



THE FEED

by **FARMER MAC**

Perspectives on the Ag and Rural Economy

Up to the Challenge

SUMMER
2022



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LETTER FROM THE CHIEF ECONOMIST

It's a turbulent time in the global economy. Supply chain stress, unprecedented monetary and fiscal stimuli, and energy shortages—all following on the heels of a disruptive pandemic—are driving inflation across the developed and developing world. In addition to being a humanitarian crisis, Russia's invasion of Ukraine created additional pressure on the global food and energy complexes. The United Nations' World Food Price Index, already rising from global supply constraints brought about by the COVID-19 pandemic in 2020 and 2021, skyrocketed to a new record in March 2022. Global food costs are 60% higher in 2022 than pre-pandemic levels. Ukrainian farmers—major international food trade contributors—will see production limits this year, as they've been hit hard by damage to vital infrastructure, reduced access to inputs and labor, and clogged logistics to move supply to market. Food security challenges often lead to political difficulties; in the spring, several governments looked to secure their food supplies through additional purchases or limiting exports. Energy costs soared in the first half of 2022 as sanctions on Russia and supply-side constraints on oil and gas production and refining met surging demand from consumers anxious to get back on the roads. Global livestock producers grappled with diseases like African Swine Fever (ASF) and High Pathogenic Avian Influenza (HPAI), adding additional stress to the food supply picture. Meanwhile, persistent drought threatens crops, grazing conditions, and

water supplies in the American West and in many major growing regions around the globe. And central banks, behind the curve on rising inflation and overheating economies, raised interest rates sharply in 2022 to slow demand and halt rising prices. These murky conditions create a bitter stew in which businesses have to make future decisions and investments.

Fortunately, America's rural economy enters these choppy waters from a position of relative strength. Farm balance sheets are strong after two years of rising commodity prices and land values. Higher input costs have been largely matched by higher revenues from elevated food and commodity prices. Interest rates have risen faster than many expected, but many farmers and ranchers were able to lock in record-low interest rates in 2020 and 2021, limiting the sector-wide impact of rising rates. Agricultural lenders are well-capitalized with ample liquidity, helping to prevent a rapid credit cycle contraction that could reduce access to capital. America's farmers and ranchers made it through a challenging planting season, starting slow but working fast and furious in May to catch up to recent averages. Reported crop and pasture conditions ended June 2022 on par with the 2020 and 2021 crop years, giving U.S. producers a good shot at helping to fill a daunting gap in global grain production this year. U.S. oil and gas production is lurching ahead, pulled forward by higher prices and renewed demand. It



will take time to rebuild production and refining capacity, but the gears in the massive energy machine are turning along with a renewed focus on America's energy future.

Ultimately, America's tenacious food, fiber, fuel, and energy producers will have to stare down myriad global headwinds in the second half of 2022 and into 2023. This edition of *The Feed* highlights many of these issues, exploring their impacts on the industry participants and their lenders. Undoubtedly, rural America is up to the challenge of feeding and powering the billions of people around the globe that are counting on them. And as food and energy are two of the top drivers of today's inflationary environment, everyone is rooting for them to be successful.

A healthy and prosperous summer from our team to you and yours,



Jackson Takach, CFA
Chief Economist





THE RETURN OF GLOBAL FOOD INSECURITY

1, 2, 3

After decades of improving food security around the globe, the last two years have seen challenges to both food availability and affordability. Some nations have responded to these challenges by enacting the most consequential set of export restrictions in recent memory. Many countries will see impacts because of these restrictions, but the poorest nations are most likely to see a rise in food insecurity.



While the outbreak of the Russia-Ukraine conflict has led to an increased focus on global food insecurity, the global food situation has been deteriorating since 2019. In June of 2021, the USDA's Economic Research Service estimated that the number of food-insecure people globally had risen from approximately

900 million in 2020 to 1.2 billion in 2021. Macroeconomic impacts of the COVID-19 pandemic and a reduction in global grain stocks rendered food both less affordable and less available in many lower-income nations. However, even this outlook from June 2021 understates the current challenges to the global food system.

Since the USDA's report, global food prices have continued to rise. Production problems and shipping constraints led to rapid increases in the second half of 2021, while the onset of the Russia-Ukraine conflict has placed even further pressure on global food prices. The Food and Agriculture Organization of the United Nations projects that global food prices rose 26.1% in 2021 and will rise 16.3% in 2022, the fastest two-year growth in history. Prices have increased faster than they did during the 1972 wheat crisis, the 2008 financial crisis, and the 2011 supercycle (when high wheat prices contributed to the onset of the Arab Spring).

Export Restrictions

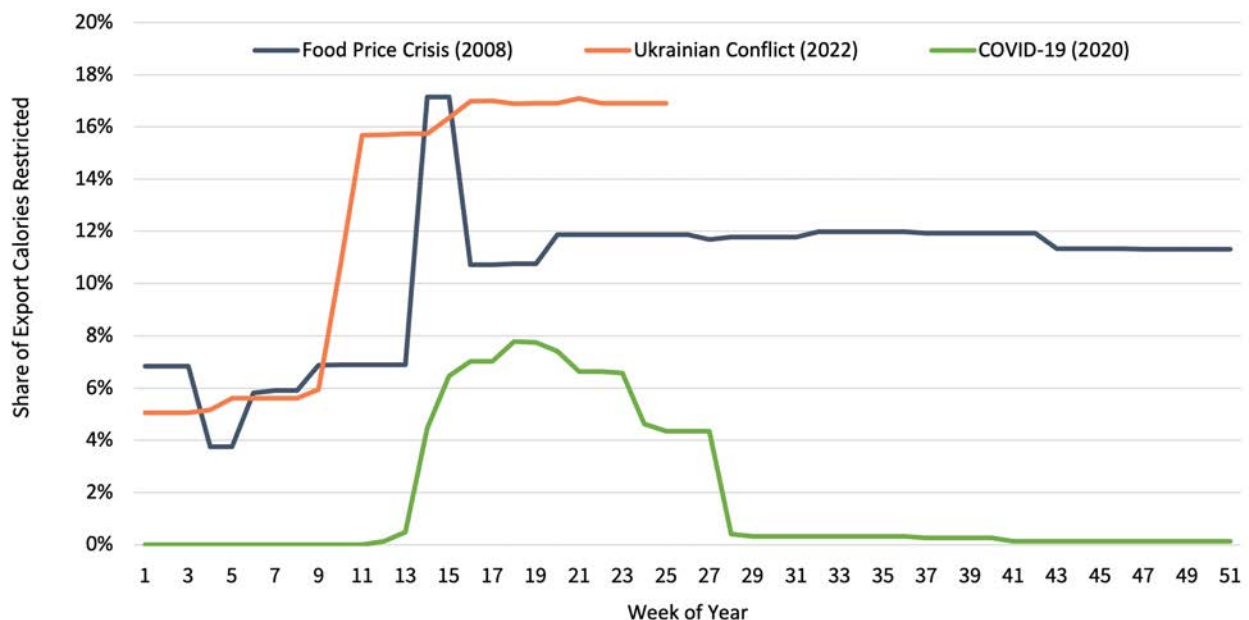
The challenge for the global system is that policy decisions may exacerbate the problem. Some nations, like Indonesia and Argentina, already had export bans in place for specific commodities at the start of 2022 due to rising prices. The war in Europe has led to a rapid expansion of export bans as nations try to mitigate food cost increases, including from important agricultural

exporters like Russia. As of the middle of June, the International Food Policy Research Institute has found that there are 19 nations with active bans on at least 31 commodities, as well as additional export licensing. Almost 17% of all traded agricultural calories were potentially subject to export bans or other restrictions, exacerbating the current food crisis.

Export restrictions can lead to market uncertainty, and in many cases lead to price movements in commodity futures markets. Some of the current restrictions, like those in Russia and India, represent large shares of all export calories and have the most potential to be market moving. Others, like Serbia and Moldova, are less market moving because, while a large share of produced wheat is exported, the total quantities represent a small share of total traded calories. Still, others (like Algeria and Egypt) are typically not wheat exporters and had little-to-no impact on markets.

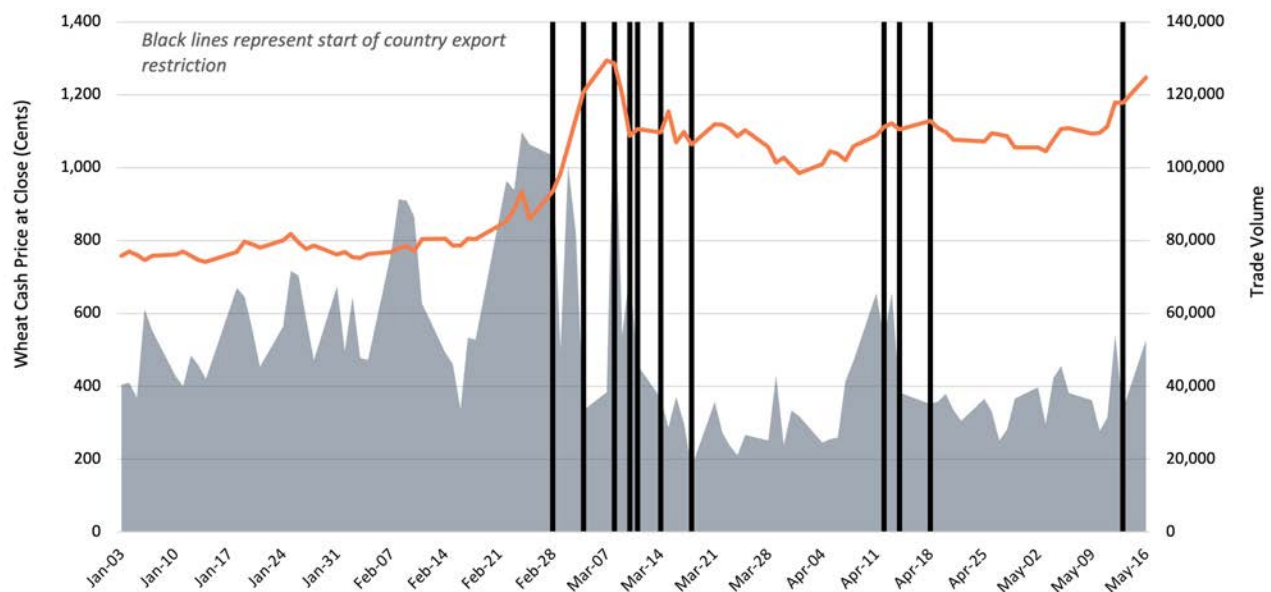
Not all restrictions are created equal. Russia's wheat ban was specifically for the 2021/22 wheat crop, and only applied to other nations in the Eurasian Economic Union (EEU): Armenia,

Figure 1: *The Russia-Ukraine Conflict Has Led to a Record Share of Exported Calories Being at Risk of Restriction*



Source: IFPRI Food & Fertilizer Export Restrictions Tracker

Figure 2: Wheat Prices Have Responded to Some Agricultural Export Restrictions, but Not All



Source: Nasdaq ZW Historical Data, IFPRI Food & Fertilizer Export Restriction Tracker

