREIF also provides regional timberland and agricultural crop-level return breakdowns.

- NCREIF Timberland Index represents a market value of about $25 billion (as of 2Q 2022), where the South's largely pine plantations and Pacific Northwest (PNW)'s mixed conifer plantations make up 65% and 28% of the total, respectively.
- NCREIF Farmland Index represents a market value of about $14 billion (as of 2Q 2022), of which permanent crops (such as wine grapes, almonds, citrus, etc.) represented 39%, and annual cropland (including corn, soybeans, cotton, and others) the remaining 61%.

Additionally, a second source of historical return data is used for farmland: the U.S. Ag 32 State Index, produced by the TIAA Center for Farmland Research at the University of Illinois, which goes back to 1970. These annual return data provide insight into the relationship between inflation and farmland investments before 1991, prior to the inception of the NCREIF Farmland Index. This USDA-based performance record is a representative measure of diversified farmland returns of the top 32 states as ranked by agricultural activity and converted into an aggregate return series.

For equities and bonds, publicly available indexes are used to reflect broad public equity and fixed income market performance, as well as public equity in timberland and farmland. These indexes provide benchmarks for private timberland and farmland. Figure 1 summarizes the data used to analyze the relationship between inflation and returns across asset classes.

Figure 1: Summary of data

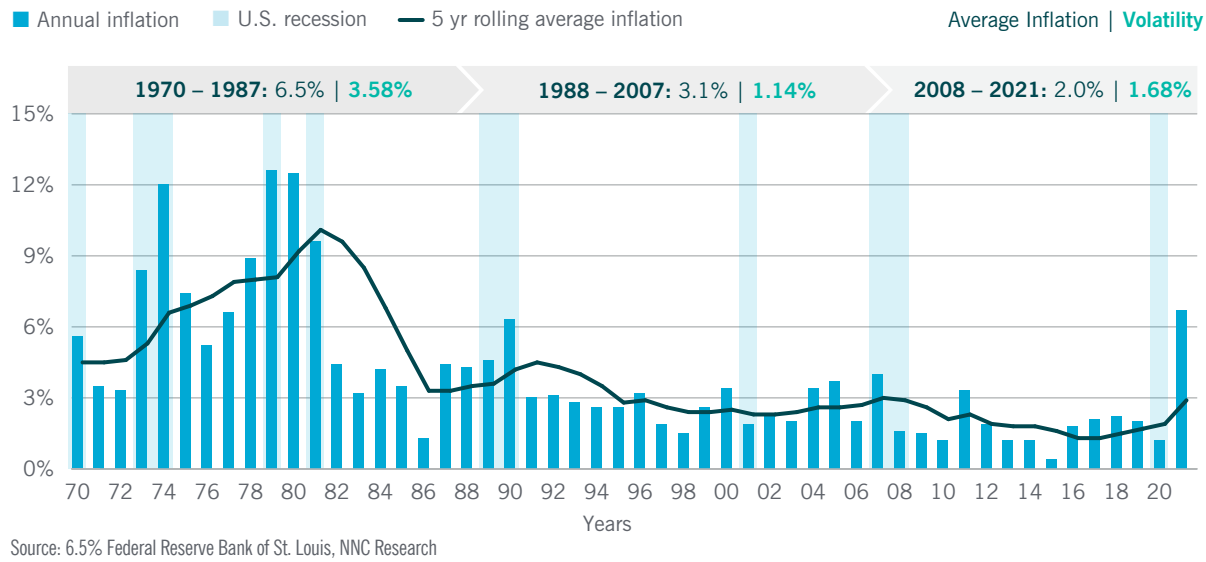
Variable	Metric	Description	Timeframe	Source
Inflation	Consumer Price Index	Consumer Price Index for All Urban Consumers: All Items in the U.S. City Average, Index 1982-1984=100, Seasonally Adjusted	1970–2022	U.S. Bureau of Labor Statistics
Private Timberland	NCREIF Timberland Index	Composite measures the returns of private-equity timberland investments	1987–2021	NCREIF
Private Farmland	NCREIF Farmland Index	Composite measures the returns of private-equity farmland investments	1991–2021	NCREIF
U.S. Ag 32 State	U.S. Ag 32 State	USDA-based data measures agricultural farmland returns aggregated by the top 32 U.S. producing states	1970–2021	TIAA Center for Farmland Research at the University of Illinois
U.S. Equities	Russell 3000	U.S. equity benchmark index	1991–2021	Bloomberg
U.S. Bonds	Barclays U.S. Aggregate	U.S. bond benchmark index	1991–2021	Bloomberg
Public Timberland	S&P Global Timberland Index	Benchmark index for publicly traded companies engaged in the ownership and management of timberlands	2002–2021	Bloomberg
Public Farmland	GSCI Agriculture Index	Benchmark index for publicly traded agricultural commodities	1991–2021	Bloomberg

