

State OF THE Market

AgIS Capital

Agricultural Investment Strategies

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A Tale of Two Crop Types

The United States (U.S.) agricultural economy stands again on a solid footing this spring, but there remain causes for concern. Persistent inflation and the U.S. Federal Reserve’s response, which has focused on tightening monetary policy, have raised alarms over the soundness of the banking system and lowered expectations for economic growth. In addition, Russia’s ongoing invasion of Ukraine and evolving geopolitical tensions between the U.S. and China have increased the divide between the East and West, which could negatively impact international trade. Furthermore, the U.S. dollar remains historically strong against foreign currencies, which reduces the competitiveness of U.S. agricultural exports and suppresses domestic prices.

WELCOME TO OUR ANNUAL STATE OF THE MARKET REPORT

This is our Annual State of the Market Report, which provides an overview of the trends and forces that are driving farmland returns. In this edition, we discuss how the issues just referenced can affect current and future farmland investment performance. We also review the National Council of Real Estate Investment Fiduciaries (NCREIF) Farmland Index and offer context and commentary on the asset class’s recent and projected performance based on emerging macroeconomic trends. Finally, we examine the causes of high-row cropland returns relative to permanent cropland returns during the past two years.



IN THIS ISSUE

- Trends 2
- The Farmland Index 5
- Our Thoughts 8
- A Historical Perspective of China’s Agriculture Policy 9
- Conclusions 16

ABOUT AGIS

AgIS Capital acquires and manages high-quality, investment-grade farmland assets. When opportunities exist to create and capture additional value for clients, we also invest in related operating companies involved in agricultural commodity processing. At present, AgIS is emphasizing investments in U.S. permanent croplands because we believe that sector’s value proposition is more consistent with the risk and return objectives of institutional investors. We also strategically review offshore opportunities that complement our investment operations in the United States.

Trends

The United States Department of Agriculture’s (USDA) Economic Research Service (ERS) released its 2023 Farm Sector Income Forecast on February 7, 2023.

In real terms, gross cash income is expected to fall 6.9 percent to \$575.4bb in 2023 because of lower cash receipts for crops and livestock products (see Figure (1)). Cash receipts for crops are expected to fall 5.7 percent to \$276.9bb. This projection is primarily attributable to lower corn and soybean prices in 2023. Real cash receipts for dairy and poultry products are expected to be down \$19.9bb in 2023, moving cash receipts for livestock and products 8.3 percent lower to \$243.0bb. Direct government payments are expected to fall 36.1 percent to \$10.2bb, the lowest level since 1982 in real terms.

Total production expenses in real terms are expected to increase 1.3 percent to \$459.5bb this year, the fourth highest level posted since recording began in 1929 (see Figure (2)). Higher livestock and poultry costs and higher labor and interest expenses are expected to outweigh reduced feed, pesticide, fertilizer, and fuel costs. As a result, gross farm income is expected to fall 4.0 percent to 596.4bb. Additionally, net farm income (NFI) is expected to drop 18.2 percent in 2023 to \$136.9bb.

Despite the 18.2-percent reduction just referenced, NFI for 2023 is projected to reach the sixth highest level achieved since 1960. If this forecast is correct, this would be 17.5 percent higher than the average achieved between 2014 and 2022, and 42.5 percent higher than the average from 1960 to 2022 (as depicted in Figure (3)).

Figure 1 - Real Gross Cash Income Components: 1960 to 2023f, billions, 2023 dollars

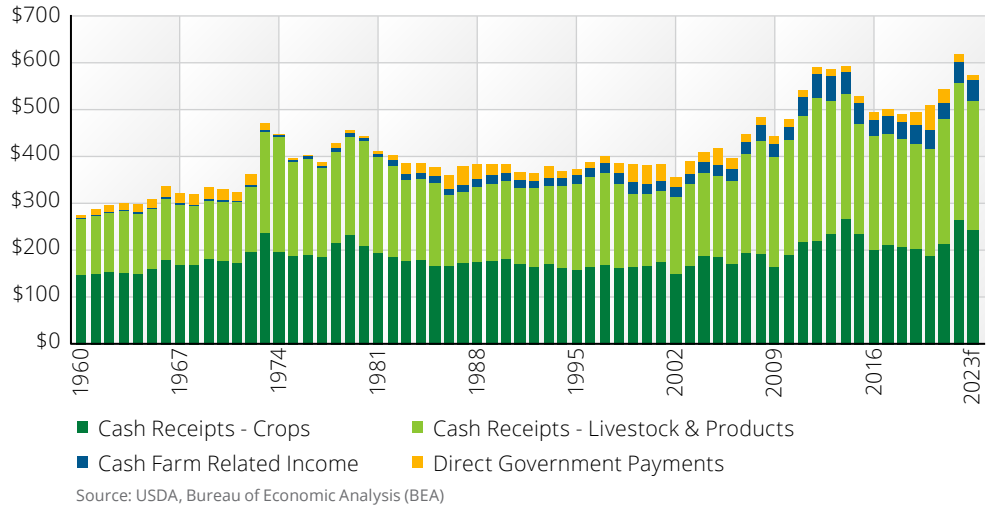


Figure 2 - Real U.S. Farm Income Components: 1960 to 2023f, billions, 2023 dollars

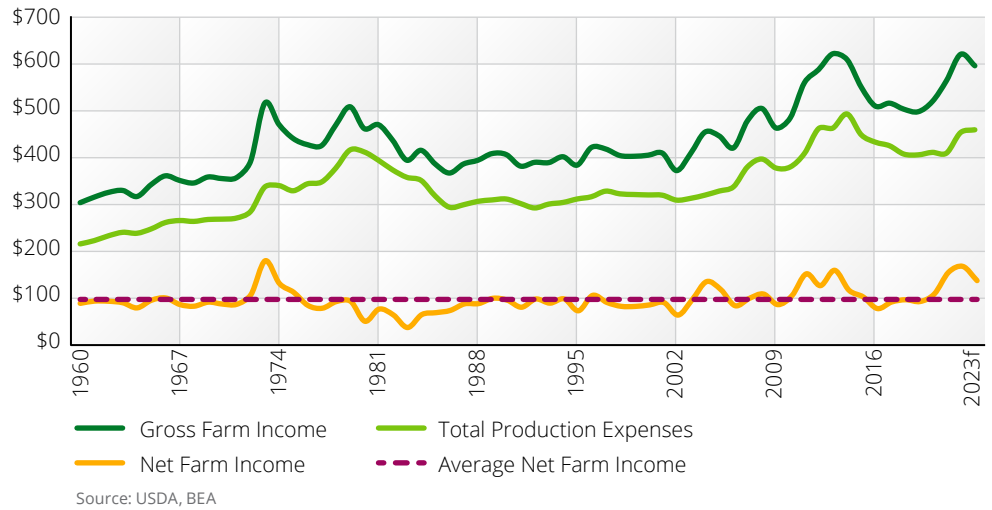
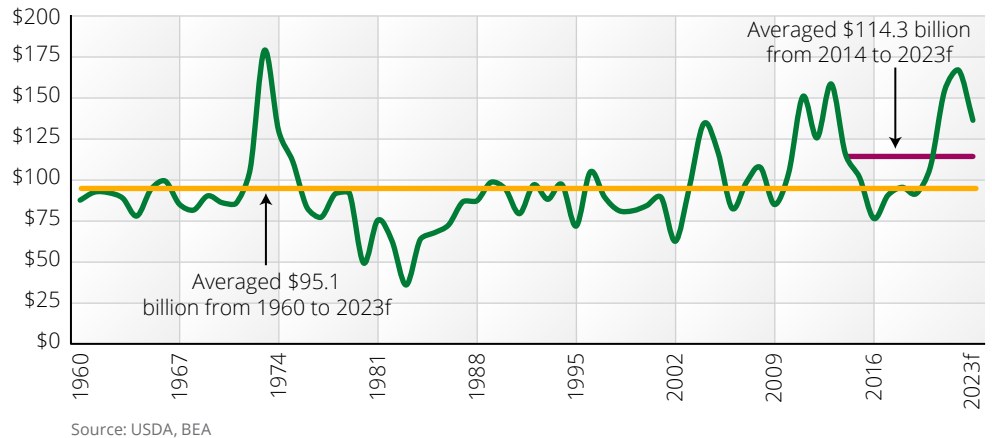



Figure 3 - Real U.S. Net Farm Income: 1960 to 2023f, billions, 2023 dollars



In real terms, U.S. agricultural exports are expected to fall 8.6 percent to \$184.5bb because of lower-than-expected corn, sorghum, and soybean exports. Agricultural imports are expected to fall 0.2 percent to \$199.0bb. If expectations come to fruition, U.S. agricultural imports will exceed exports for just the third time since 1960 in 2023 (see Figure (4)).