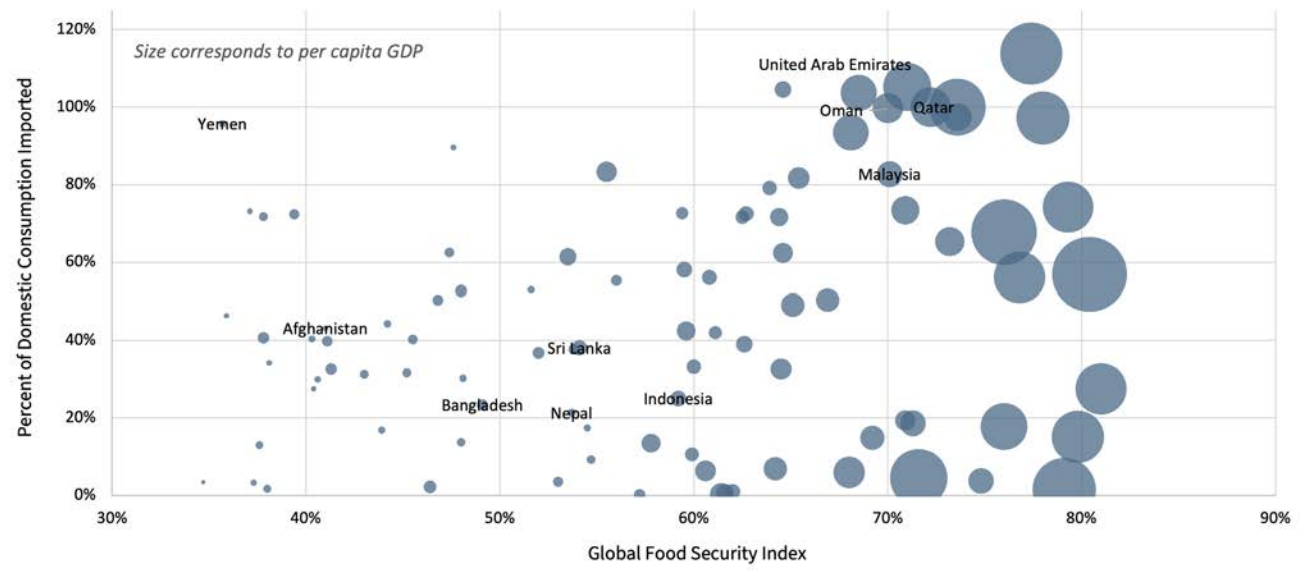
Belarus, Kazakhstan, and Kyrgyzstan. The primary impact was that it created a ripple effect where all other EEU nations banned wheat exports shortly following Russia's decision. While this illustrates the potentially contagious nature of export restrictions, it has had limited impact during the current crisis, and Russian wheat exports to importers like Turkey, Iran, and Egypt have been almost unchanged. This was also true of Russia's 2020 export restrictions, which capped exports well above prior year export values.

However, a second set of restrictions has emerged that has the potential to be more harmful. India's May 13 export ban on wheat had less to do with the Ukrainian conflict, and more to do with rapidly rising domestic prices. Unlike Russia's ban, India's extends into the next crop marketing year, covering a time when a large share of new crop wheat would be exported. Many nations that import wheat from India were already seeing rising food insecurity, including Bangladesh, Sri Lanka, Indonesia, and Yemen. While recent discussions have talked about potential exemptions for food-insecure nations, the uncertainty caused by the announcement has led to even further pressure on prices.

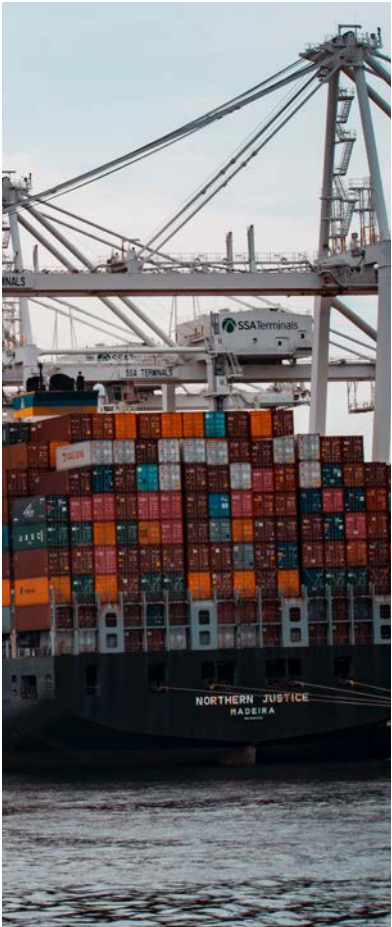
Unequal Impacts

India's ban on the export of wheat offers a case study into the potential unequal impacts of export bans. **Figure 3** on the following page shows the share of cash grains a country imports relative to domestic consumption compared to their overall food security, as measured by The Economist's Global Food Security Index. The named countries represent the top 10 destinations for exported Indian wheat during the 2020/21 crop marketing year. India primarily serves three sets of customers: wealthy nations with limited agricultural production, poorer nations with large agricultural production, and states with intense need. These groups are unlikely to feel the impacts of India's food ban equally, highlighting two aspects of food insecurity: affordability and availability.

Figure 3: Export Restrictions Are Unlikely To Be Felt Equally by Impacted Nations



Source: Economic Impact Global Food Security Index



For the wealthiest nations with minimal agricultural production, access problems can be overcome by incomes. These nations often devote their scarce production resources to higher-value commodities, like animal protein production and specialty commodities, while importing most of their cash grain commodities. Nations like the United Arab Emirates have responded to potential access issues in the past by increasing their imports of cash grains during periods of strain. By consistently importing more food than is typically consumed, these nations ensure important redundancy to avoid access problems.

For the second group of poorer agricultural producers, food is often available but may be less affordable. Throughout the high-price period of 2008, nations like Bangladesh and Indonesia saw very limited impact to the total overall domestic consumption of cash grains. Ending stocks did not necessarily fall, but there was evidence of potential calorie switching in domestic consumers. Nations like Malaysia saw declines in beef consumption during the high price period, despite the negligible change in other consumption. For these nations, export restrictions contributed to a narrowing of domestic food choices, even if cash grains were still available.

For the group of states with intense need, export restrictions are acute challenges that can lead to true availability issues. In Afghanistan and Yemen, high-price years lead to very small or nonexistent ending stocks for major commodities. Stocks-to-use ratios are consistently low, and even lower during years of export restrictions. What is imported is generally eaten, often as a direct good rather than for protein production. When these nations lose access to markets due to export restrictions, there may be no replacement for them on the global stage.

This pattern was evident in 2008 and may be a foundation for the pattern of 2022 as production declines, high prices, and export restrictions roil the global commodity markets. Wealthy nations pay more, middle-income nations cut back on choice, and poor nations are often forced to go without. The threats to the global food system in 2022 are likely to be more severe than any shortage faced since the 1972 grain crisis, and the results may be more severe than any outcome in recent memory. Like so many times before, two things are likely to happen if these threats continue to play out: many major agricultural producers around the world will place restrictions on their exports, and America's farmers and ranchers will do what they can to help meet the need.







THE U.S. – CHINA AGRICULTURAL TRADE RELATIONSHIP

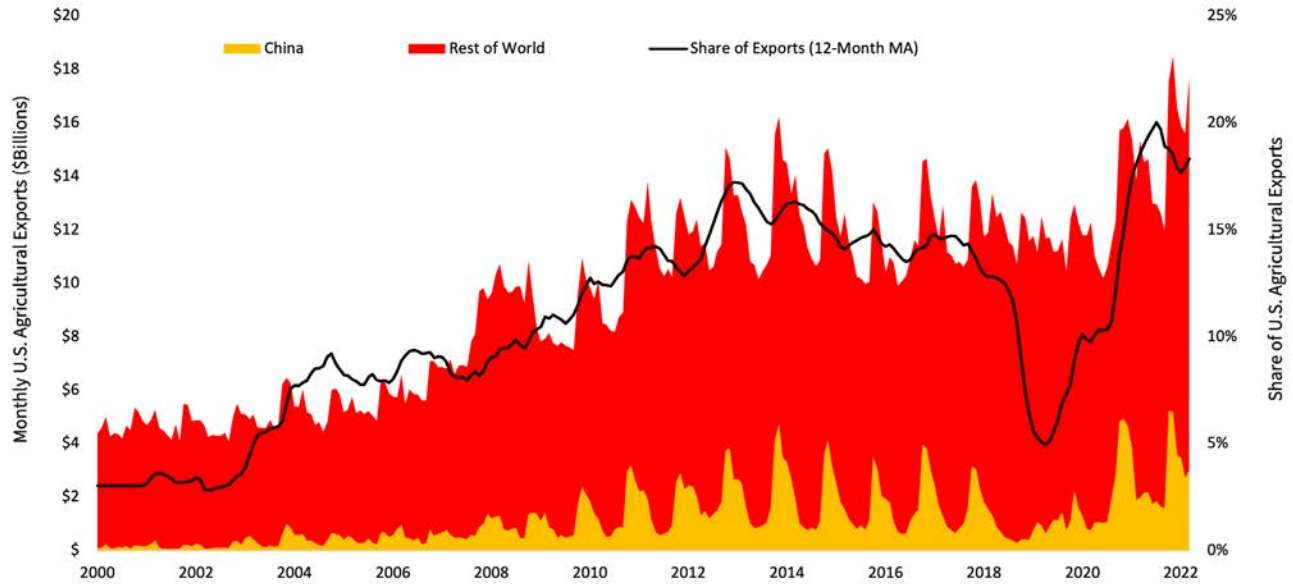
4, 5, 6, 7, 8

China is one of the most important agricultural markets for America's farmers and ranchers. However, there is some evidence that Beijing would prefer to find alternative sources for their agricultural needs. The Chinese government has focused on improving domestic production and promoting new trade partners. While these efforts have not been wholly successful to date, they remain a potential risk for American producers.

In early 2021, China demonstrated why it is one of the United States' most unique agricultural trading partners. Corn production in both Brazil and Ukraine was faltering on dry conditions, and prices were rising. China had historically produced a large amount of the corn it consumed and imported only a small amount from Ukraine as necessary. In late 2020, a poor domestic crop and untenable pork prices for Chinese consumers led to a decision to purchase a massive quantity of feed at any cost. In the last week of January 2021, Chinese companies committed to buy almost 10% of the United States' entire new corn crop, in the single largest one-week sale of corn in U.S. history.

Unlike those of many other trading partners, China's purchases are often highly concentrated. The historic January 2021 purchase was driven by a single company, known as the Chinese National Cereals, Oils, and Foodstuffs Corporation (COFCO). Like many major Chinese agricultural companies, COFCO is a state-owned enterprise, with dual commercial and national security objectives. Chinese agricultural purchases are large and are typically performed by state-owned enterprises like COFCO. This means that decisions often have as much to do with national policy objectives as they do with market forces. The potential for sudden shifts was shown in 2018, when trade conflicts led to Chinese purchases falling from approximately 15% of all U.S. agricultural exports to merely 5%.

Figure 4: *U.S. Exports to China Have Risen Substantially, but the Relationship Is a Volatile One*



Source: USDA FAS Global Agricultural Trade System Database

While the U.S.–China trade relationship improved over the following years, Chinese thought leaders acknowledge two key problems with their agricultural consumption. First, China’s large population means that it is difficult to produce enough food domestically to feed its population, especially to produce those feeds used for protein production. Second, Chinese agricultural imports are highly concentrated. Many goods are imported from just one or two countries, making it difficult to replace those imports in the event of a disruption such as the 2018 trade conflict. Specifically, China imports almost a third of its agricultural products from North America and, in an era of rising tensions with the United States, that reliance is perceived by some in Beijing as a potential risk.