ANALYSIS

Despite economic conditions and effective monetary policies that kept inflation within a moderate window over the past 30 years, impacts related to the COVID-19 pandemic and the war in Ukraine have produced major supply chain disruptions, initiating a new inflationary period. As institutional investors turn to real assets, such as timberland and farmland, for inflation protection, it is essential to understand their historical performance in relation to inflation through past inflationary regimes.

Figure 2: Average annual inflation over the past three decades was 2.4%, a stable level compared to other inflationary periods.

Annual and 5-year rolling average inflation. 1970 – 2021



Source: 6.5% Federal Reserve Bank of St. Louis, NNC Research

We identify three different inflation periods in the U.S. since 1970 (Figure 2). The first, 1970–1987, was dominated by the stagflation of the 1970s — a combination of high inflation and low output growth resulting from external oil shocks. In the second, from the late 1980s until the Global Financial Crisis (GFC), 1988–2007, inflation remained consistently low and stable. And the most recent, post-GFC 2008–2021, encompasses a period of prolonged expansionary monetary policy ending with global economic shocks, including the COVID-19 pandemic and the war in Ukraine, that have produced major supply chain disruptions and led to a dramatic rise in inflation.

*"Real assets, such as **farmland and timberland**, have shown a strong ability to hedge against inflation, and long-term returns have far outpaced the inflation rate."*

Historical performance and spreads to inflation

FARMLAND AND TIMBERLAND RETURNS CONSISTENTLY OUTPACE INFLATION

Even though both timberland and farmland have been impacted by moments of macroeconomic instability and market volatility, such as the farm debt crisis of the 1980s or the Global Financial Crisis (GFC), long-term returns have remained positive and consistently exceeded inflation. As displayed in Figure 3, since market data became available in the early 1990s, private timberland and farmland average annual returns exceeded inflation by 6.9% and 8.5%, respectively. Regional timberland, crop-level returns, and the Ag 32 Index show similar spreads to inflation.

Figure 3: Average annual returns, volatility, and spreads over inflation

	1970 – 1990			1991 – 2007			2008 – 2021			1991 – 2021		
	Avg.	Std. Dev.	Spread to CPI	Avg.	Std. Dev.	Spread to CPI	Avg.	Std. Dev.	Spread to CPI	Avg.	Std. Dev.	Spread to CPI
Private Timberland	–	–	–	**13.4%**	**9.6%**	**10.7%**	**4.3%**	**4.5%**	**2.2%**	**9.3%**	**8.9%**	**6.9%**
South	–	–	–	11.3%	7.0%	8.0%	3.5%	4.7%	7.1%	7.8%	7.1%	7.6%
Northwest	–	–	–	15.7%	16.2%	8.5%	6.7%	7.1%	10.2%	11.6%	13.5%	9.3%
Private Farmland	–	–	–	**11.3%**	**7.6%**	**8.6%**	**10.3%**	**5.5%**	**8.3%**	**10.9%**	**6.6%**	**8.5%**
Row crops	–	–	–	10.8%	4.7%	8.0%	9.1%	5.1%	7.1%	10.0%	4.9%	7.6%
Permanent Crops	–	–	–	11.2%	10.9%	8.5%	12.2%	8.1%	10.2%	11.7%	9.6%	9.3%
Almonds (1992–2021)	–	–	–	15.6%	23.3%	12.0%	14.0%	16.1%	12.0%	14.9%	19.9%	12.0%
Wine grapes (1997–2021)	–	–	–	11.6%	9.6%	4.8%	9.8%	6.9%	7.7%	10.6%	8.1%	6.1%
U.S. Ag 32 State	12.2%	8.9%	5.9%	**10.6%**	**2.8%**	**7.9%**	**6.1%**	**3.4%**	**4.1%**	**8.6%**	**3.8%**	**6.2%**
Average Annual Inflation	6.3%	3.3%		**2.7%**	**0.7%**		**2.0%**	**1.5%**		**2.4%**	**1.2%**	