Farm sector debt is forecasted to increase 3.3 percent to \$535.1bb this year. Non-real estate debt is expected to remain flat, while real estate debt is expected to increase 4.7 percent to \$375.9bb. Real estate debt continues to climb, while non-real estate debt remains 34.3 percent lower than the record achieved in 1979 (as illustrated in Figure (5)). For the most part, farm sector coverage ratios remain in line with the past decade, but that could change if interest rates continue to rise.

 U.S. agriculture imports are expected to exceed exports for just the third time since 1960.

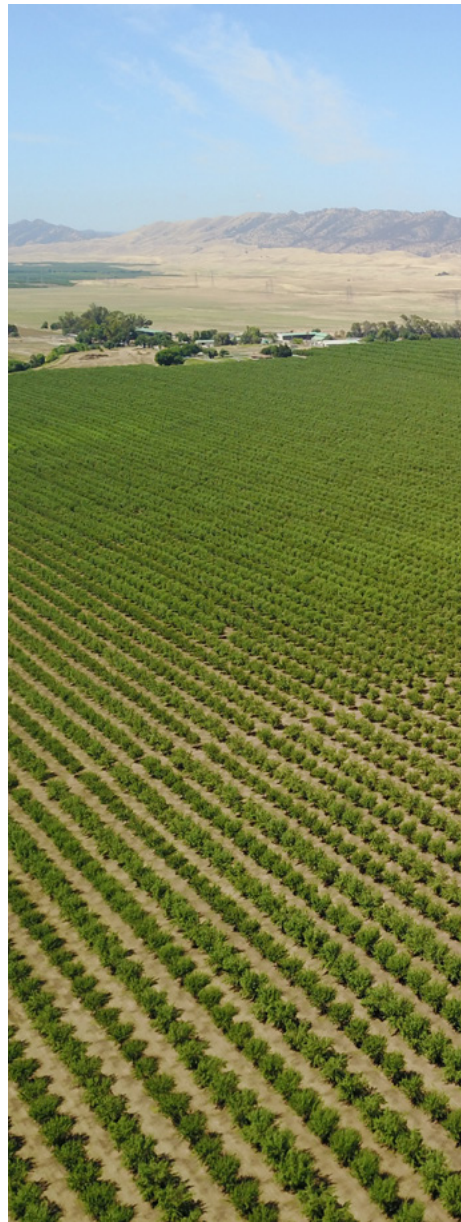
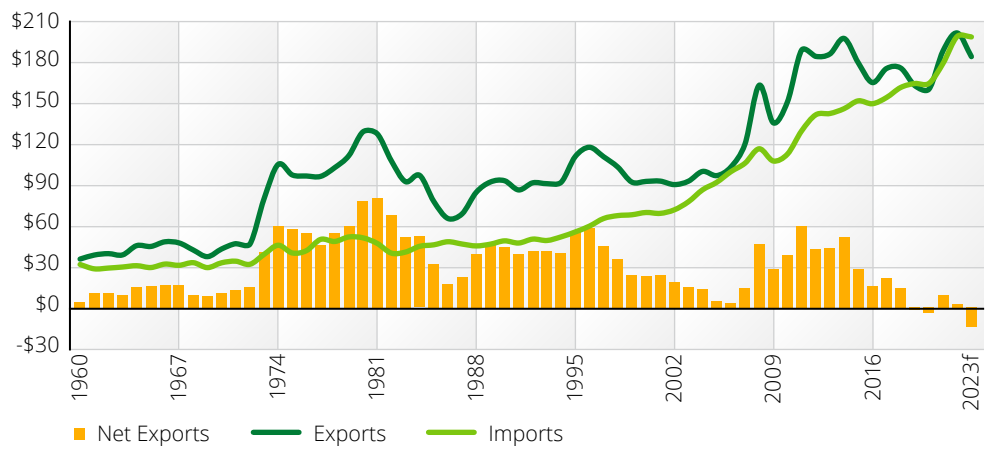


Figure 4 - Real U.S. Agriculture Imports and Exports: 1960 to 2023f, billions, 2023 dollars



Source: USDA, BEA

Figure 5 - Real U.S. Farm Debt in Real Estate and Non-Real Estate: 1960 to 2023f, billions, 2023 dollars



Source: USDA, BEA

Figure 6 - Real U.S. Farm Assets and Farm Real Estate: 1960 to 2023f, trillions, 2023 dollars



Source: USDA, BEA

Figure 7 - U.S. Farm Sector Debt Ratios: 1960 to 2023f

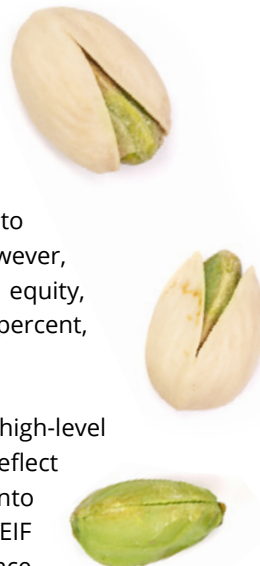


Source: USDA, BEA

The real value of farm assets is expected to increase 2.3 percent to \$4.0tt this year (see Figure (6)). The real value of farm real estate is forecasted to increase 3.4 percent to \$3.4tt.

Farm sector equity is expected to increase 2.1 percent in 2023 to \$3.5tt, marking a record for the second consecutive year. However, given that farm debt rose more than asset values and farm equity, the debt-to-equity ratio ticked up to 15.2 percent and 13.2 percent, respectively, as illustrated in Figure (7).

The USDA's farm income and balance sheet forecasts provide a high-level overview of the profitability of the U.S. agricultural sector and reflect diverse uses, crop types, and geographies. To gain more insight into the current situation, we analyze the performance of the NCREIF Farmland Index, which provides detail on the relative performance of various property types.



SUSTAINABILITY HIGHLIGHT:

Solar Arrays in California

AgIS Capital continues to invest in solar to utilize clean energy and improve the financial performance of our clients' investments. In addition to constructing two new solar arrays in 2022, we are updating and optimizing existing arrays.



Western solar array on the Monterey vineyard



Eastern solar array on the Monterey vineyard

The two arrays pictured are on a Monterey County vineyard in California, which will be modernized in 2023 with the addition of new hardware and remote monitoring and reporting technology. This will assist us in making the most efficient and cost effective use of the electricity produced by the arrays.

Learn more about AgIS Capital's ongoing Sustainability efforts on [our website](#).

The Farmland Index

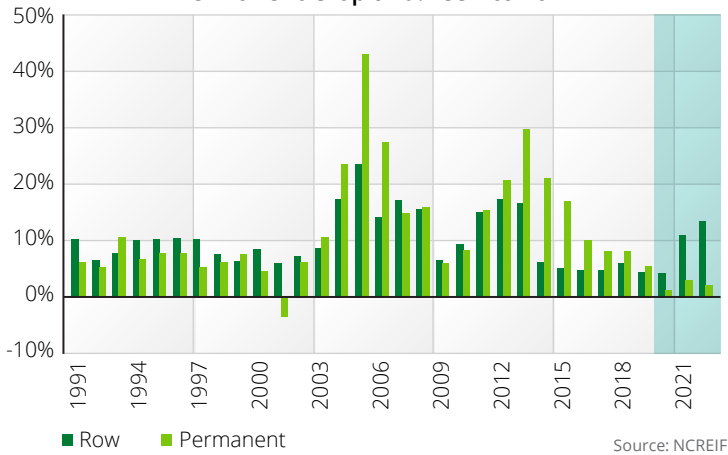
NCREIF's Total Farmland Index (TFI) continued its 32-year streak of posting positive annual total returns in 2022. The index's annual total return was 9.5 percent for the year ending December 31, 2022 (see Row (1), Column (g) in Figure (8)). The income return was 3.3 percent, and the capital return was 6.0 percent. The TFI was comprised of 1,315 assets in 2022, an increase of 55 properties from the previous year. The value of the TFI was \$15.3bb, while the average value per property was \$11.6mm.