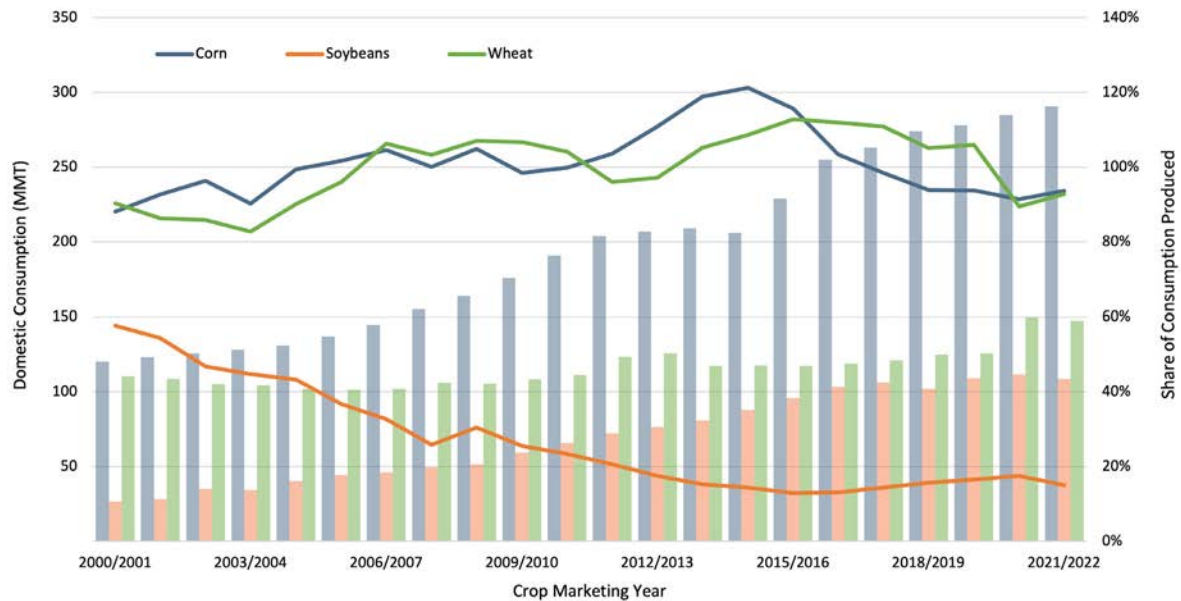
This is in part why China often talks about food through a national and food security lens. China’s most recent 5-year plan, which was enacted in 2021, includes aims to “promote the diversification of import sources, and cultivate large international grain merchants.” Their 2022 Agricultural Outlook Conference was titled “promoting stable supply,” with aims to grow

88% of all grain consumed in China by 2031. While these goals do not expressly mention the United States, their apparent goal is to reduce China’s reliance on U.S. commodities should the need arise.

Domestic Growth

China’s goal to grow most of its own grain is challenged by the rapid improvement in living conditions in the country. While China has almost tripled the amount of corn it grows domestically since 2000 (due largely to increased acreage), domestic consumption has risen almost as much. This is driven by large increases in domestic meat consumption: per-capita pork, beef, and poultry consumption in China had all risen at least 50% between the start of the African Swine Fever outbreak in 2018 and 2000. However, Chinese per-capita consumption is already approaching nearby nations with much higher per-capita GDPs like South Korea. This suggests that Chinese demand for proteins could slow, something that would help China reach its goal of fulfilling its own feed needs.

Figure 5: China's Reliance on Agricultural Imports Has Not Declined Despite Large Production Increases



Source: USDA PSD Database, USDA FAS GATS Database



However, China may struggle to grow additional feed even if protein consumption growth slows. China has only 75% of the arable land that the United States does, yet has a population almost four times larger. This has been exacerbated by decades of internal migration and urbanization that have led to a large amount of farmland being converted to nonagricultural purposes: One study from 2021 found that the total amount of farmland in China declined 6% between 2009 and 2019. Chinese production has also been hampered by persistently slow yield growth.

There have been many hypotheses why Chinese yield growth has lagged other nations; slow approval processes for genetically modified seed, soil erosion, fertilizer use restrictions, poor domestic seed availability, and other institutional and environmental factors are all possible culprits. What remains true is that more than a decade after corn yields became a top concern for the Ministry of Agriculture, yield growth has slowed even further. The combination of both declining acres and slow yield growth means that China may have extreme difficulty meeting its production goals even if protein consumption slows in the coming years.

Diversification of Imports

China's other aim is to reshape global patterns of trade to influence how agricultural products flow. The largest of these is the Belt and Road Initiative, which aims to create a series of land and maritime transit routes between China and the European, African, and Asian continents. Members of the Chinese Ministry of Commerce have indicated that these investments are designed specifically to counter established trade routes with North America. This is evidenced by the relatively low share of foreign direct investment in North American agricultural investment: while China imported almost a third of its agricultural products from the U.S. in 2014, outward investment in North America represented just 2% of China's total agricultural investments.

China's efforts have seen mixed results. On the negative side, many investments fail to produce the designed returns and are abandoned: Heavy financial and technological investment in countries like Cambodia do not appear to have materially influenced Cambodian agricultural production or exports to China. And the purchase of Smithfield Foods in the U.S. did not lead to a greater amount of pork being exported to China

within the first years after its purchase. Yet other areas have seen success; Chinese investments in Brazil have coincided with declining transportation costs between Mato Grosso and Shanghai. This led to a historic change in 2021, when it became cheaper to ship soybeans from Brazil to China than from the U.S. However, as Chinese incomes rise and China imports more consumer-oriented goods like dairy and tree nuts, it has found itself importing even more goods from the U.S. and its allies.

Even if Beijing's preference is to reduce its reliance on American agricultural products, that doesn't mean the inevitable end of U.S.–China agricultural trade. Between the 1950s and 1980s, Japan exhibited many of the same characteristics of modern China: investment in foreign agribusiness, attempts to diversify agricultural imports, acquisition of U.S. farmland, and other similar features. However, the U.S.–Japanese agricultural relationship remained strong. Japan imported its second-highest value of U.S. agricultural products in 2021 since the USDA began collecting that data in 1996. The rise of great power competition may strain the U.S.–China trade relationship, but not every path ends in a fracturing of this important outlet for American farmers and ranchers.



U.S. ENERGY RESPONSE TO GLOBAL DISRUPTION

9, 10, 11, 12

Tight oil and natural gas supplies drove higher energy prices in early 2022 and will likely continue to keep prices high throughout 2022. There is no single solution to this disequilibrium, and even a resolution to the Russia-Ukraine conflict would take time to impact global energy markets. There could be some relief in mid-to-late 2023 as additional U.S. production comes online and helps increase supply.



You don't have to look hard to find evidence that energy markets are in disequilibrium. West Texas Intermediate oil prices touched 14-year highs in June 2022; retail gasoline prices set new nominal records in June 2022; average U.S. natural gas prices reached a 14-year high in May 2022; and coal prices hit a 35-year high in December 2021. This phenomenon isn't limited to North America—in March 2022, the International Monetary Fund's global energy price index set a new nominal record, a function of elevated energy prices in nearly all geographies and across all categories. The fact that current energy prices have yet to surpass 2008 inflation-adjusted peaks is of little consolation to the consumers and industries grappling with higher input costs at every turn. Farmers, food producers,

and rural energy providers are sensitive to these markets, but unfortunately, they have little influence over the cause and response to the current global energy disconnection.

Cause

The current energy market situation is a function of several coincident factors. The COVID-19 pandemic all but halted global economic activity in March and April of 2020. This sudden slowdown created a chain reaction that led to a dramatic oversupply of oil; in April of 2020 oil futures prices went negative, since there was effectively no place left to store oil coming out of the ground. As seen in **Figure 6**, oil producers responded by capping wells and shutting off production, causing the number of active oil and gas rigs to plummet. As the economy started to spin back up, demand for oil and gas increased but producers hesitated to redeploy capital into new wells and resource discovery. Earnings for the top three oil production companies in the U.S. set historical records in 2021, but cash flow for capital investment was near 15-year lows and cash flows

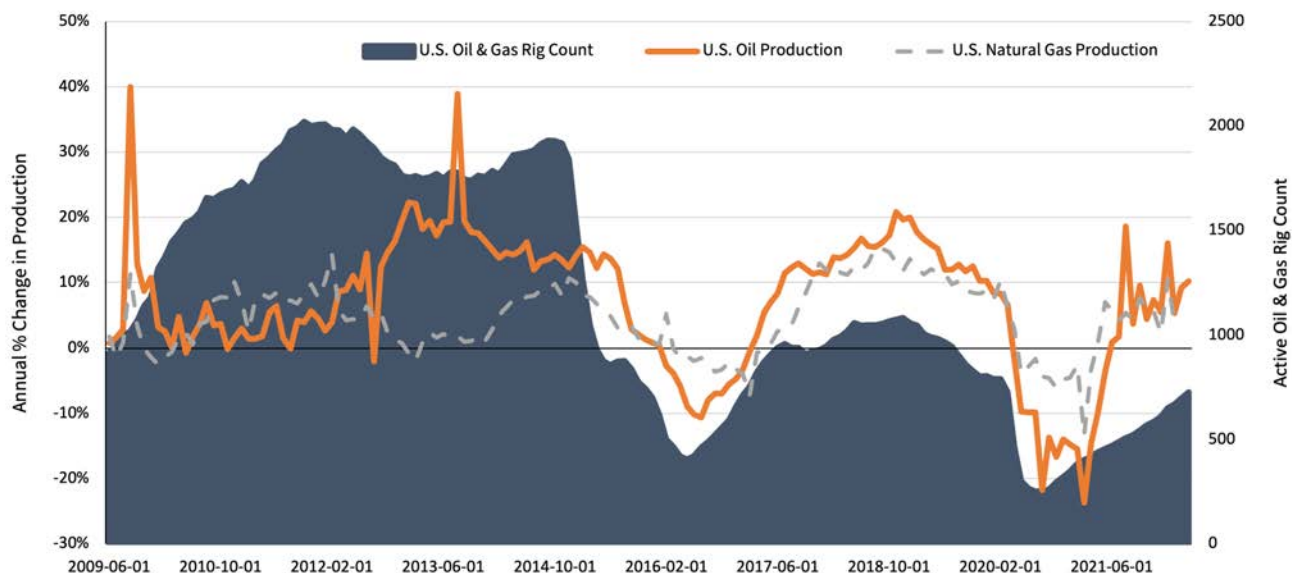
to investors in the form of stock buybacks and dividends set a new 15-year high. Meanwhile, oil producers returned capital to investors rather than invest in new production.

In the March 2022 Federal Reserve Bank of Dallas energy production survey, 59% of executives of publicly-traded oil companies cited investor pressure as the primary reason producers were not ramping up production faster. In that same survey, respondents cited labor shortages and supply chain snarls as additional headwinds to production. Finally, the global response to the Russian invasion of Ukraine included many sanctions and embargos on Russian oil, which exacerbated the global supply shortage.