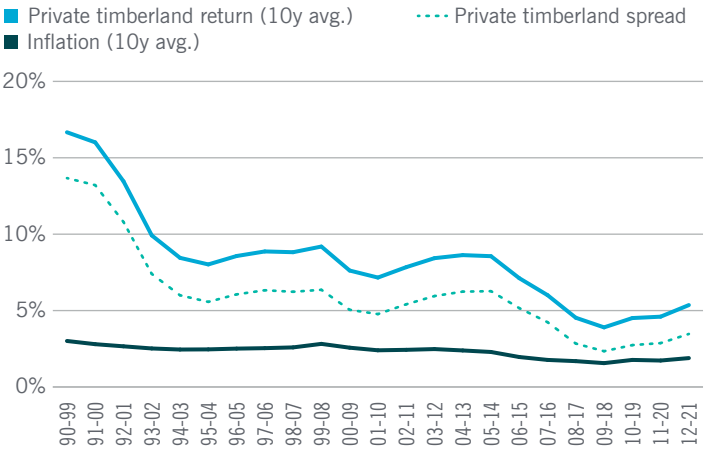
Source: Nuveen Natural Capital analysis

Private Timberland and Inflation

Private timberland has outperformed inflation annually over the last 30 years, with an average spread of +6.9% over CPI (Figure 4). Long-term average returns and the positive spread to inflation held relatively steady even through the GFC, when the housing market collapsed, impacting the demand for wood products and timber prices, indicating timberland's resiliency and inflation hedge ability. More recently, despite broader market volatility, strong housing market fundamentals and robust housing demand have helped boost timber prices and timberland returns, which continue to outpace inflation. The last four quarters of return data through the end of 2Q 2022 show private timberland returns at 12.0% and inflation at 8.6%.

Figure 4: Timberland return spread over inflation averages +6.9% over 10-year periods

10-Year average timberland return spread over inflation, 1991 – 2021



Source: Federal Reserve Bank of St. Louis; NCREIF; NNC Research

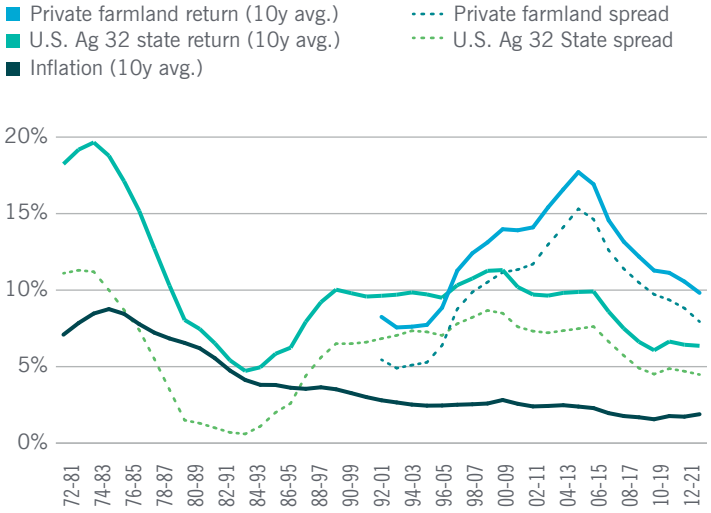
Private Farmland and Inflation

Similar to timberland, average private farmland returns exceeded inflation over the last 30 years, providing consistent long-term income and capital appreciation even through periods of volatility. Even despite the current market volatility, the last four quarters of return data (3Q 2021 to 2Q 2022) show private farmland returns at 9.7% and inflation at 8.6%.