Figure 8 - NCREIF Farmland Returns: One- and Five-year, Annualized, Million dollars, as of 12/31/2022

	Market Value (a)	Percent of Index (b)	Property Count (c)	Value Per Asset (d)	One Year Return			Five Year Annualized Return		
					Income (e)	Capital (f)	Total (g)	Income (h)	Capital (i)	Total (j)
(I) Total Farmland Index										
1 Total Farmland	\$15,258.9	100%	1315	\$11.6	3.3%	6.0%	9.5%	3.9%	2.4%	6.4%
2 Annual Cropland	\$9,405.6	62%	992	\$9.5	3.8%	10.4%	14.4%	3.5%	4.3%	7.9%
3 Permanent Cropland	\$5,853.4	38%	323	\$18.1	2.6%	-0.4%	2.2%	4.5%	-0.5%	4.0%
(II) Annual Cropland by Region										
4 Pacific West	\$971.1	10.3%	43	\$22.6	3.9%	5.0%	9.1%	3.9%	2.5%	6.4%
5 Pacific Northwest	\$547.5	5.8%	64	\$8.6	4.0%	0.8%	4.8%	3.5%	5.5%	9.2%
6 Cornbelt	\$1,961.3	20.9%	412	\$4.8	3.7%	23.7%	28.0%	3.1%	7.8%	11.1%
7 Delta	\$2,898.1	30.8%	141	\$20.6	3.3%	9.6%	13.1%	3.2%	4.3%	7.6%
8 Southeast	\$584.5	6.2%	51	\$11.5	4.0%	6.2%	10.4%	4.1%	3.2%	7.4%
9 Mountain	\$1,145.7	12.2%	90	\$12.7	3.9%	4.9%	8.9%	3.9%	1.4%	5.3%
10 Southern Plains	\$284.6	3.0%	17	\$16.7	4.4%	2.6%	7.1%	4.5%	2.3%	6.9%
11 Lake States	\$518.6	5.5%	119	\$4.4	4.5%	12.0%	16.8%	3.8%	4.9%	8.8%
12 Other Regions (approximate)*	\$494.2	5.3%	21	\$23.5	4.2%	4.2%	8.8%	4.1%	1.4%	5.7%
13 Annual Cropland	\$9,405.6	100%	958	\$9.8	3.8%	10.4%	14.4%	3.5%	4.3%	7.9%
(III) Permanent Cropland by Region										
14 Pacific West	\$4,974.2	85.0%	243	\$20.5	2.3%	-0.6%	1.7%	4.8%	-0.4%	4.3%
15 Pacific Northwest	\$501.7	8.6%	40	\$12.5	3.5%	0.6%	4.1%	0.0%	-0.5%	-0.5%
16 Lake States	\$112.1	1.9%	19	\$5.9	17.6%	-2.0%	15.3%	10.0%	-2.3%	7.6%
17 Other Regions (approximate)*	\$265.4	4.5%	21	\$12.6	1.1%	1.7%	3.2%	5.8%	-0.1%	5.8%
18 Permanent Cropland	\$5,853.4	100%	323	\$18.1	2.6%	-0.4%	2.2%	4.5%	-0.5%	4.0%
(IV) Management Type Subindexes										
19 Directly Operated Permanent	\$4,282.0	28.1%	225	\$19.0	1.6%	-0.6%	1.0%	4.2%	-0.8%	3.4%
20 Leased - Annual	\$9,337.9	61.2%	990	\$9.4	3.8%	10.5%	14.5%	3.5%	4.3%	7.9%
21 Leased - Permanent	\$1,571.4	10.3%	98	\$16.0	5.4%	0.1%	5.6%	5.4%	0.6%	6.0%
(V) Crop Type-Subindexes										
22 Annual Commodity	\$5,687.8	37.3%	796	\$7.1	3.7%	9.4%	18.6%	3.2%	5.4%	8.7%
23 Annual Fresh Produce	\$1,068.6	7.0%	46	\$23.2	3.9%	5.6%	5.3%	3.8%	1.9%	5.8%
24 Annual All Others	\$2,649.2	17.4%	150	\$17.7	3.9%	3.9%	9.9%	3.9%	3.0%	7.0%
25 Almonds	\$1,045.5	6.9%	65	\$16.1	-0.6%	-1.7%	-2.3%	4.0%	-3.0%	0.9%
26 Apples	\$322.6	2.1%	21	\$15.4	3.7%	1.0%	4.7%	-0.8%	-0.9%	-1.7%
27 Pistachios	\$1,084.1	7.1%	32	\$33.9	3.0%	1.2%	4.2%	9.5%	0.7%	10.5%
28 Wine Grapes	\$2,141.7	14.0%	98	\$21.9	3.6%	-1.0%	2.6%	3.5%	0.3%	3.8%
29 Citrus	\$393.8	2.6%	25	\$15.8	0.9%	1.7%	2.6%	4.7%	-0.2%	4.4%
30 Other Permanent Crops	\$867.8	5.7%	83	\$10.5	4.1%	-0.6%	3.4%	4.0%	-0.3%	3.8%

Source: NCREIF. Returns are for the year ending 12/31/2022. *NCREIF does not disclose the performance of regions in which there are insufficient properties or reporting managers. However, the performance of these regions is included in an aggregate index, and therefore the returns for these regions can be algebraically computed. Note: the five-year annualized returns for 'Other Regions' were estimated using the 2022 market values as weights. Therefore, the five-year annualized returns for the 'Other Regions' are approximate.

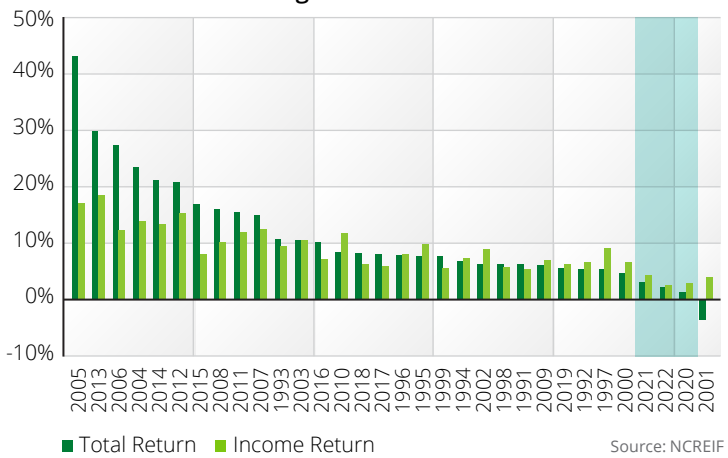
Figure 9 - Annual Total Returns for Row and Permanent Cropland: 1991 to 2022



The NCREIF Annual Cropland Index consisted of 992 assets in 2022, an increase of 34 from the prior year. The value of these assets was \$9.4bb, while the average value was \$9.4mm per property. Annual crops posted a total return of 14.4 percent in 2022, with income returns of 3.8 percent and capital returns of 10.4 percent.

Historically higher commodity prices since 2020 helped row crop income returns increase for a third consecutive year, despite capital values increasing 7.3 and 10.4 percent in 2021 and 2022, respectively. The capital appreciation largely reflected higher future farm income expectations, which is attributable to the historically high commodity prices that have been generated since 2020 (see “Our Thoughts” in the next section for further analysis). Given the relatively large capital appreciation garnered by the sector over the past two years, row cropland income expectations appear to have overridden expectations of increasing interest rates.

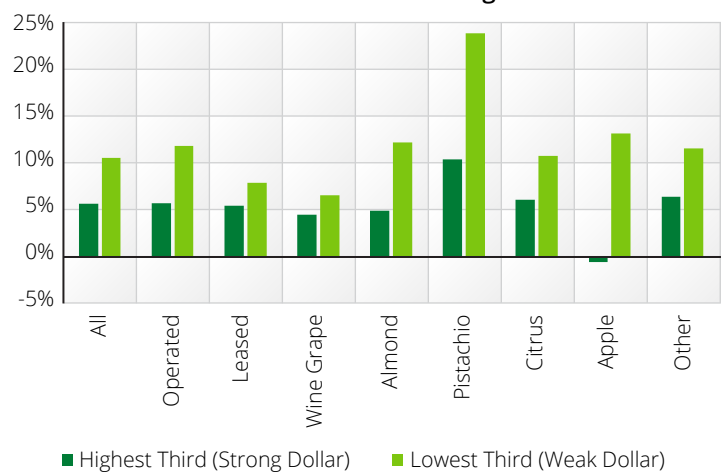
Figure 10 - NCREIF Permanent Cropland Total Returns Ranked from Highest to Lowest: 1991 to 2022



The NCREIF Permanent Cropland Index consisted of 323 properties, with a total of 21 new assets being added in 2022. The total value of these permanent crop assets was \$5.9bb, with an average value of \$18.1mm per property. In stark contrast to row cropland performance in 2022, the Permanent Cropland Index posted a meager total return of 2.2 percent, with income of 2.6 percent and capital returns of -0.4 percent.

Figure (9) illustrates how annual cropland outperformed permanent cropland for the third consecutive year in 2022. While row crops exhibited relatively strong returns during the past three years, permanent cropland income and total returns in 2020, 2021, and 2022 are among the four lowest posted, as illustrated in Figure (10).

Figure 11 - Average Permanent Crop Income When the RNEER is Sorted from Highest to Lowest



Source: NCREIF, FRED.
 Note: RNEER index values are sorted from highest to lowest and the RNEER and the corresponding permanent cropland income returns are divided into thirds. "Highest Third" represents the average income returns corresponding to the top third index values of the RNEER, while "Lowest Third" corresponds to the average income returns corresponding to the lowest third index values.