The Path Forward

As with most complex problems, there is no easy fix to the current global energy situation. Even if there were a swift resolution to the Russia-Ukraine conflict, international energy trade is already being rerouted, with European nations looking for new sources of oil and gas. Meanwhile, U.S. energy

Figure 6: U.S. Oil Production Starting to Ramp Up but Will Take Time To Rebuild Supply



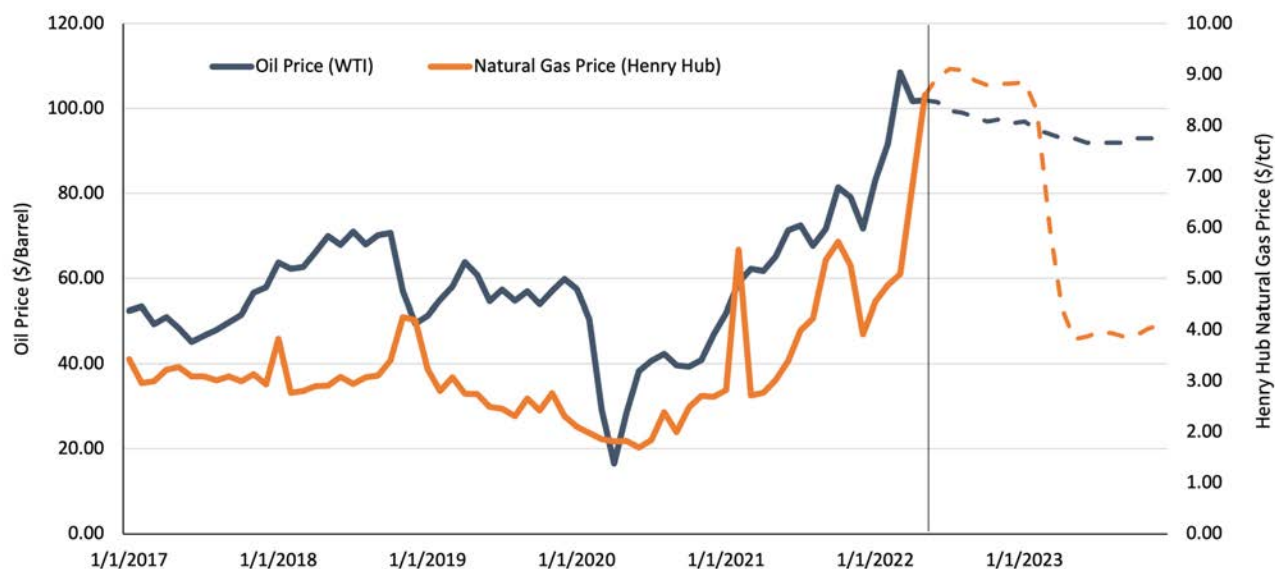
Source: Baker Hughes; U.S. EIA; U.S. DOE

infrastructure is aging rapidly, and new oil and gas discovery projects face an uphill battle given that many investors are rotating out of fossil fuel investment and into renewable energy projects. While renewable energy is certainly a big part of the future, there are logical constraints on how much and how fast that capacity can come online. Solar, wind, and biomass-generated power should continue to decrease in cost relative to fossil fuel-based production, but the supply chain, parts, and labor necessary to complete the massive electric transformation may be stretched thin in the coming years. In the meantime, electric vehicles will likely continue to gain in popularity in the U.S., but may continue to be limited by the availability of battery minerals and charging infrastructure.

Low supplies with limited substitutes are likely to keep energy prices high for the near and intermediate terms. The U.S. Energy Information Administration forecasts elevated oil and natural gas prices for the remainder of 2022 and into early 2023. Their forecasts call for increases in production to take hold in mid-2023, and natural gas prices may fall faster than oil if supply can

rebound more quickly. Electricity producers have few gas-to-coal plant switching opportunities, and Bloomberg New Energy Finance projects that solar and wind generation capacity in the U.S. will increase between 30 and 40 gigawatts in each of the next two years, a sizable increase—but only roughly 5% of total U.S. electricity generation capacity. Until domestic and global supplies stabilize, energy production will likely take an “any-and-all” approach with additional supply from fossil fuels and renewables. Finally, these forecasts indicate continued pressure on fertilizer and fuel costs for producers into 2023, although the rate of increase is likely to moderate later in the year.

Figure 7: Monthly Average Energy Prices Expected to Remain Elevated into 2023



Source: U.S. EIA Short-Term Energy Outlook, May 2022





GLOBAL FOOD PRICES AND EXPORT RISKS

13, 14, 15, 16, 17, 18

Agricultural exports have been a major cause of the current robust price environment. However, food cost increases and a rising dollar threaten to create headwinds for U.S. producers. How much of a headwind producers will face depends on what commodities and what markets they sell to.

Agricultural exports are a primary reason why the U.S. farm economy is in the robust shape it is today. In an era of global production challenges and geopolitical uncertainty, American production is essential for myriad countries across the globe. The United States is a critical supplier of agricultural commodities to the Americas, the Middle East, Asia, and the Central African coast. In other regions, like India and the European Union, the United States fills important niche roles through its production of consumer-oriented foods like fruits, nuts, and vegetables.

The diverse nature of America's partners means that American products are sold to a

broad set of consumers. Dairy exemplifies the heterogeneous nature of America's export partners. For example, the largest dairy export partner in 2021, Mexico, predominantly imported non-fat dry milk (though they see this as an inferior good that they hope to replace with liquid milk). Canada, our second-largest partner, imported higher-value consumer products, like infant formula, whey protein drinks, and other consumer-oriented products. And our third largest partner, China, imported whey protein powders used as feed for piglets. It is important to note that the varied nature of these countries' use of American dairy products also implies that they will respond differently to rising prices.

Food Costs

While prices have already been increasing over the last two years, the Russia-Ukraine conflict has led to an acceleration in global food prices. In addition to the direct impacts of the conflict on Ukrainian production, it has also led to an increase in global fertilizer costs and inflamed the shipping constraints that have already plagued the sector. As nations begin to worry about their ability to feed their populations, many have begun enacting restrictions on the export of agricultural inputs and commodities. Some major grain exporting countries, like India, have announced a ban on exports to control inflationary pressures. At the same time, Southeast Asia and parts of Europe are experiencing a renewed outbreak of African Swine Fever, widening the global protein deficit.

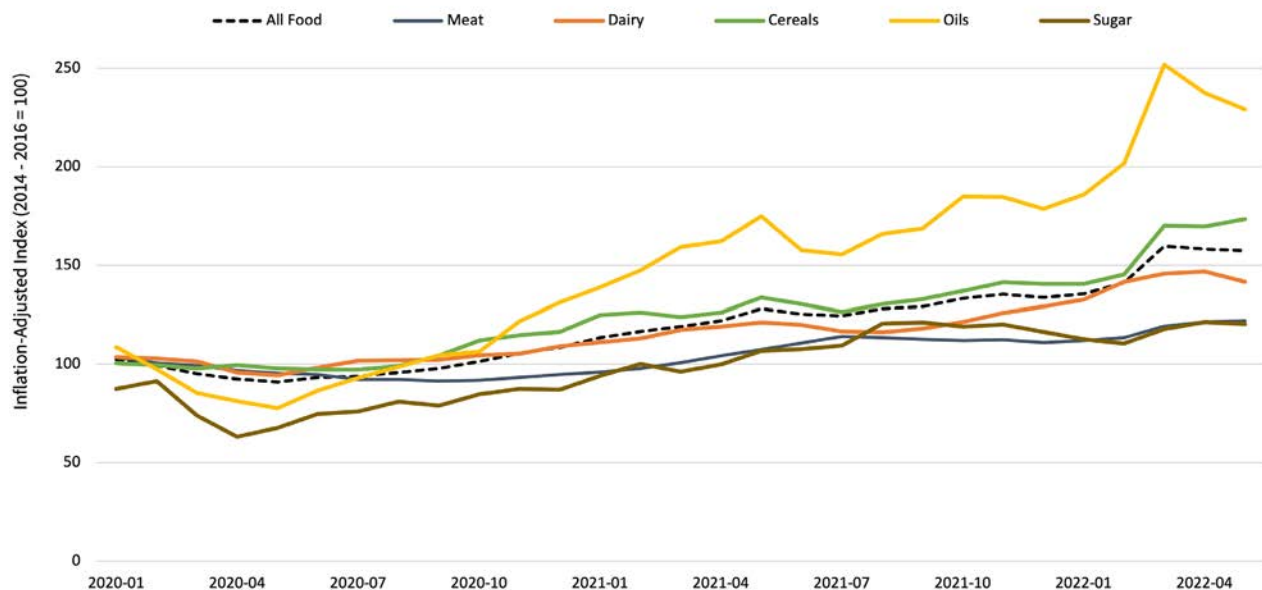
These factors have contributed to the explosion in global food costs—but there is some potential upside for U.S. producers. The U.S. is uniquely positioned to make up for some global deficits, which is partially why the USDA's Economic Research Service has projected that U.S.

agricultural exports will reach a record \$191 billion in the 2022 fiscal year. The key obstacle to this record export value may be cost. **Figure 8** shows the Food and Agriculture Organization's global price index for various agricultural commodities. The current crises have put global food prices at all-time real highs (i.e., adjusted for inflation), eclipsing the 1970s wheat crisis. Complicating these cost increases are the rising U.S. dollar and threats to global growth. Both prices and exchange rates have the potential to reduce global demand, and both factors will be felt differently depending on what commodities and partners are involved.

Exchange Rates

Since the outbreak of the Russia-Ukraine conflict, the U.S. dollar index has seen consistent growth, and as global growth expectations sputter, investors have flocked to the relative safety of the dollar. However, specifics matter in how exchange rates influence agricultural imports. The primary difference relates to whether a currency is devaluing against the dollar specifically, or whether it is losing ground to many currencies at once.

Figure 8: *The Global Cost of Food Has Reached All-Time Highs*



Source: Food and Agriculture Organization of the United Nations Food Price Index

The U.S.-Japanese trade relationship has given us examples of both types of devaluation over the last decade. Japan imports a substantial amount of products from Oceanic countries like New Zealand and Australia. Over the last year, the Japanese yen fell against the currencies of both the U.S. dollar and Oceanic currencies, meaning that Japan could not replace more expensive U.S. products with relatively cheaper products from New Zealand or Australia. On the other hand, the U.S. dollar strengthened against both the yen and the Australian dollar between 2013 and 2014. This relative advantage was one of the drivers of the 2014 Japan-Australia Economic Partnership Agreement which, along with the relative cost of U.S. beef, led to the decline of almost a fifth of U.S. beef exports to Japan during this period.

Global Growth

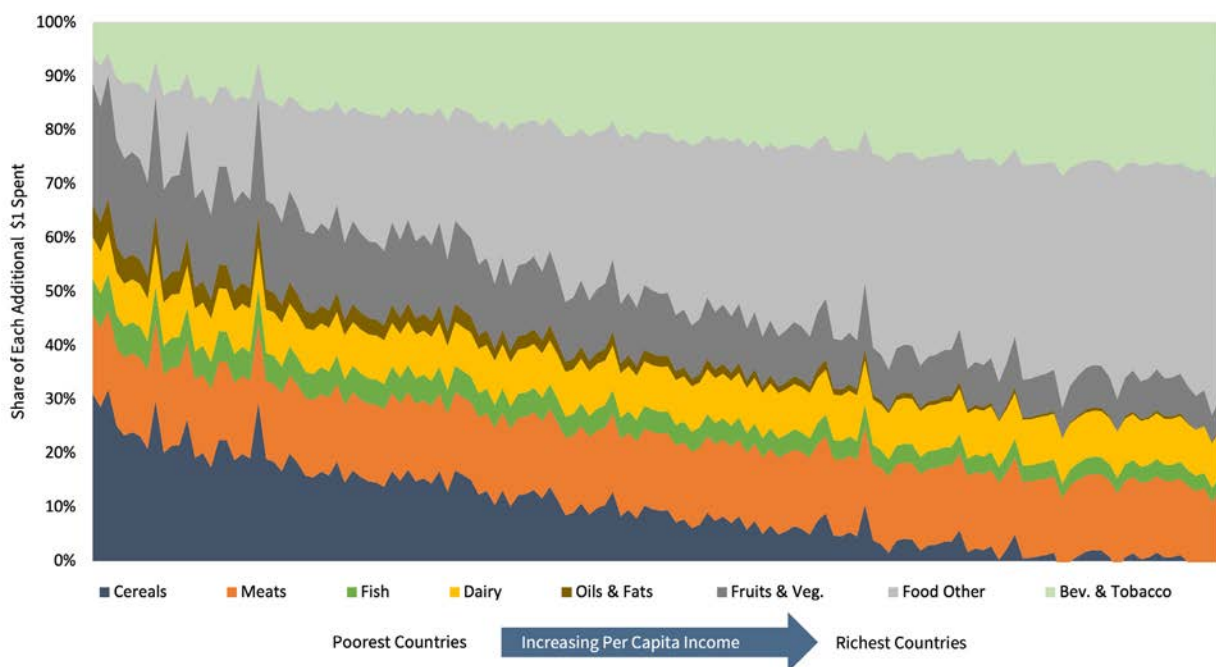
In its April forecasts for global growth, the International Monetary Fund (IMF) reduced its growth expectations for 2022 from 4.4% to 3.6%. While the IMF projections decreased emerging market growth by far more than advanced economy growth, this was driven by large forecast

declines in the Russian economy. Of the U.S.'s top agricultural export destinations, Canada, China, and ASEAN nations saw smaller declines, while Japan, Europe, and Mexico saw larger ones.