Only once have farmland returns fallen below inflation — in the late-1980s during the farm debt crisis. During this period, the farmland industry entered a credit-induced crisis product of a grain embargo, oil market turmoil, and fixed interest rates on farm mortgage loans peaking at nearly 18%. At the time, the average U.S. farm debt to equity level was 29%. In contrast, farm debt to equity currently stands at a healthy 15%.

Figure 5: Farmland return spread over inflation average +8.5% over 10-year periods

10-Year average farmland return spread over inflation, 1972 – 2021



Source: Federal Reserve Bank of St. Louis; NCREIF; TIAA Center for Farmland Research; NNC Research

Private farmland outperformed inflation annually over the last 30 years with an average spread of 8.5% over CPI (Figure 5). However, when analyzing the performance of farmland versus inflation, it is important to highlight the variety of crop types an investor can gain exposure to and why certain investments may perform differently in inflationary environments. Some of the differences can be driven by crop-specific supply and demand factors. For example, as consumers have shifted towards healthier diets, demand for commodities like almonds over the past 30 years has grown, resulting in higher returns than other permanent crop types.

Correlation with inflation

TIMBERLAND AND FARMLAND OFFER A "BUILT-IN" INFLATION HEDGE

The CPI captures movements in food, fiber, and timber prices that ultimately drive changes in timberland and farmland returns. The positive relationship between timberland and farmland returns and inflation is rooted in the production of raw materials for products in the CPI basket of goods (e.g., food, fiber, building materials, housing, furniture, tissue, paper, and packaging). The transmission of higher food, fiber, and forest product prices to timber and crop prices increases cash yields and, ultimately, asset valuations, supporting the positive correlation between inflation and performance.

Figure 6: Correlation with inflation

Correlation coefficient: annual returns and annualized inflation rate

	1970 – 1990	1991 – 2007	2008 – 2021	1991 – 2021
Private Timberland		**0.40**	**0.51**	**0.48**
South		0.10	0.40	0.38
Northwest		0.53	0.47	0.47
Private Farmland		**0.30**	**0.21**	**0.23**
Row crops		0.34	0.47	0.43
Permanent Crops		0.25	-0.08	0.04
Almonds (1992 – 2021)		0.43	0.47	0.45
Wine grapes (1996 – 2021)		0.50	-0.08	0.13
U.S. Equities		**-0.09**	**-0.36**	**-0.16**
U.S. Bonds		**0.23**	**-0.15**	**0.16**
Public Timberland (1992 – 2021)		**NA**	**-0.44**	**-0.35**
Public Agriculture		**0.31**	**0.02**	**0.16**
U.S. Ag 32 State	**0.73**	**0.28**	**0.57**	**0.57**

Source: Nuveen Natural Capital analysis.

RETURNS OF TIMBERLAND AND FARMLAND INVESTMENTS DISPLAY A POSITIVE AND STRONG CORRELATION WITH INFLATION, SUPERIOR TO OTHER ASSET CLASSES.

Over the past three decades, the correlation between timberland and farmland returns and actual inflation has been positive and exceeded the correlation between inflation and traditional asset classes. This pattern has also remained consistent in the years leading up to the GFC. Between 1991 and 2021, annual returns of private-equity timberland and farmland investments show a positive correlation of 0.48 and 0.23, respectively, higher than bonds or stocks. For the period 2008-2021, the correlation coefficient between timberland and farmland investments and inflation was 0.51, and 0.21, respectively.

ROW CROPS SHOW A STRONGER POSITIVE RELATIONSHIP WITH INFLATION THAN PERMANENT CROPS

While the correlation between farmland and inflation (Figure 6) clearly indicates a positive relationship, the crop-specific analysis shows nuances exist when analyzing the returns of different crop types. Row crops have a more consistent relationship with inflation than permanent crops. Even within the permanent crop designation, there are differences in correlation between crop types. This result signifies that not all farmland investments have the same capability to hedge against inflation. Based on the above analysis, certain products like wine grapes may have more elastic demand during inflationary periods than almonds or row crops. This result emphasizes the importance of diversified permanent crop holdings in an institutional portfolio when considering inflationary hedging capabilities.