The strengthening of the dollar's value since 2014 has undoubtedly hindered the income performance of permanent crops. The Real Narrow Effective Exchange Rate (RNEER) measures the value of the U.S. dollar against a weighted average basket of a 'narrow' selection of foreign currencies (to convert from nominal to real terms, a price deflator of the country adjusts the currencies). Figure (11) details how the average permanent crop income returns of various sub-indices increase as the dollar's value weakens. For all nine permanent cropland indices, the average income was higher when the relative value of the dollar was lower, and vice versa.

Income returns for the Total and Operated Permanent Cropland Index in 2022 and 2020 ranked as the lowest and second lowest posted in the 32 years of the index's existence (See Row (1), Column (c) and Row (1) Column (a), respectively, in Figure (12.a)). Interestingly, the highest (strongest) and second-highest levels of the RNEER index since 1991 occurred in 2022 and 2020, respectively, as is shown in Figure (12.b).



Figure 12a - Recent Permanent Crop Income Returns Ranked from Lowest to Highest

Index	2020 (a)	2021 (b)	2022 (c)	Years
1 Total Permanent	2 nd	4 th	1 st	32
2 Operated Permanent	2 nd	4 th	1 st	32
3 Leased Permanent	5 th	8 th	7 th	31
4 Wine Grapes	1 st	4 th	2 nd	26
5 Almonds	5 th	6 th	1 st	31
6 Pistachios	-	3 rd	1 st	20
7 Citrus	3 rd	4 th	1 st	29
8 Apples	4 th	-	-	24
9 Other Permanent	3 rd	7 th	4 th	30

Source: NCREIF

Figure 12b - Recent RNEER Statistics Ranked from Highest to Lowest

Index	2020	2021	2022	Years
10 RNEER	2 nd	5 th	1 st	32

Source: FRED

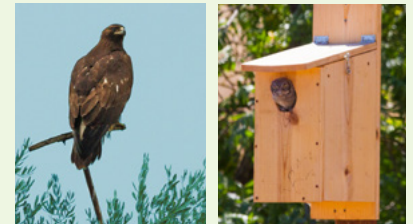


The relative strength of the U.S. dollar is thought to have negatively impacted permanent crop income returns in recent years. The following section explains why row and permanent cropland returns have diverged since 2020.

SUSTAINABILITY HIGHLIGHT:

Key Biodiversity Efforts

Facilitating nesting and hunting habitat for predatory birds is a biodiversity priority on the farms AgIS Capital manages for clients. Simply leaving large trees undisturbed, or ground space in the case of burrowing owls, goes a long way.



Golden Eagle Western Screech Owl

We also place nesting boxes for owls, song birds, and wood ducks, as well as raptor perches across our clients' farms so these important species have ample opportunity to make themselves at home. In exchange for the habitat support, these birds help keep rodent and insect populations under control and therefore reduce our need to use rodenticides or other harsher methods of control. A single pair of barn owls can consume up to 2,000 gophers in a year! Through this effort we are also able to support our local communities by sourcing nesting boxes for the farms from various FFA and school woodshop programs.



Great Horned Owl

Learn more about AgIS Capital's ongoing Sustainability efforts on [our website](#).

Our Thoughts

As was just explained, total row cropland returns in the NCREIF Farmland Index exceeded permanent cropland returns for a third consecutive year in 2022 (see Figure (9)). Despite two years of successive increases in interest rates, row crop capital returns more than doubled total permanent cropland returns in 2021 and 2022. Additionally, despite two years of significant capital appreciation, the row cropland income rate of return increased for a third consecutive year.

Many institutional investors have asked us why permanent cropland returns have lagged those of row cropland and whether the divergence between returns is attributable to inflation. These are complex questions because the current period of analysis encompasses

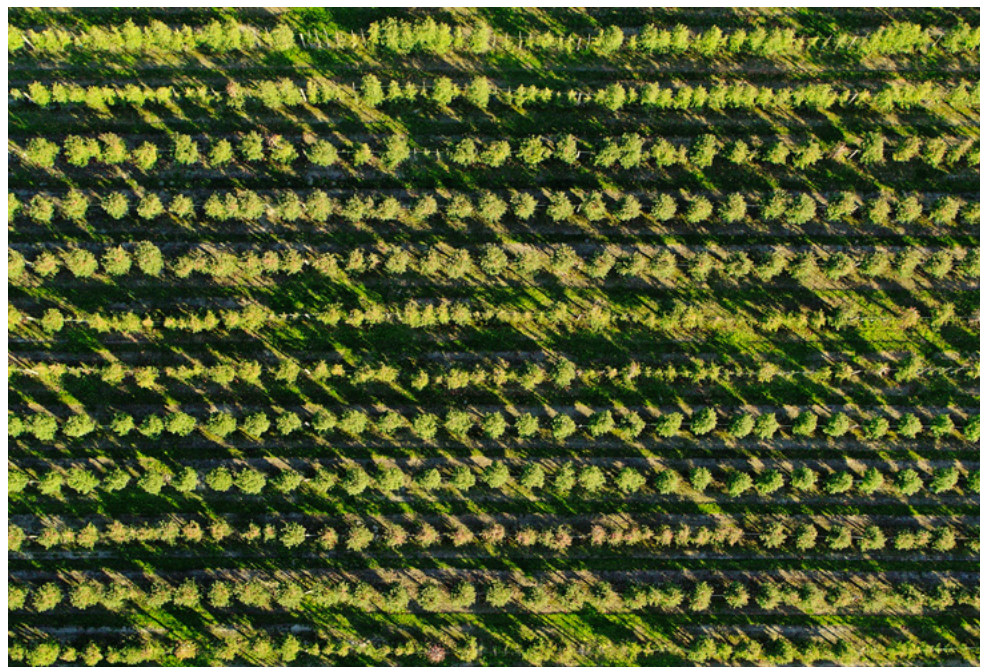
an uptick in inflation and interest rates, the Covid-19 pandemic, Russia's invasion of Ukraine, and rising geopolitical tensions between the U.S. and China, which pertain to both the ongoing trade war and Taiwan's sovereignty.

Our analysis indicates that the Chinese Communist Party (CCP) has a history of changing its domestic agricultural policies in response to shifts in its perception of food security and potential social unrest. The CCP brought food security to the forefront after the Covid-19 pandemic and several African Swine Fever

epidemics. Its recent efforts to stockpile grain, as discussed in the following pages, appear to have contributed to the global increase in primary row crop output prices since 2020. The rise in output prices appears to have led to higher than expected future farm income for row crop producers. The increased income expectations have overridden the impact of higher than expected interest rates, which has led to an increase in farmland capital values. However, the CCP has prioritized building standing inventories of essential grains and oilseeds and has yet to focus on doing the same with higher-valued permanent crops. Thus, global permanent cropland output prices and capital values have not directly benefited from China's domestic agricultural policies.



Our analysis indicates that the Chinese Communist Party has a history of changing its domestic agricultural policies in response to shifts in its perception of food security and potential social unrest.





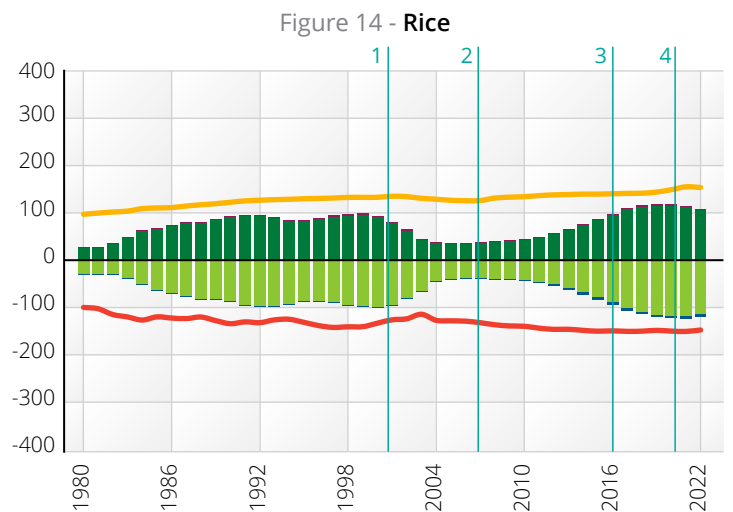
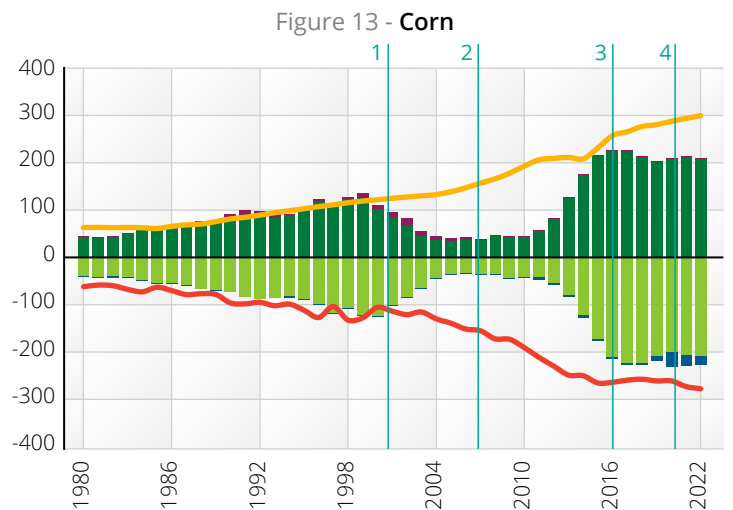
A Historical Perspective of China's Agriculture Policy