Changes in growth expectations will likely not impact all nations equally. **Figure 9** shows how each country spends an additional dollar on food, sorted by per capita income. The wealthiest nations spend upwards of 70% of an additional dollar on beverages, food away from home, and high-end consumer-oriented goods like cheese and beef. On the other hand, the poorest nations spend the plurality of an extra dollar on grains. During times of strain, individuals in emerging economies might conserve calories by spending a greater share of their food budget on grains and less on proteins, while individuals in wealthier nations have more slack.

As we wrote in the spring 2022 issue of *The Feed*, American consumers often don't change their food buying habits in response to price changes; rising prices (or falling incomes) have a muted impact on total consumption in wealthy nations. This is less true in the developing world, where rising costs or falling incomes can have a much

Figure 9: How Consumers Spend an Additional Dollar on Food Depends on Their Incomes



Source: USDA ERS, International Food Consumption Patterns

more significant impact. For example, one 2014 USDA study found that in India, a 10% rise in the price of beef was associated with a roughly 5% decline in total consumption, compared to only a 1.5% decline for U.S. consumers. In other words, while wealthy economies may see a negligible impact on imports because of rising costs, developing nations are more likely to change consumption patterns for most commodities. That said, consumers in low-income countries will still have inelastic demand for staple goods like rice or wheat, continuing to stock up on those important calorie sources.

American exports are likely to be a critical source of support for many countries this year. The rising dollar and slowing growth will be headwinds,

but context matters. Slower growth and weaker currencies might not have a significant impact on agricultural consumption in advanced economies, but those wealthier nations could seek alternative sources if exchange rates create an opportunity. Meanwhile, developing economies are more likely to respond to slow growth or weak currencies, although proteins and consumer-oriented goods are more at risk than staple goods. Knowing the products and players for each partnership can help explain the potential risks of a given relationship. Exports are likely to remain a critical source of support for America's farmers and ranchers, but understanding the dynamics of global trade can help some of the headwinds we are likely to see in the coming years.



ANIMALS HAVE PANDEMICS, TOO

19, 20, 21

Animal protein producers regularly grapple with pathogens. African Swine Fever and Highly Pathogenic Avian Influenza are circulating in herds and flocks around the globe. These diseases can cause significant supply disruptions and are keeping hog, pork, poultry, and egg prices high.

Pathogens and disruptive diseases are not exclusive to the human experience. While humans around the world are experiencing a frustrating combination of COVID-19 whiplash and fatigue, our animal protein sectors are experiencing a similar phenomenon. This year, two diseases challenged the world's protein producers: African Swine Fever (ASF) and Highly Pathogenic Avian Influenza (HPAI). Beyond devastating the herds and flocks in which there is an outbreak, these diseases can cause many complicated downstream effects that ripple through the ag and food supply chains for years. As is the case with human pathogens, prevention and containment are the best tools to handle these diseases.

African Swine Fever

Followers of hog and pork markets remember quite vividly the ASF outbreak in China in 2018 and 2019. Between 2018 and 2020, analysts estimate that the Chinese hog industry lost nearly half its hog herd and the USDA estimates that Chinese pork production fell by 33%. The steep decline in hogs caused a pork shortage and subsequent

price spike, creating scarcity and driving consumer inflation. Chinese importers subsequently turned to the U.S. for pork in 2019 and 2020, which also drove up pork prices in the U.S. Meanwhile, soy exports to China dropped severely in 2019 and 2020, as there were fewer animals to feed soymeal. While Chinese hog producers have now recovered much of their herds, the whiplash from 2019 and 2020 was severe enough to disrupt trade flows and local market conditions in the U.S. and Brazil.

Unfortunately, while ASF has calmed in China, it is still spreading in Europe and in other Asian countries. Between January 2020 and May 2022, more than 1.8 million pigs have perished from either the disease or disposal for containment, 75% of them in European countries. Fortunately, there has yet to be a case in the U.S. or its territories—and with the proper prevention and containment, it could stay that way. Should a case arise in the U.S., trade restrictions, quarantines, and disposals would put additional upward pressure on global food prices and even more on domestic food price inflation. Global pork supplies will likely stay tight for the near term, even without a single case in the U.S.



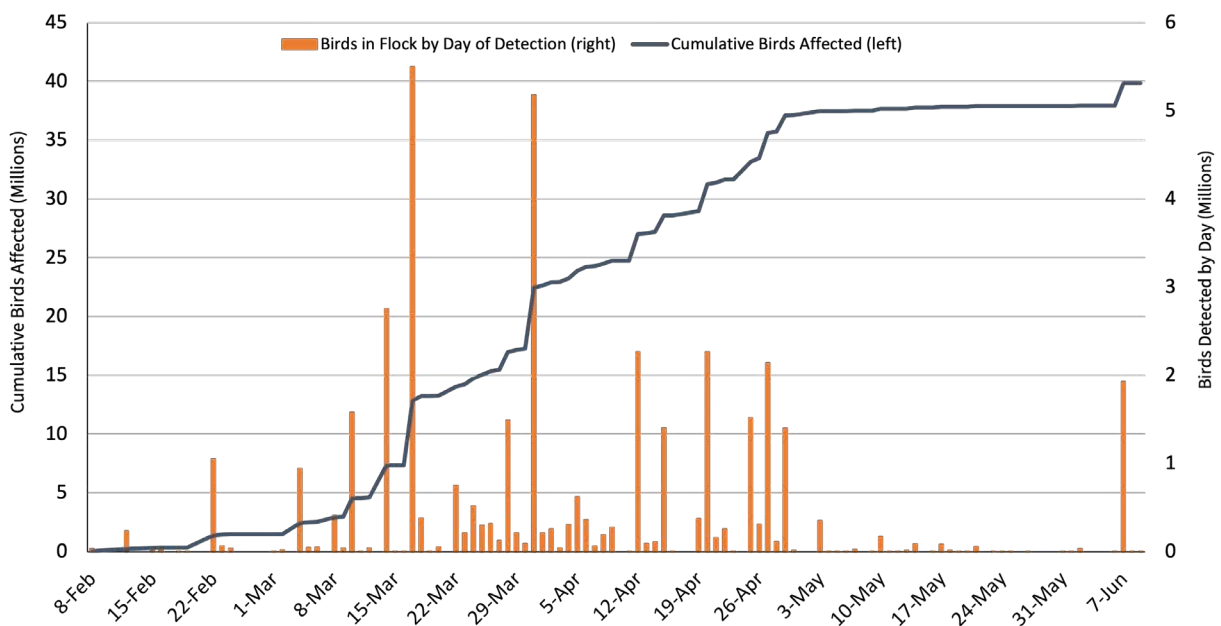
Highly Pathogenic Avian Influenza

HPAI is another disease that can create supply-side challenges for producers. This flu can affect many types of birds, including wild birds, chickens, turkeys, ducks, geese, and others. HPAI is highly infectious and generally fatal for chickens, and it spreads typically from flock to flock via wild birds' migration patterns in the spring and early summer months. It can also spread to humans, so large outbreaks are monitored closely, with a high percentage of infected flocks disposed of to prevent spread. In 2014 and 2015, the U.S. experienced the largest outbreak of HPAI in its history, resulting in the destruction of more than 48 million commercial, backyard, and wild birds.

In February 2022, a commercial turkey farm reported the first case of HPAI in the U.S. this year. Since then, more than 40 million birds have been affected by the 2022 outbreak, as shown in **Figure 10**.

Similar to ASF, outbreaks of HPAI are generally met with import restrictions, supply disruptions, and typically higher prices. Over 75% of the birds affected by the current HPAI epidemic are egg layers, breeders, or pullets, and the disruption to egg production may be responsible for much of the 62% increase in U.S. retail egg prices in the first half of 2022. Through mid-June, retail egg prices in the 2022 outbreak had yet to reach the peaks of the 2015 outbreak, but they could continue to rise during the second half of the year.

Figure 10: The Number of U.S. Birds in Flocks Affected by HPAI



Source: USDA APHIS 2022 HPAI Outbreak Data

DROUGHT SUBSIDES, BUT DRY SUMMER LIKELY

22, 23, 24, 25, 26

While national water conditions have improved, many areas in the Southwest are still experiencing severe drought, and are likely to experience those conditions through the summer. Legal cases have so far had a limited impact on producer water availability, but both the frequency and intensity of these cases have increased over the past few years.

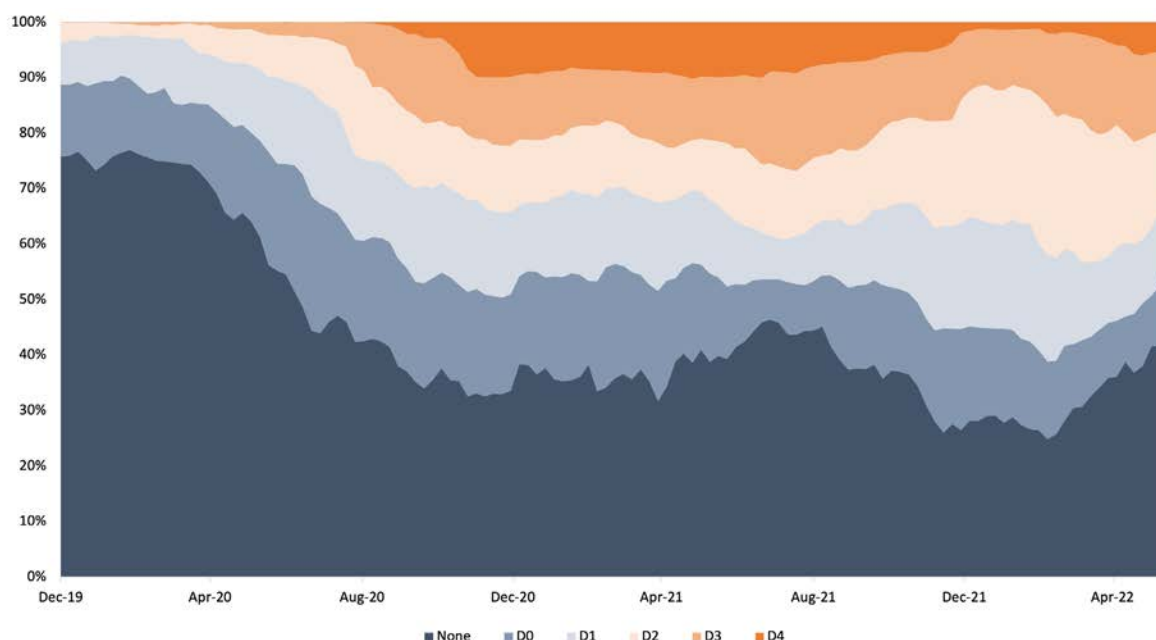
In late April, drought conditions across the West Coast were becoming ubiquitous. More land was in some stage of dryness or drought than at any point since 2012. These conditions were concentrated along the West Coast, Mountain States, and Plains states. National pasture, winter wheat, and sorghum conditions were at historic lows. National conditions have seen modest improvements since. **Figure 11** shows national drought conditions through the middle of June. The sweeping drought covering much of the country has given way to smaller but more severe pockets of extreme drought in parts of Texas, New Mexico, and California.