THE CORRELATION BETWEEN FARMLAND INVESTMENTS AND INFLATION HAS BEEN STRONGER IN MOMENTS OF SUSTAINED HIGH INFLATION

The U.S. Ag 32 State Index approximates a diversified agricultural portfolio over a longer time series. As displayed in Figure 6, the correlation coefficient between the U.S. Ag 32 State Index and inflation during the period that covers the stagflation of the 1970s was 0.73, stronger than the periods before (0.28) and after (0.57) the GFC when the inflation remained low and stable. These correlation coefficients highlight that farmland investments are most correlated to inflation when investors need them most: during periods of sustained high inflation.

THE INFLATION HEDGE ABILITY OF TIMBERLAND AND FARMLAND INVESTMENTS IMPROVES WITH LONGER HOLDING PERIODS

In the case of private timberland investments, the correlation between inflation and annualized returns in holding periods of 5-year increments went from 0.48 for single-year holding periods to 0.94 for a 25-year investment horizon. Similarly, private farmland correlation coefficients went from 0.23 to 0.75 for the same two hold periods.

Figure 7: Correlation of timberland and farmland returns with inflation by holding period

Correlation coefficient between annualized returns and inflation in holding periods of 5-year increments

		1-Year	5-Years	10-Years	15-Years	20-Years	25-Years	30-Years
Private Timberland	**1987 – 2021**	**0.48**	**0.81**	**0.87**	**0.91**	**0.99**	**0.94**	**0.98**
South	1987 – 2021	0.38	0.57	0.82	0.83	0.93	0.85	NA
Northwest	1987 – 2021	0.47	0.42	0.39	0.41	0.87	0.91	NA
Private Farmland	**1992 – 2021**	**0.23**	**0.14**	**-0.02**	**-0.38**	**-0.61**	**0.75**	**NA**
Row crops	1992 – 2021	0.43	0.33	0.25	0.08	0.44	0.89	NA
Permanent Crops	1992 – 2021	0.04	-0.10	-0.31	-0.66	-0.91	0.29	NA
Almonds	1992 – 2021	0.45	0.35	0.31	0.20	0.63	0.81	NA
Wine grapes	1996 – 2021	0.13	0.04	0.07	-0.24	0.78	NA	NA
U.S. Ag 32 State	**1970 – 2021**	**0.68**	**0.74**	**0.70**	**0.58**	**0.62**	**0.76**	**0.90**

Source: Nuveen Natural Capital analysis

Quantifying the inflation hedge

To quantify the relationship between investment return and inflation, we use a linear regression with annual return as a function of CPI. Formally, this is a test of the "Fisher Hypothesis[5]," which states that the expected nominal return of an asset is equal to the risk-adjusted real rate that investors expect from the asset plus the expected rate of inflation. We estimate the equation below where $Return_{i,t}$ is private timberland, private farmland or U.S. Ag 32 State return all in year t, CPI_t is CPI Index in year t, and β_i is the parameter to be estimated. If $\beta_i < 0$, then the asset is classified as an inferior inflation hedge if $0 < \beta_i < 1$, then the asset is characterized as a partial inflation hedge, and if $\beta_i > 1$, the asset serves as a superior inflation hedge.

$$\ln\left(\frac{Return_{i,t}}{Return_{i,t-1}}\right) = \alpha + \beta_i \ln\left(\frac{CPI_t}{CPI_{t-1}}\right) + \varepsilon_i$$

EMPIRICAL RESULTS SUGGEST THAT PRIVATE-EQUITY TIMBERLAND AND FARMLAND INVESTMENTS PROVIDE A STATISTICALLY SIGNIFICANT HEDGE AGAINST INFLATION