The Chinese Communist Party (CCP, or State) has always prioritized ensuring food security and social stability because hungry, angry people start revolutions. As a result, it has a long history of storing relatively large stockpiles of essential grains (corn, wheat, rice, soybeans, etc.) to maintain consumption if production falters. It also has a track record of enacting interventionist policies to enhance rural farm income. Some policies have had unexpected consequences, and the CCP has typically intervened further in response. Understanding how the CCP's agricultural policies have evolved over the past four decades can help explain why row crop commodity prices have climbed since 2020.

As a closed, planned economy, China historically consumed what it produced. Prior to the mid-1990s, State policies suppressed food prices for the benefit of consumers, transferring wealth from rural to urban people. However, the widening divide between rural and urban incomes in the mid-1990s caused the CCP to switch course by allowing domestic prices to exceed world prices and by subsidizing agricultural production. By 2000, domestic corn prices exceeded world prices by 35 percent, and increases in domestic production levels led to growing stockpiles.

As a result of these strategic moves by the CCP, paying above-market prices for substantial amounts of grain became expensive. Consequently, in preparation for its membership in the World Trade Organization (WTO) in 2001, the CCP switched course again and pledged to reduce trade barriers, lower support for domestic producers, and allow domestic and world prices to converge. Its new objective was to lift people from poverty by opening markets to spur economic growth. This is denoted by Line (1) in Figures (13) through (20). However, despite its pledges, it appears China continued to provide grain export subsidies to reduce its stockpiles.

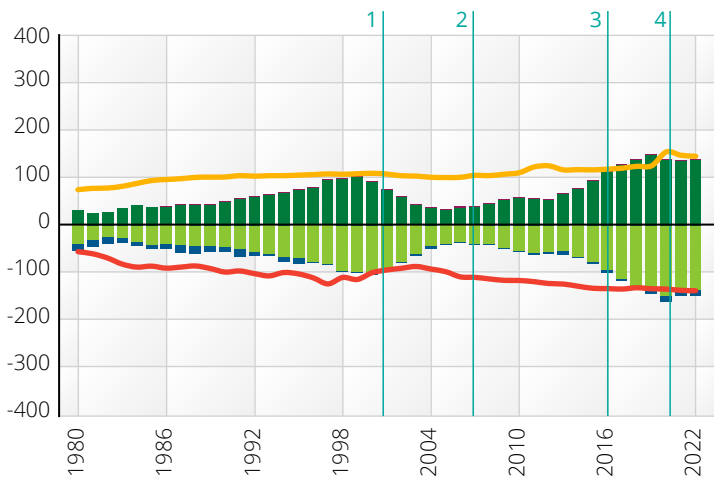
Figures 13-16 - Distribution of Chinese Crops: 1980 to 2022, mmt



■ Beginning Stocks
 ■ Exports
 — Consumption
■ Ending Stocks
 ■ Imports
 — Production
 Source: USDA

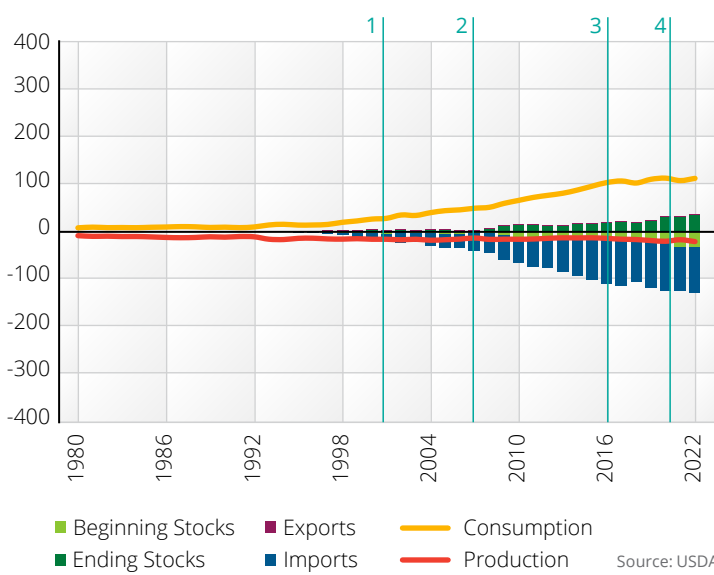
Figures 13-16 - Distribution of Chinese Crops: 1980 to 2022, mmt

Figure 15 - Wheat



The CCP pledged to end corn stockpiling in 2016,¹ purportedly selling 100 million tons between April and October 2018.

Figure 16 - Soybeans



■ Beginning Stocks ■ Exports — Consumption
■ Ending Stocks ■ Imports — Production Source: USDA

In 2007, commodity price shocks caused consternation within the CCP, which decided to re-focus on food security. In 2008, the State enacted the Temporary Purchase and Storage Policy (TPSP), a move that is indicated by Line (2) in Figures (13) through (20). Reversing its tilt toward free enterprise, the State began incentivizing farmers to increase corn production by paying a subsidy linked to input costs and by establishing a minimum price at which it would purchase corn. Furthermore, the CCP increased its minimum purchase price yearly to enhance rural farm income continuously.

Because of these efforts, China's farmers began planting the hills with corn. This culminated with 45.0 million hectares harvested in 2016, representing a 50 percent increase from 2007—the year before the State enacted the TPSP. As a result, China's corn stockpile swelled as the government procured more than 282.8 million tons from 2012 to 2015. In addition, the policy of increasing minimum corn prices annually resulted in domestic prices exceeding world prices by more than 60 percent in some provinces. This left the CCP as the only buyer of domestically grown corn. Once again, the financial burden of buying more corn each year at increasing prices became unsustainable for the State.

In 2016, China abandoned the TPSP and switched to a Producer Subsidy Policy (PSP), as indicated by Line (3) in Figures (13) through (20). As a result, world corn prices again began to influence domestic prices. Furthermore, the CCP started incentivizing the production of other grains and oilseeds to alleviate the environmental degradation caused by an excessive use of fertilizers and pesticides.

The CCP pledged to end corn stockpiling in 2016,¹ purportedly selling 100 million tons between April and October 2018. (However, domestic prices in 2018 did not reflect the large quantity brought to market, causing some analysts to question the quality and level of China's corn stocks. Reports of widescale corruption pertaining to grain procurement and sales lend credence to these questions²). In response to these policies, China's domestic corn stocks fell 10.1 percent between 2016 and 2019, while world corn-ending stocks fell 20.1 percent.

¹ <https://www.ft.com/content/15b0fb4a-f59e-11e5-803c-d27c7117d132>
² https://www.chinadaily.com.cn/china/2015-04/20/content_20484036.htm



Line (4) in Figures (13) through (20) marks the beginning of the Covid-19 epidemic in 2020, which added to the already heightened tensions generated by the Trump Administration's tariff escalation in 2018 and the U.S.'s deepening ties with Taiwan over China's objections. Furthering strain arose in 2022 with Russia's invasion of Ukraine.

In response to Covid-19, the CCP brought food security back to the forefront and enacted policies to increase corn, rice, wheat, and soybean stockpiles. However, La Niña and other weather anomalies, coupled with Covid-19-induced supply-chain issues, largely kept global production of these commodities below trend from 2020 to 2022. As a result, the lower output kept ending stocks from replenishing. Additionally, increased demand for renewable diesel and biofuels further pressured stocks.