The U.S. has had many cycles of dry weather in the past. Both the 2002 and 2012 droughts led to significant impacts on U.S. production. What is unique about the current period is both the duration

and severity of that dryness. Of the 100 weeks with the most severe drought since 2000, 42 were in 2021. June 2022 marked a year and a half with at least 10% of the country experiencing at least category D3 extreme drought, the longest period since 2000. While many producers will experience no water access challenges in 2022, those who do have experienced both longer periods and more severe periods of drought than many recent droughts.

One of the contributing factors to this period of dryness is the current La Niña weather event. The national Climate Prediction Center's June forecast found that there was a 52% chance that the event would persist through the summer and an even greater chance of it persisting through the winter. While La Niña events typically last less than 12 months, the current pattern has already persisted

Figure 11: Water Conditions Have Improved Since April, but Are Still Dry by Historic Averages



Source: University of Nebraska-Lincoln Drought Monitor

for 20 months. The extreme drought currently seen in Texas and the Southwest is the exact pattern of dryness expected from a La Niña event, and its persistence through the summer could signal difficult growing conditions for producers in those regions.

Compounding these problems are rising challenges for both surface and subsurface water availability for producers across the country. While California producers have experienced restrictions for years due to the Sustainable Groundwater Management Act, water access is likely to become a greater challenge for producers across the country. One study from the U.S. Geological Survey found that the Ogallala aquifer, which supplies water to eight Plains states, has seen water levels fall by as much as 150 feet since the aquifer was first tapped in 1950. Those declines have continued in recent years, with entities like the High Plains Water District in Northern Texas finding a decline of 0.63 feet between 2021 and 2022.

These declines are likely to lead to restrictions for producers across the country in the coming years. In Nebraska, the state government invoked an interstate compact that allowed them to divert water from eastern Colorado in a plan that cost

approximately half a billion dollars. In southern Georgia, a Florida legal challenge could have put water usage restrictions to ensure that sufficient water flowed downstream. And although that case was won in Georgia's favor, downstream water rights have also been the subject of Supreme Court lawsuits in just the last decade between Montana and Wyoming, Texas and New Mexico, and Kansas and Nebraska. The increasing frequency of these cases poses additional risks to producers who may become subject to water restrictions resulting from select decisions.

For now, the worst of the 2022 drought is over for many regions. Select pockets of drought remain in the Southwest and Texas, and those regions are likely to see continued water shortages due to the persistent La Niña pattern. That same pattern has helped and should continue to alleviate water shortages in the Northern Plains. Midwest producers are likely to see wetter conditions at the end of the growing season. But producers, especially those in the Southwest and Plains, should be cognizant of potential water restrictions coming out of court cases in the coming years.

GRAIN AND OILSEEDS PRICES FIRM AMID FEARS OF GLOBAL SHORTAGES

27, 28, 29, 30

Ukrainian wheat and corn supply shocks are keeping global grain commodity prices at elevated levels. Soybean supplies look to be ample in 2022, but elevated demand from biofuels may help absorb the extra supply and keep prices elevated for soybeans as well. Production prices are the biggest threat to grain and oilseed producer profits as 2023 starts to become a distant focus.

While consumers around the globe are battling inflation on almost every front, food price inflation presents perhaps the biggest threat to both emerging and advanced economies. The United Nations Food and Agriculture Organization Food Price Index has increased by nearly 70% since the COVID-19 pandemic, the second-fastest rise in food prices in the last 30 years. A big part of that rise is an increase in commodity prices, particularly for wheat, corn, and soybeans. The principles of economics explain much of these gains in price, but farmers (and their lenders) are experiencing higher input prices that

offset the gains in price. Luckily, the balance of these forces remains optimistic for 2022.

Supply

Wheat and corn markets got a bit of a jolt in early 2022 from a drop in expected global supplies. The war in Ukraine broke out during winter wheat dormancy and ahead of the spring planting season for corn and spring wheat. While the world may not know the full impact on Ukrainian corn and wheat production until the fall, damage and



disruption to their agricultural infrastructure has been enough to erode expectations since March 2022. In May 2022, the USDA forecast declines of 34% and 53% in 2022 for Ukrainian wheat and corn production, respectively. While Ukraine ranks only tenth in the world in wheat production and ninth in corn production, they are a prominent exporter of those commodities—in 2021, Ukrainian producers exported 79% of their corn crop and 66% of their wheat crop. In addition to these threats to production posed by the Ukrainian conflict, strained shipping lanes are creating stress on food supply chains in much of Africa and parts of Asia, pushing up food prices and creating a humanitarian food security crisis in many poorer countries.

U.S. production faced some early concerns due to a cool, wet start to spring, but producers bounced back in May and June. Planting progress for both corn and soybeans started the season at the worst (or nearly the worst) in 42 years. However, as **Figure 12** highlights, better weather in May and June allowed growers to catch up quickly. Winter wheat conditions remain bearish, with reported crop conditions at their lowest levels since 2014 and the spring wheat plant approximately two weeks behind normal levels. Finally, soybeans have the best prospect of rebuilding global supplies this year, with very large crops already from Brazil and expected from the U.S. in the fall.

Demand

Despite higher prices, demand for grains and oilseeds has kept pace. With the production declines in Ukraine, the world will rely more on other producing regions, like the U.S., Europe, Australia, and even Russia to feed

their populations. High fuel costs have helped ethanol producers stay profitable in rising corn prices. Soybean exports remain stalwart, but an expected increase of 20% in soybean oil usage for biofuels and renewable diesel helps boost domestic demand for beans. Rising prices for animal proteins like pork, dairy, poultry, and beef also help support higher feed prices. Overall, demand fundamentals are healthy even in a high-price environment.

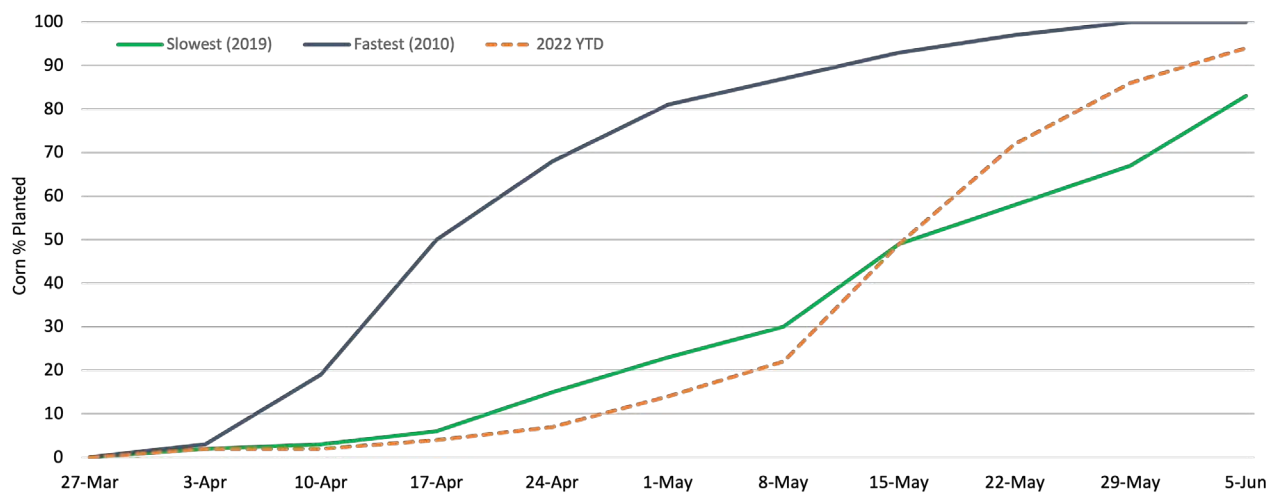
Risks Ahead

The most significant risk for farmers for the remainder of this year and into next is the rising price of practically everything. Input prices for seed, fertilizer, and chemicals are up sharply in 2022. While fertilizer prices could pause for the short term, they are unlikely to retreat, given high energy prices and trade disruptions from Russia. Combined with land costs and rising rental rates, the cost to plant an acre of corn, wheat, or soybeans will almost certainly increase in 2023. Lenders may see additional credit drawn to help with capital costs, but they too have higher input costs with rising interest rates. Growers and their lenders should start preparing for 2023 and 2024, when commodity prices might ease—but input costs may be slower to respond.

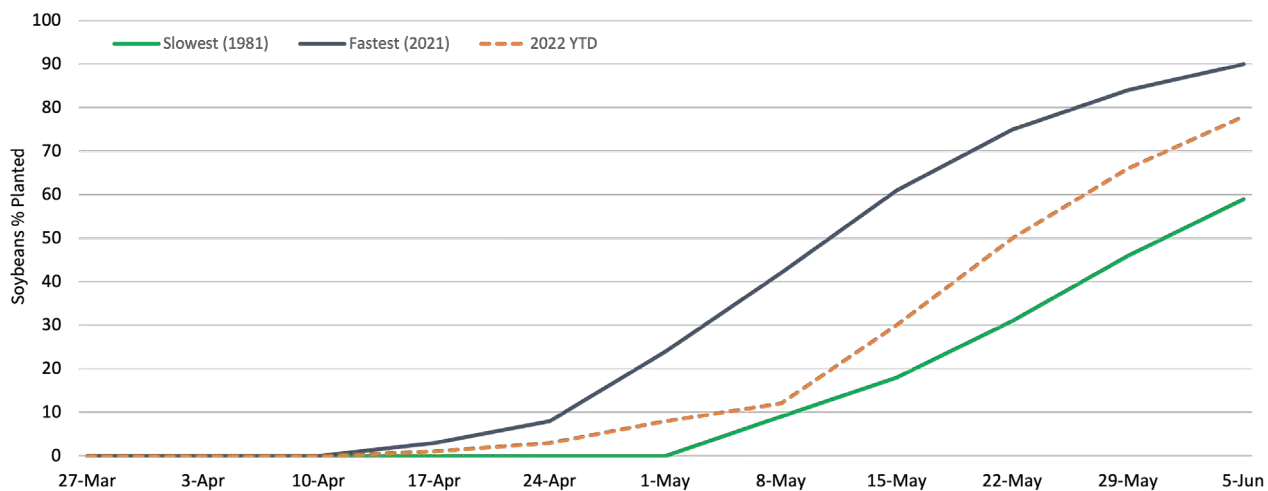


Figure 12: U.S. Corn and Soybean Planting Pace Caught in May and June After Tepid Start

Corn Plant Progress



Soybean Plant Progress



Source: USDA NASS Quick Stats



ALFALFA AND OTHER HAY PRICES RISE ON LOWER DOMESTIC SUPPLY

31, 32, 33

Hay and alfalfa prices have risen sharply in the last year, as U.S. drought conditions led to both lower production and increased demand for feed. Hot export markets and strong livestock prices are likely to lead to continued strength for the sector over the near term.