The linear regression results shown in Figure 8 suggest that private timberland assets and farmland investments (as proxied by the U.S. Ag 32 State) have a positive relationship with inflation, as the regression and estimated coefficients are greater than 1 and statistically significant at the 95% confidence level. For timberland, the estimated coefficient of 1.4, indicates that a 1% increase in inflation is associated with a 1.4% increase in the nominal rate of return. Farmland annual returns, proxied by the U.S. Ag 32 dataset, returned an estimated coefficient of 1.6 (1970 – 2021), indicating that a 1% increase in actual inflation is associated with a 1.6% increase in the nominal rate of return. Both results confirm that timberland and farmland investments are positively related to changes in inflation, with positive changes in returns that are more than proportional to increases in inflation, thereby preserving the investment's value and real rate of return over time.

Figure 8: Quantifying the relationship between timberland and farmland returns and inflation

Estimation of linear regression model (Fisher Hypothesis test). Historic timberland and farmland returns vs. U.S. inflation rates

					Regression Statistics		
	Intercept α	Inflation β	Significance Level	95% C.I.	Adjusted R-Square	Standard Error	Number of Observations
Private Timberland	0.0170	**1.42**	0.02 **	[0.26 - 2.58]	0.03	0.04	140
Private Farmland	0.0265	-0.19	0.70	[-1.13 - 0.76]	-0.01	0.03	124
Row Crops	0.0223	0.22	0.48	[- 0.4 - 0.84]	0.00	0.02	124
Permanent Crops	0.0311	-0.73	0.32	[-2.16 - 0 .7]	0.00	0.04	124
U.S. Ag 32 State	0.0367	**1.66**	0.00 ***	[1.16 - 2.16]	0.46	0.05	52

Where, Inflation β = Estimated coefficient of the inflation variable in the linear regression; C.I. = Confidence Interval
*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.
* Statistically significant at the 10% level.
Source: Nuveen Natural Capital analysis

WHAT DOES THIS MEAN FOR INVESTORS?

The current economic environment highlights the importance for investors to design portfolios that protect against inflation. Results show that farmland and timberland investments continue to serve as a hedge against inflation and provide tools for investors to build inflation-resilient portfolios. Both asset classes offer investors a compelling alternative to protect the purchasing power of investment portfolios supported by returns that have historically outpaced inflation rates, a strong positive correlation between returns and inflation, and where increases in inflation are associated with more than equivalent increases in returns.

Private-equity timberland and farmland investments protect against inflation as demonstrated by:

- Returns that have consistently outpaced inflation. Between 1991 and 2021, the average spread to inflation was 6.9% for timberland and 8.5% for farmland.
- A remarkably consistent, positive correlation between returns and inflation that appears to be stronger for longer holding periods and through periods of market volatility and sustained inflation.
- A statistically significant relationship between inflation and returns where increases in CPI result in more than proportional increases in timberland and farmland returns, validating the hypothesis that both asset classes provide a "superior" hedge against inflation.

In addition to the above, results of the analysis highlight that not all farmland is created equal as a hedge against inflation. An individual crop's supply and demand dynamics and elasticities impact an investment's correlation to inflation. The strong positive correlation between inflation and row crops suggest that these investments provide a more effective hedge than permanent crops. However, during periods of high inflation or over a long hold period, we expect diversified farmland portfolios, with both row and permanent cropland, do offer significant inflation hedging benefits and a more attractive total return profile. We did not observe differences in the inflation hedging characteristics of timberland in the South compared to the Northwest.

Opportunities for further research include an exploration of the inflation hedging ability of timberland and farmland investments in the context of an asset allocation model, and a study of expected and unexpected inflation. Further, research into the inflation hedging ability of investments that produce ecosystem service values in addition to food, fiber, and timber will be an increasingly important question as environmental markets continue to expand.

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A word on risk

As an asset class, agricultural investments are less developed, more illiquid, and less transparent compared to traditional asset classes. Agricultural investments will be subject to risks generally associated with the ownership of real estate-related assets, including changes in economic conditions, environmental risks, the cost of and ability to obtain insurance, and risks related to leasing of properties. Nuveen provides investment advisory solutions through its investment specialists.

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