Figures 17-20 - World Ending Stocks and the Proportion Held by China: 1980 to 2022, mmt

Figure 17 - Corn

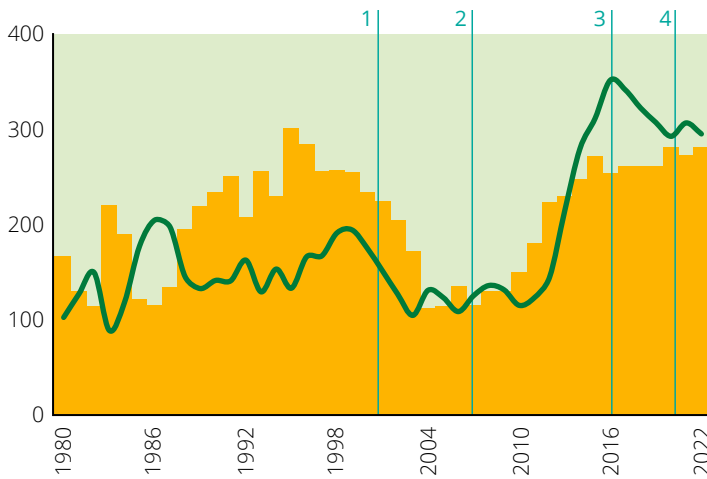


Figure 19 - Wheat

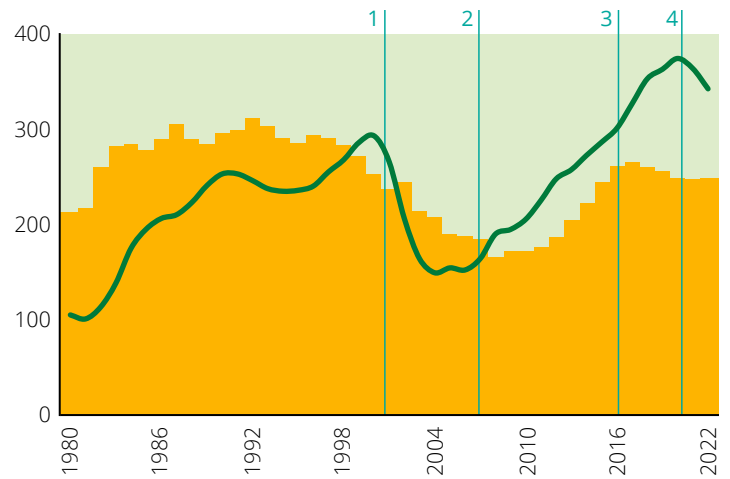


Figure 18 - Rice

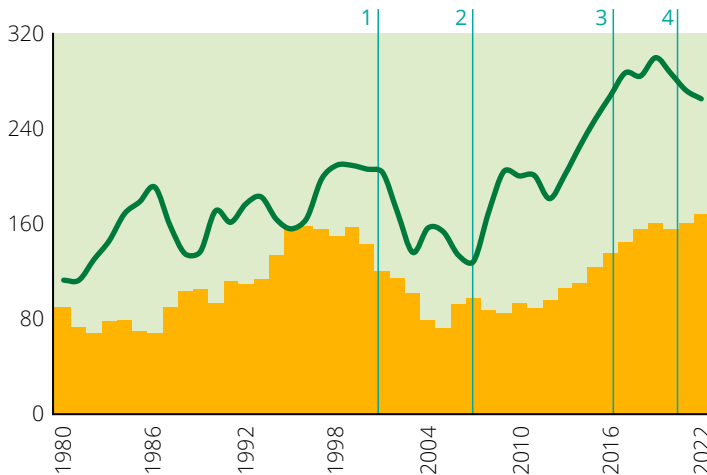
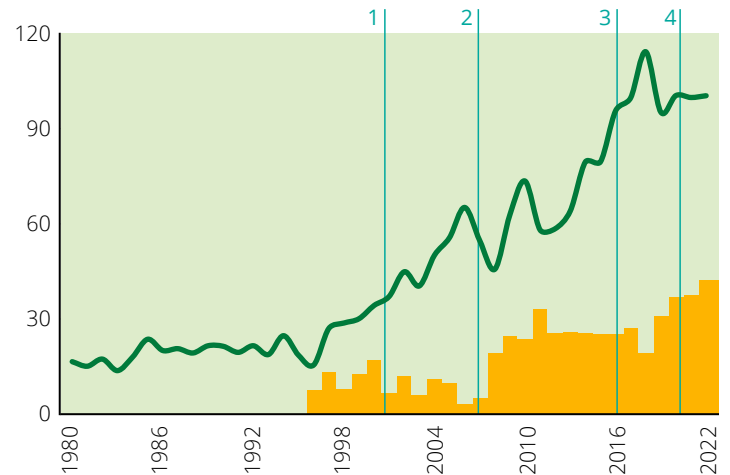


Figure 20 - Soybean



China Rest of World Ending Stocks

Source: USDA

Figure 21 - Changes in the Distribution of Ending Stocks for Corn, Rice, Wheat, and Soybeans: 2019 to 2022

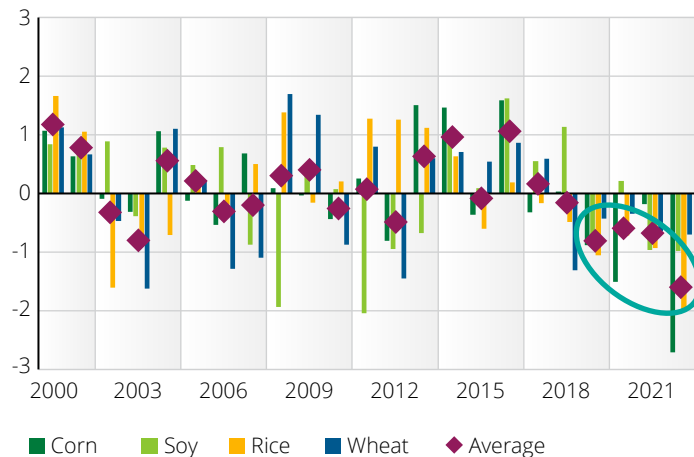
	Percent Change in World Endings Stocks (1)	Percent Change in China's Ending Stocks (2)	Percent Change in Proportion of Ending Stocks Held by China (3)
Corn	-3.9%	3.4%	7.6%
Rice	-5.7%	-8.2%	-2.7%
Wheat	-11.5%	-7.0%	5.2%
Soybeans	5.5%	43.4%	35.9%

Source: USDA

For example, ending stocks for corn, rice, and wheat were higher before Covid-19 in 2019 than in 2022 (see Column (1) in Figure (21)). However, China's proportion of global-ending stocks rose for all but rice (see Column (3) in Figure (21)).

In response to a perceived increase in risks to food security and social stability, which it attributed to geopolitical tension with the U.S.³, the Covid-19 epidemic⁴, and the Russian invasion of Ukraine⁵, the CCP appears to once again be in a stockpiling mode. "[Increased spending on grain reserves] reflects Xi's (Xi Jinping, Chairman of the CCP) belief that the Chinese people's meals cannot be blocked by the Americans and others. So, to ensure food and energy security, or to ensure that China can be self-sustained, is largely Xi's thinking", said Alfred Wu⁶, an associate professor at the National University of Singapore.

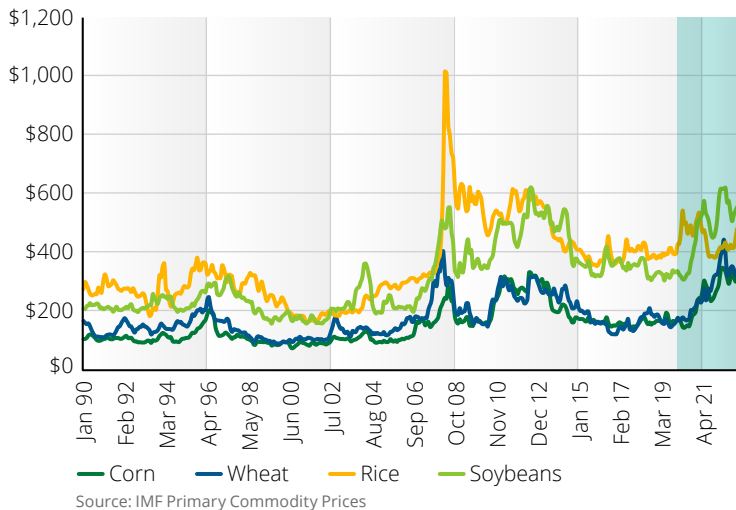
Figure 22 - Deviations of Actual and Projected* Production in Standard Score: 2000 to 2022



Source: USDA
* Production trends use data from 2000 to 2018 to project expected production in 2019, 2020, and 2022.

Weather anomalies and other factors, however, have limited the global production of major grain and oilseeds (see Figure (22)). For example, Ukrainian corn production, which typically accounts for 3.1 percent of world production, fell 35.9 percent to 27 mmt in 2022 because of the Russian invasion. The drought in Argentina, which usually accounts for 4.4 percent of world corn production, also caused production in that country to fall 28.8 percent from its peak in 2020. Drought also impacted production in the E.U., in 2022, causing production to drop 25.8 percent to 53.0 mmt. Lastly, U.S. corn production fell 8.9 percent in 2022 because of dryness during the growing season. These production shortfalls amount to 81.7 mmt of corn.