Like many other commodities, alfalfa hay and other hay prices have seen considerable price increases over the last two years. Between April 2021 and 2022, average prices for alfalfa increased by 31%. Hay prices had seen double-digit growth the year prior. **Figure 13** shows bids across the country for various quality alfalfa between the middle of 2020 and mid-June 2022. Almost every class of alfalfa has seen almost a \$100 increase in price per ton over that period. While this is good news for hay producers, it can be a source of strain for the livestock producers who rely on them for feed.

There are several causes for this rapid increase, both foreign and domestic. The most important has been the drought conditions. The severe droughts of 2021 were uniquely centered on critical hay-growing states like California, Texas, Idaho, Montana, and Colorado, and

total production for alfalfa and other hay fell to its lowest level since 2012. At the same time, drought led to pasture conditions that were near historic lows. Through the first half of 2022, pasture conditions remain at their worst point in five years, further increasing demand for feed as livestock producers seek to make up for poor pasture conditions. States that experienced drought conditions first in 2021, like California, were also the first to see increases in local bid prices for hay and alfalfa.

The second cause of the price boom was growth in export demand. In 2021, more than half of the 2.8 million metric tons of alfalfa the U.S. exported went to a single customer: China. While China has imported a considerable amount of alfalfa from the U.S. in the past, this new demand is the result of rapid increases in domestic Chinese dairy herd size. In 2017, one USDA estimate

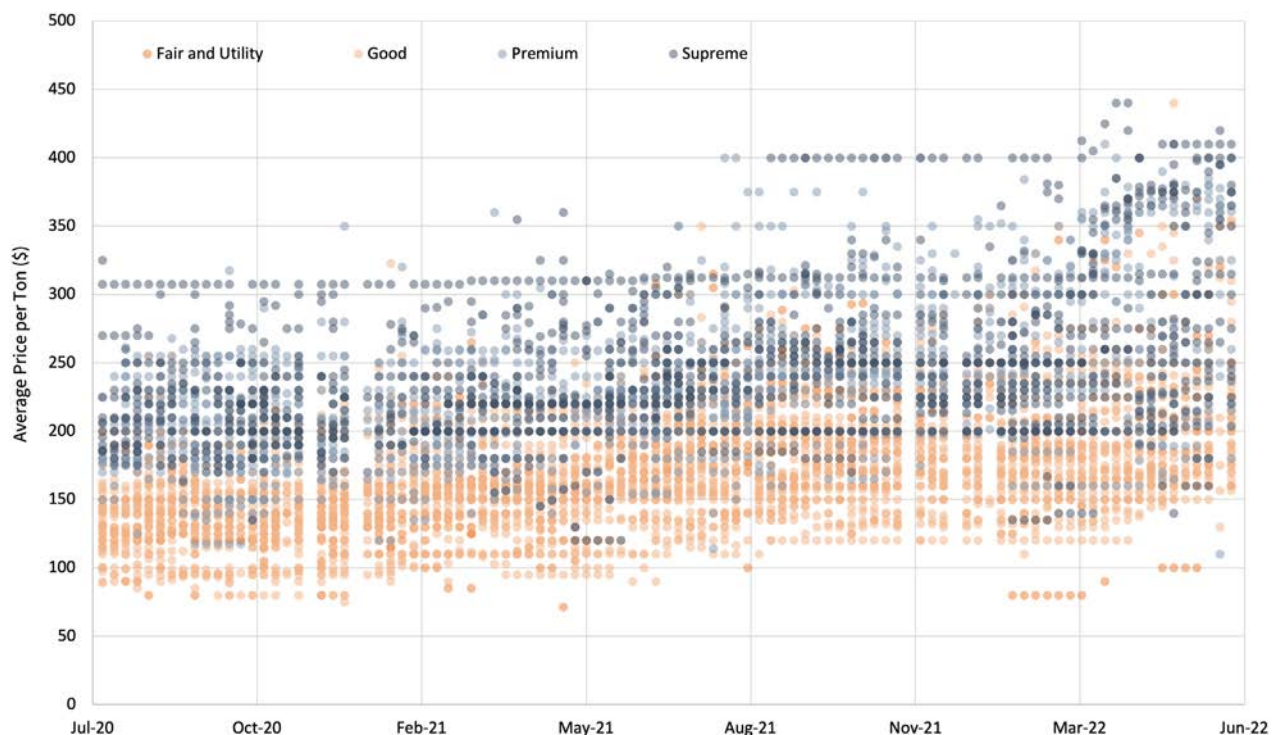
claimed that the size of the Chinese milk herd was 7.5 million. By 2021, that number had risen to 10.5 million. The rapidly increasing demands of Chinese consumers are in direct conflict with China's difficulty in growing enough feed, as discussed in a prior article in this issue. This means that, barring major political disruption, the record-breaking export demand for U.S. hay is unlikely to subside in the near term.

However, export risks remain. The U.S. has seen large forage exports to Middle Eastern nations like Saudi Arabia and the United Arab Emirates, but both nations saw precipitous declines in their imports of U.S. alfalfa in 2021. As these nations are almost entirely dependent on forage imports for domestic protein production, this scaling back isn't because their demand has changed. Instead, the declining imports from the U.S. represent these nations' successful efforts to find alternative sources for forage imports, either

from South America or, recently, via attempts to develop large production regions in African nations like Sudan.

Over the medium term, prices are likely to subside. The USDA estimates that the number of grain-consuming animal units will fall to its lowest level in five years, due in part to feed costs. Meanwhile, drought conditions are improving across the Northwest, which will help boost domestic supply. Export markets are likely to remain strong, but new competitors and political realities may help ease hay exports off their very robust 2021 levels. Luckily, strong commodity markets mean that livestock producers can absorb some of these cost increases. And in the near term, alfalfa and other hay producers will likely earn strong profits for whatever crop they can get out of the ground.

Figure 13: Bid Prices For Alfalfa and Hay Have Risen Considerably Over the Last Year



Source: USDA AMS. Direct Hay Reports

ALMONDS MARKETS HEAD TOWARDS PRE-PANDEMIC EQUILIBRIUM

34, 35, 36, 37, 38

Almond producers have faced a suppressed price environment since shortly after the start of the COVID-19 pandemic. After two years, a combination of robust exports and smaller supplies has helped put the sector back on a path towards equilibrium.

The almond sector has been waiting on a turnaround since seeing disruptions in early 2020. Shortly after the outbreak of COVID-19, almond prices fell by almost 25% and have remained near those lows since. Producers have faced headwinds from both stagnant foreign demand and growing domestic supplies. The good news is that while current market indicators are not unanimously positive, the almond sector appears to have some opportunity to return to a pre-pandemic price environment in the coming year.

Foreign demand has always been one of the most important components of the almond industry, and almonds will likely face both risks and opportunities

in this category this year. On the positive side, exports to emerging markets like India have surged, allowing almond export volumes to climb after years of stagnation—Combined with continued strong exports to developed, slower-growth countries (like those in the European Union), total export value has the potential to match the previous peak set in 2015. **Figure 14** demonstrates that the almond sector is growing increasingly reliant on foreign demand, with an estimated 90% of cash receipts coming from foreign sales in 2021.

However, as discussed earlier in this issue, rising prices have the potential to place headwinds on these export markets, with consumers in middle-income nations like India more likely to reduce

consumption in the wake of price increases. And even among developed nations like Japan, currency devaluation means that the implied price of U.S. almonds has risen 25% from exchange rates alone over the last year. While consumers in these nations change their buying behavior less as a result of price increases, significant increases could lead to some changes in consumption.

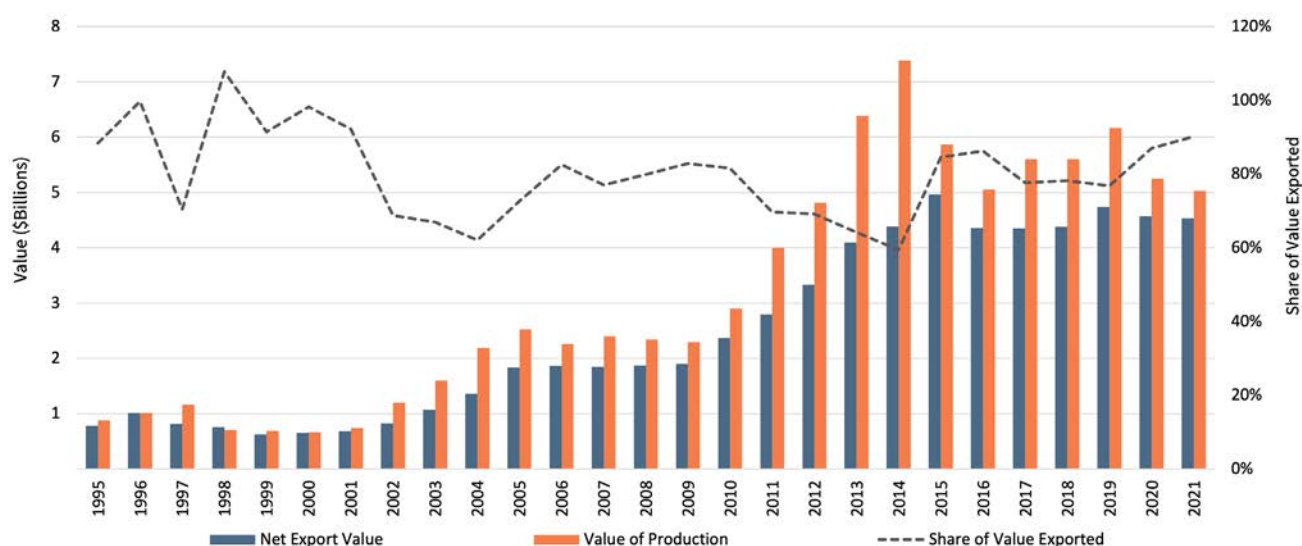
The larger challenge for almond producers has been the surge in domestic supply. Early estimates for 2022 are that there will be 1.37 million bearing acres of almonds, 50 thousand acres above last year's peak. Between 2010 and 2020, total U.S. almond production doubled, while total quantities exported rose by only 25%. Within the U.S., per capita availability of almonds continued to rise, with the number of pounds of almonds available per American rising from 0.83 to 2.46 pounds between 2000 and 2020.

Luckily, there are some indications for 2022 that the sector is beginning to pull back from the rapid expansion that has dominated the last decade. The number of non-bearing acres, or acres younger than three years, is forecast to fall in 2022. Next year will feature the first year where acres planted after the 2020 price declines will

enter into production, and producers in the wake of the price declines appear to have scaled back new plantings in consideration of drought issues. Production estimates for 2022 are below 2021 levels despite record acres, which will further help move the markets into equilibria.

It is unlikely that producers will see a return to the old days of \$3.00 per pound over the near term. The COVID-19 pandemic exposed the gap between supply and demand that had been coming in the industry for years. However, the current market is also unlikely to reflect what producers will experience after this growing season. Export quantities have surged to new developing markets, though global prices still present risks. Producers have scaled back new acres, and are likely to start reaping the rewards during the 2023 growing season. The realities of water availability and climate have led to near-term production declines that have helped stabilize price free-falls. Almond producers are likely to face one more year of a suppressed price environment, but for the first time in a while there are some hopeful signs for the future.