Figure 23 - Historical Monthly Commodity Prices: January 1990 to March 2023 USD per metric ton



Source: IMF Primary Commodity Prices

In conjunction with increasing demand for biofuels, production shortfalls have kept global ending stocks below trend. Given the inelastic demand for these commodities, prices rose to ration demand, as is shown in Figure (23).

As a result of the CCP's agricultural policies, China, which currently is home to 18.1 percent of the world's population, holds 70.2 percent of global corn stocks, 62.4 percent of global rice stocks, 50.3 of global wheat stocks, and 35.2 percent of global soybean stocks. In addition, the *South China Morning Post* reported on March 6, 2023, that the CCP intends to increase spending on reserves of grain and oilseeds to US\$19.2bb in 2023. This would represent an increase of 13.6 percent from the previous year.⁷ Therefore, it appears that the CCP's efforts to increase its grain stocks are occurring when global production and ending stocks have been tight, which is magnifying China's impact on global commodity prices.

3 <https://www.cfr.org/timeline/us-china-relations>
 4 https://www.wsj.com/articles/chinese-protests-spread-over-governments-covid-restrictions-11669516403?mod=hp_lead_pos2
 5 <https://www.scmp.com/economy/china-economy/article/3213767/chinas-xi-jinping-says-ukraine-war-has-shown-extreme-importance-food-security?module=inline&pgtype=article>
 6 <https://www.scmp.com/news/china/politics/article/3212442/chinas-two-sessions-2023-premier-li-keqiang-bows-out-appeal-economic-recovery?module=inline&pgtype=article>
 7 <https://www.scmp.com/economy/china-economy/article/3212519/china-food-security-budget-grain-reserves-grows-136-cent-amid-self-sufficiency-push>

IMPLICATIONS FOR U.S. FARMLAND RETURNS

In theory, the value of farmland capital is a function of all expected future farm income and the opportunity cost of capital, which is the rate at which farmland market participants discount their expectations of future farm income. In its most fundamental form (without expectations, for simplification), the mathematical expression of the relationship is:

Equation 1

$$Value = \frac{Return}{Rate}$$

Where the numerator (“Return”) is the return to owning farmland, and the denominator (“Rate”) is the rate used to discount farmland returns. Equation (1) also can be expressed in terms of the income rate of return:

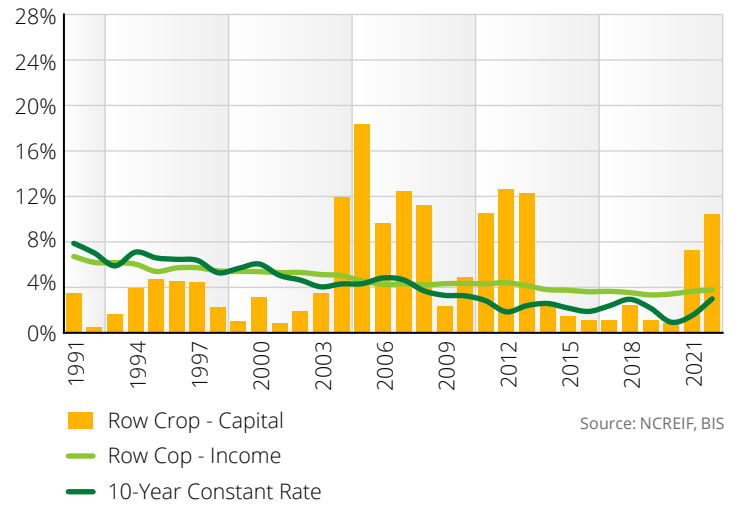
Equation 2

$$Rate = \frac{Return}{Value}$$

All row cropland in the NCREIF Farmland Index is leased, so the numerator in Equation (2) reflects the lease payments received by row cropland owners. Therefore, the light-green line “Row Crop-Income” in Figure (24) depicts the ratio of farmland Return to farmland Value from Equation (2).

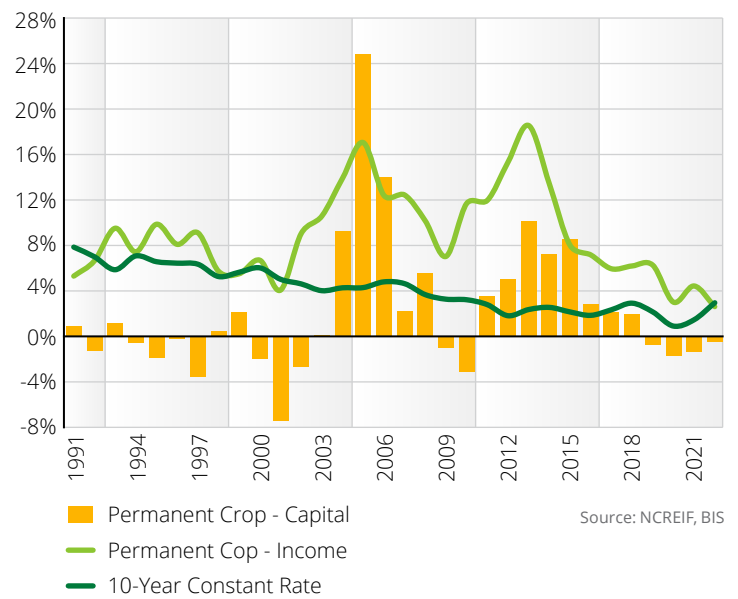
Historically, the row crop income rate of return has closely tracked the 10-year constant maturity rate, as the latter represents the opportunity cost of capital for farmland investors. Figure (24) demonstrates how the value of row cropland capital (yellow columns) adjusts to equilibrate the row crop income rate of return with the 10-year constant maturity rate. Consequently, the NCREIF row crop income returns and the 10-Year Constant Treasury Rate have a correlation coefficient of 92.4 percent. In contrast to the row cropland assets in the NCREIF Index, its permanent cropland assets can be leased or directly operated.⁸ Unlike a relatively fixed lease rate for row cropland, income from directly operated permanent crops is a function of realized prices, yields, and expenses. As a result, permanent crops typically exhibit higher income returns than passively managed row crops, as is illustrated in Figure (25).

Figure 24 - Row Crop Returns and the 10-Year Constant Maturity Rate: 1991 to 2022



Source: NCREIF, BIS

Figure 25 - Permanent Crop Returns and the 10-Year Constant Maturity Rate: 1991 to 2022



Source: NCREIF, BIS



Income from directly operated permanent crops is a function of realized prices, yields, and expenses. As a result, permanent crops typically exhibit higher income returns than passively managed row crops.

⁸ Note: Before 2001, leased permanent cropland averaged 50.8 percent of the permanent cropland index. From 2001 through 2022, leased permanent cropland averaged 19.9 percent of the permanent cropland index. Therefore, the influence of leased permanent cropland returns was greater before 2001.

An implication of Equation (1) is that changes in the value of farmland from one year to the next, dV_t , should reflect the expectations of difference between the ratio of farmland returns and discount rate in period t , and the ratio of farmland returns and discount rate in period $t-1$:

Equation 3

$$E[Value_{(t)}] - Value_{(t-1)} = E[dV_t] = \left[\frac{E[Return_{(t)}]}{E[Rate_{(t)}]} \right] - \left[\frac{Return_{(t-1)}}{Rate_{(t-1)}} \right] = E[Ratio_{(t)}] - Ratio_{(t-1)}$$

The returns and discount rate in Figure (24) display three facts:

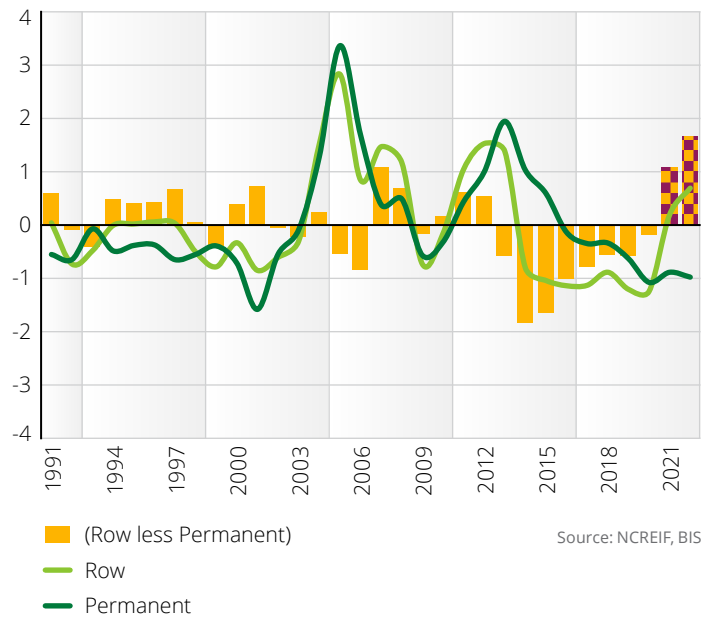
- 1 The value of row cropland (yellow columns) in the NCREIF Index appreciated 7.3 percent in 2021 and 10.4 percent in 2022.
- 2 Row cropland income increased from 3.4 percent in 2020, to 3.6 percent in 2021, and again to 3.8 percent in 2022.
- 3 The 10-year constant maturity rate increased from 0.1 percent to 1.4 percent, to 3.0 percent during the same period.

This is the first time in the history of the NCREIF Farmland Index that income, capital, and interest rates simultaneously rose for two consecutive years. According to Equation (3), if rates and farmland values are both expected to increase, then farmland market participants must expect returns to increase at a pace exceeding the expected increase in rates. Figure (26) portrays total returns for row and permanent cropland in a standard score so that "0" in the vertical axis represents the average return from 1991 to 2022, and each horizontal line above or below "0" represents a standard deviation from above or below the average return.

The yellow columns in Figure (26) measure the difference between row and permanent cropland total returns in a standard score. For the first time, the difference between these returns was more than one positive standard deviation above the average difference for two consecutive years beginning in 2021. This indicates that row cropland total returns were unusually strong in 2021 and 2022 relative to those of permanent croplands.



Figure 26 - NCREIF Permanent and Row Cropland Total Returns in Standard Score: 1991 to 2022



TYING IT ALL TOGETHER

As we explained earlier, the CCP has historically built-up grain stocks when food security or social stability threats arise. Several such domestic threats have developed since 2020, and the CCP is clearly in a stockpiling mode. Weather anomalies and other factors since 2020 have kept global production of wheat, corn, rice, and soybeans below the trend from 2000 through 2019. In addition, increased demand for biofuels has chipped away at global ending stocks. Given the inelastic demand for rice, wheat, corn, and soybeans, prices rose considerably in response to China increasing its share of below-trend ending stocks.

Higher row crop commodity prices have seemingly increased expectations of future farm income. Moreover, given that row cropland capital values increased in 2021 and 2022, farmland investors appear to expect row crop income to increase more than interest rates.

For example, from Equation (3), if

$$E[dV_t] > 0$$

then

$$E[Ratio_{(t)}] - Ratio_{(t-1)} > 0$$

and, therefore,

$$\frac{E[Return_{(t)}]}{Return_{(t-1)}} > \frac{E[Rate_{(t)}]}{Rate_{(t-1)}}$$

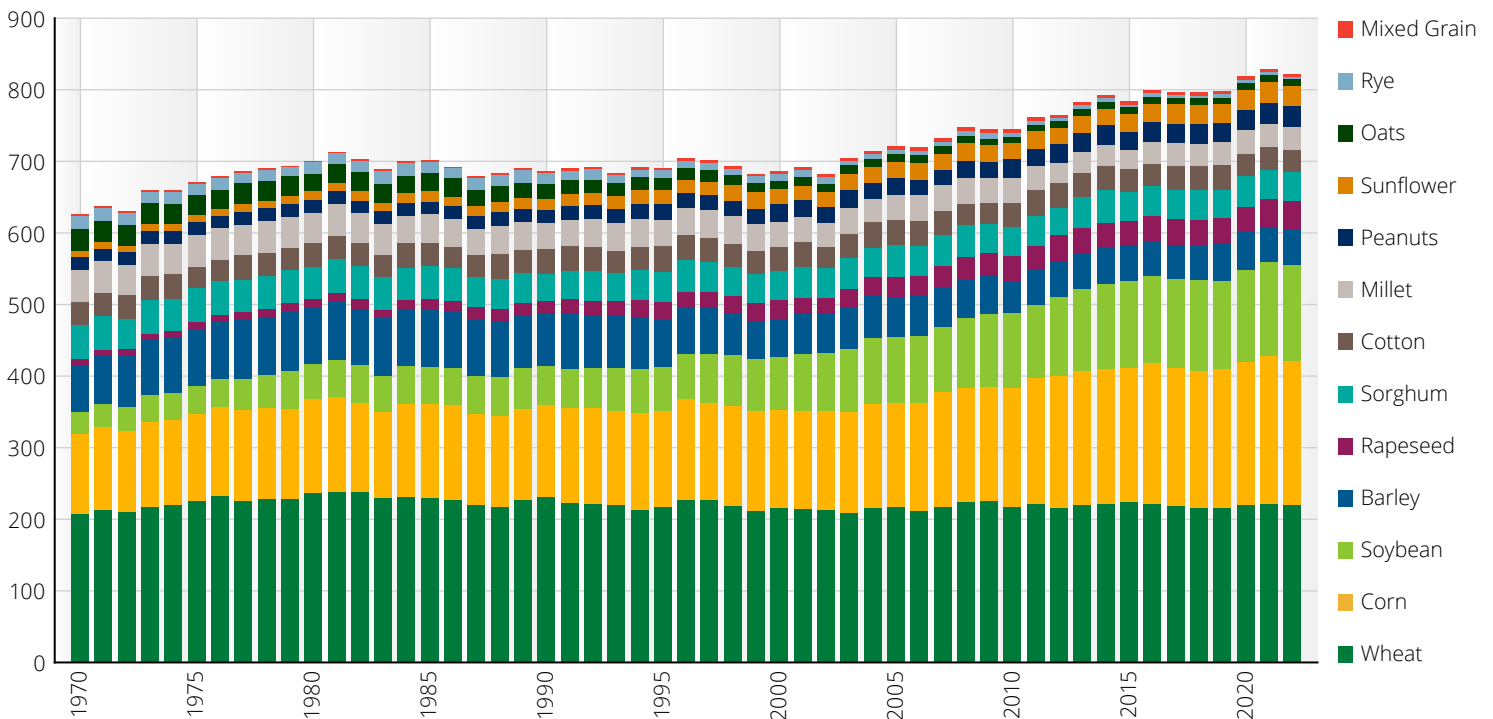
However, as was referenced earlier, the CCP has not prioritized stockpiling non-essential, higher-valued permanent crops, and thus permanent cropland prices and returns have yet to benefit from China's prevailing domestic agricultural policies.

Regarding questions of whether the divergence between row and permanent crop returns in 2021 and 2022 was attributable to inflation affecting row crop prices more than those for permanent crops, inflation does not

appear to be the culprit. In fact, inflation is generally a symptom rather than the cause of such challenges. Higher row crop prices have been driven by many factors. Production issues, tighter grain stocks, and strong oilseed demand are all partially responsible. However, the role of China's shifting agricultural policies is often overlooked.

Going forward, we at AgIS Capital believe row crop production should return to trend. This is because harvested acreage continues to expand (see Figure (27)) and yields should revert upward, replenishing global ending stocks and reducing row crop output prices. There is even the possibility that the elevated price signals in previous years will bring about a surplus of production. For example, corn production in Brazil, Russia, and China has increased 22.5, 10.9, and 6.3 percent, respectively, since 2019. If this trend continues, and Argentina, the U.S., Ukraine, and the E.U., revert to normal production levels, corn prices will certainly trend downward.

Figure 27 - World Harvested Area by Commodity: 1970 to 2022, million hectares



Source: USDA

Conclusions

Given the many exogenous shocks experienced since 2020, the U.S. agricultural economy has demonstrated resilience. Row and permanent cropland values appear to rationally reflect expectations of future farm income: the value of capital in the NCREIF Annual Cropland Index increased 20.6 percent since 2019, while the value of capital in the NCREIF Permanent Cropland Index decreased 4.1 percent. However, permanent cropland values have not benefited from China's stockpiling activities and the consequent increase in output prices.

This article demonstrates that weather anomalies, Russia's war on Ukraine, and China's stockpiling activities were among the drivers of recent row cropland returns. We expect production to normalize, the war to end, and the CCP's stockpiles to stop growing, or even shrink, which should place downward pressure on row crop output prices. Given the tremendous appreciation in row cropland capital values that has occurred during the past two years, combined with our expectations for lower row



Permanent cropland investors stand to be rewarded with higher income and capital values when the relative value of the dollar begins to wane.

cropland income, and the recent increase in interest rates, we believe the value of row cropland capital should rationally adjust downward to equilibrate with the opportunity cost of capital.

Finally, we also expect the dollar's relative value to revert downward, which should place upward pressure on both row and permanent crop output prices (although this will not be enough to support current row crop prices). Given that permanent cropland capital values have decreased in recent years, permanent cropland investors stand to be rewarded with higher income and capital values when the relative value of the dollar begins to wane. From our perspective, it is currently a very good time to hold U.S. permanent crop assets and to place new capital in the sector.



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