Figure 14: Almond Reliance on Exports is Climbing After Seeing a Pullback in Earlier Years



Source: USDA FAS GATS, USDA 2022 NASS California Almond Forecast

THE IMPROVED FINANCIAL HEALTH OF AG BORROWERS AND LENDERS

BY ZACHARY CARPENTER

39, 40, 41, 42, 43

Market volatility, rising input prices, and rising interest rates have ag borrowers and lenders concerned. However, the strength of farm finances (and the strength of their capital providers) is much improved since the 1980s. Lower leverage, higher capitalization, and improved liquidity should buffer the sector if a downturn were to strike.



Editor's Note:

Special Guest Author Zachary Carpenter is the Executive Vice President – Chief Business Officer at Farmer Mac. Through a career spanning over two decades of work in financial services, Zack has accumulated deep expertise in analyzing the ag economy and the agribusiness value chain. In this article, he shares an expert examination of the current financial ecosystem—and points to some reasons to believe that ag producers and lenders are on solid footing despite recent volatility.

This year has brought unprecedented market volatility, economic and supply chain disruptions, and increased geopolitical tensions. As a result, commodity, input, and energy prices are reaching near-record highs. Meanwhile, in an attempt to combat inflation, the Federal Reserve has increased the Federal Funds Rate at the fastest pace in nearly 30 years, with further increases expected this year. These events are sending shock waves throughout agricultural sectors as producers look to navigate this historic environment.

This volatility has created questions regarding the state of the agriculture economy and ag borrowers, especially as increasing input, energy, and financing costs begin to eat into relatively healthy margins. Many of the issues we are facing today—slowing economic growth, rising inflation, increasing interest rates, etc.—echo the 1980s farm crisis. In assessing potential risks facing the ag and food sectors, we at Farmer Mac are also considering the health of the financial system that will need to support producers during such volatile times.

However, while the specter of the farm financial crisis understandably still looms large in some minds, the health of farm finances is much stronger in many respects today compared to the farm financial crisis, largely due to lower leverage. The total sector debt-to-asset ratio has averaged between 10-15% since the early 2000s, compared to 15-23% during the farm financial crisis. As Dr. Zhang noted in our last edition of *The Feed*, over 80% of Iowa farm ground is debt free, a trend that likely extends to other grain belt states. While the overall level of farmland debt has increased, the number of farms with debt has decreased during this period, partly due to continued farmland consolidation. This decline is also a function of changes in lending standards and practices.

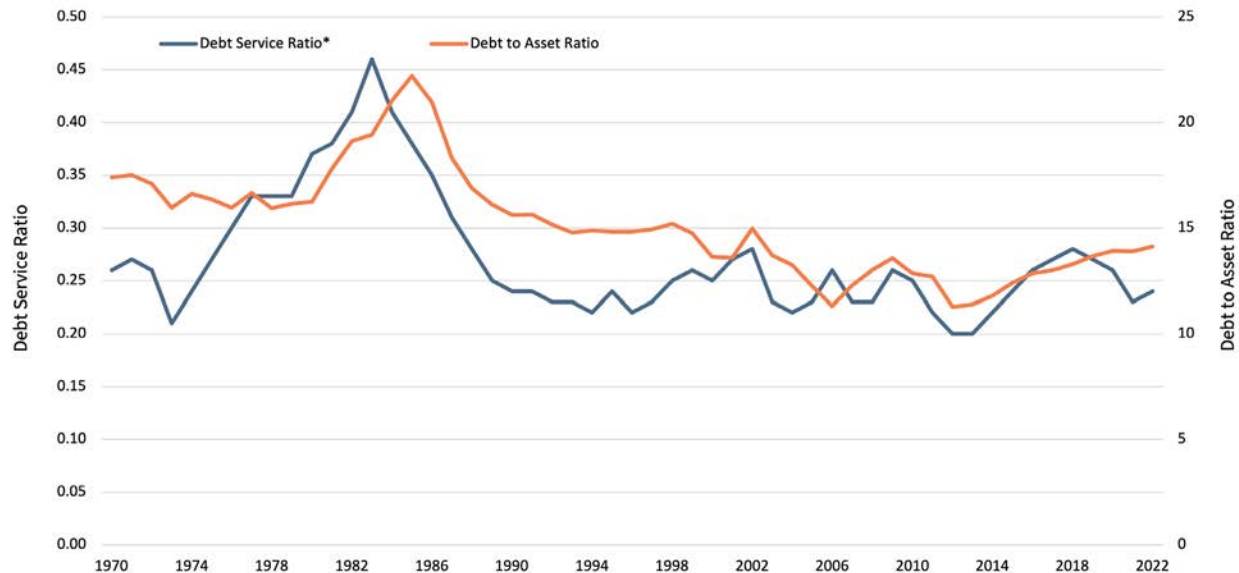
From an agriculture lending perspective, the industry is dominated by the Farm Credit System and commercial banks, which combined represent nearly 70% of total agricultural real estate lending (and over 60% of operating lines).

While structurally different (cooperative versus deposit-taking), both are in a much-improved position than in prior years. Partly, this reflects continued consolidation. Active agriculture banks have decreased by over 70% since the late 1970s to just over 1,200 today. The Farm Credit System continues to consolidate, with total banks and associations down 37% since 2000 and with another round of large mergers announced this year. Meanwhile, financing institutions are more diverse than ever, creating scale and risk mitigation across larger, diversified portfolios.

Another component of lending financial health reflects increasing capital and liquidity levels. Agriculture banks averaged equity capital ratios around 8% during the 1980s. Current levels on average are closer to 12%. The Farm Credit System overall is significantly more capitalized, currently averaging 15% equity capital ratios, which is more than double the equity capital ratios during the farm financial crisis. More importantly, these entities are holding significantly more liquidity to mitigate severe and prolonged capital market crises. The Farm Credit System banks' liquidity position at the end of 2021 (cash and eligible investments) was \$81 billion, or 23% of total debt, providing 175 days of liquidity to cover maturing debt and borrowings. This compares to a mere 20 days of liquidity in the 1986-1987 period.

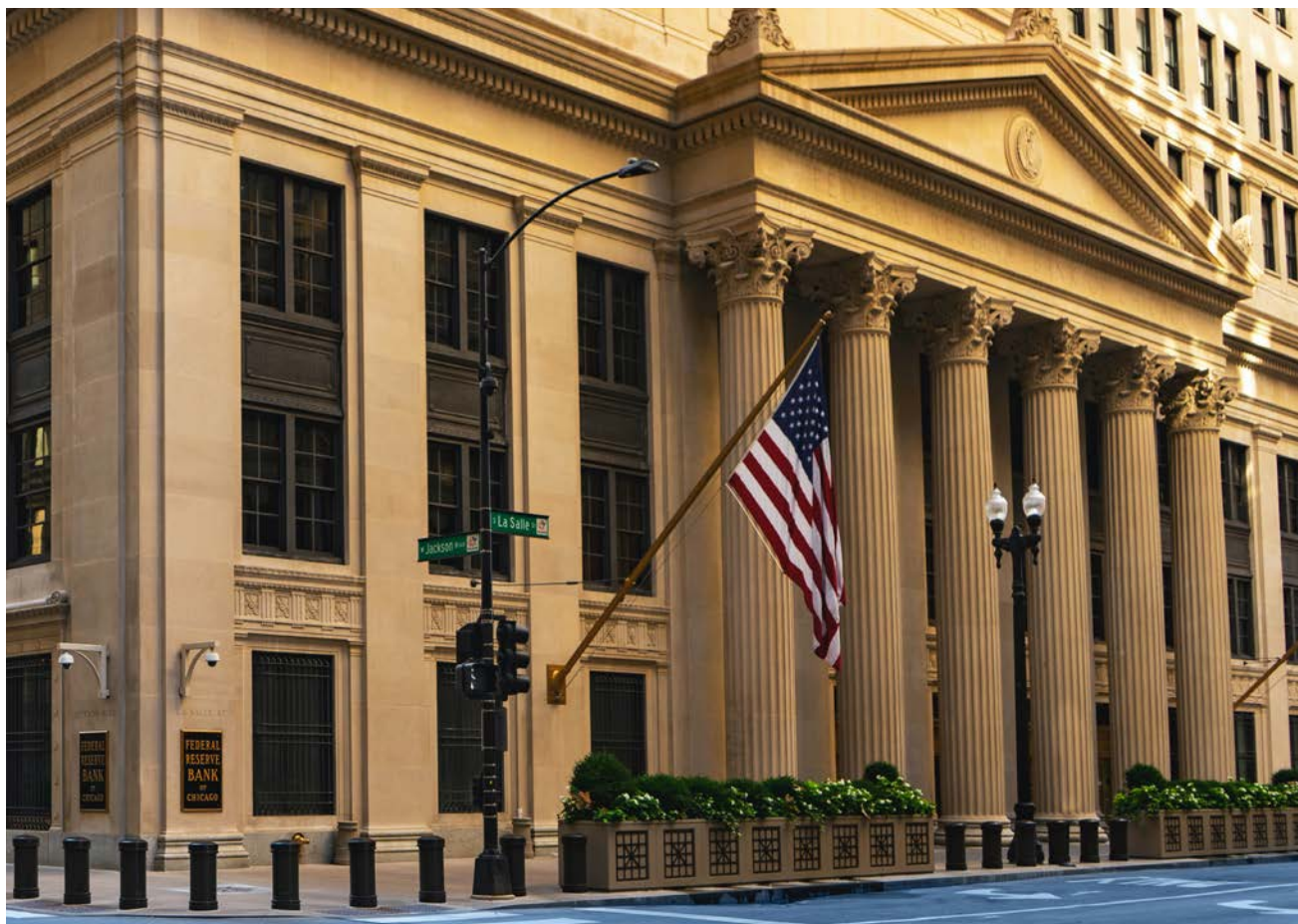
Thus, while the near-term operating environment will likely remain volatile across most agricultural sectors, there is good reason to believe agricultural producers and financing institutions are on solid footing. Continued consolidation, improved liquidity and capital levels, and relatively healthy borrowers have resulted in a landscape that is much more suitable to handle volatility—and even more importantly, able to handle a potential prolonged downturn in the years to come.

Figure 15: Farm Sector Solvency Ratios Were Far Higher Than Today's Levels Before the Farm Crisis



Source: USDA ERS Farm Income and Wealth Statistics

**Note: Debt service ratio refers to interest and premium payments divided by cash receipt and government income*



ABOUT THE AUTHORS



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Jackson Takach, Chief Economist, is a Kentucky native whose strong ties to agriculture began while growing up in the small farming town of Scottsville. He has since dedicated a career to agricultural finance where he can combine his passion for rural America with his natural curiosity of the world and his strong (and perhaps unrealistic) desire to explain how we interact within it. He joined the Farmer Mac team in 2005, and has worked in the research, credit, and underwriting departments. Today, his focus at Farmer Mac currently includes quantitative analysis of credit, interest rate, and other marketbased risks, as well as monitoring conditions of the agricultural economy, operational information systems analysis, and statistical programming. He holds a Bachelor's degree in economics from Centre College, a Master's degree in agricultural economics from Purdue University, and a Master's of Business Administration from Indiana University's Kelley School of Business.



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ABOUT THE FEED

The Feed is a quarterly economic outlook for current events and market conditions within agriculture.

The report is broad-based, covers multiple regions and commodities and incorporates data and analysis from numerous sources to present a mosaic of the leading industry information, with a focus on the latest information from the United States Department of Agriculture and their Economic Research Service.

There are several regularly included sections like weather and major industry segments, but the authors rotate through other industries and topics as they become relevant in the seasonal agricultural cycle. Where the report adds value to readers is through its unique synthesis of these multiple sources into a single succinct report.

We hope you've enjoyed this issue.

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ISSUE NO. 26

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