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PURDUE AGRICULTURAL ECONOMICS REPORT

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Outlook 2024

Contents:

Welcome from the Editor

Roman Keeney, Associate Professor of Agricultural Economics

Welcome to the PAER Outlook 2024 issue! As is the tradition, we ask department specialists to spend time thinking about key issues in their field and consider how these have impacted outcomes over the past year and may continue to go forward. We continue to call the issue an "Outlook" to recognize the department's tradition of delivering programming at the start of the year. This aims to educate stakeholders who may benefit from knowledge in key mission areas of Purdue Ag Econ.

Much of what used to be "Outlook" programming has now transitioned to various center units in the department. In this issue, we feature contributions from faculty members who are prominent leaders in each unit, including Commercial Agriculture, Food and Agribusiness, Food Demand Analysis and Sustainability, Global Trade Analysis, and Regional Development. The PAER editors strongly recommend that readers follow the activitites of these centers throughout the year.

The articles in this issue cover our traditional farm economy topics of land values, farm credit, farm costs and return estimates, and dairy markets. Additionally, there are articles addressing the broader economy with dedicated sections on national economic outlook, trade, policy and food prices. This year we are fortunate to have spotlight topics that discuss key applied research findings from the department in the areas of energy (biofuels policy), rural development (generation gap) and agricultural trade (war in Ukraine).

Altogether, the issue provides a snapshot of the many departmental efforts in service of our land-grant mission, and we hope readers find it engaging and useful.

PURDUE AGRICULTURAL ECONOMICS REPORT

The Outlook for the U.S. Economy In 2024

Larry DeBoer, Professor Emeritus of Agricultural Economics

Summary: *Professor DeBoer explains why so many economists predicted recession in 2023 and why it didn't happen. His analysis indicates slowed growth in 2024 from reduced spending but that recession could be avoided.*

It was December 2022, and the leading indicators were flashing recession warnings. The Federal Reserve had already hiked their policy interest rate by 4 percentage points, one of the most rapid increases in its century-plus existence. The Conference Board's index of leading indicators had turned negative. The 2-year Treasury interest rate had risen above the 10-year rate, an inverted spread that nearly always precedes recession. So, many economists predicted recession for 2023.

The recession never happened. Real gross domestic product continued to grow, as did employment. The unemployment rate remained near its 50-year low. Consumer spending continued to rise. The inflation rate fell dramatically.

Now it's December 2023. The Fed increased their policy rate some more, but has kept it stable since August. The Conference Board's index is still negative. The interest rate spread is still inverted, though narrower. Recession is a possibility. But it would be sheer stubbornness to continue predicting recession in the face of so much good news. The guess here is no recession in 2024.

That's what won't happen. What will happen? Start with the components of gross domestic product growth, adjusted for inflation.

Gross Domestic Product

Consumer Spending. Household purchases of consumer goods and services makes up more than two-thirds of gross domestic product. If consumers don't spend, the economy doesn't grow. Since the end of the pandemic, consumers have been spending. Consumer spending increased 2.3% above inflation in the year through the third quarter 2023.

Consumers say they are pessimistic. The University of Michigan's consumer sentiment index has increased since its June 2022 low, but remains well below its 2019 level. It has fallen in the past three months. Prior to 2020 consumer sentiment was a good indicator of the direction of consumer spending. Declining sentiment meant slower growth in household purchases. In the past four years, though, supposedly pessimistic consumers have kept spending.

More telling, manufacturers have received fewer orders for new consumer goods in 2023. Orders declined in eight of the past 12 months, and are 5.7% below the level of November 2022. Apparently retailers and manufacturers think consumers will spend less in the next few months, and are cutting back. That's a better reason to expect consumer spending to slow.

Investment. Higher interest rates were meant to slow investment borrowing and spending. Investment spending did fall from the first quarter of 2022 to the first quarter of 2023, but growth has resumed in the past six months. Investment spending is 2.3% higher than is was a year ago, adjusted for inflation.

Higher interest rates do not seem to have had much effect on business structure and equipment investment, which is is up 4% in the past year. But higher mortgage interest rates have reduced residential investment. Housing starts are down 24% since April 2022.

Capital goods orders are a leading indicator of investment in business equipment. Orders are up slightly, by 1.3% over the past year. Building permits are a leading indicator of residential construction, and are down from the previous year by 3.7%. The Federal Reserve likely is finished with interest rate hikes, and may begin reducing rates by the end of 2024. Interest rates won't cause additional restraint, but probably won't encourage more spending either. The outlook for investment spending is continued modest growth.

Government purchases. Purchases by all levels of government have risen 4.7% above inflation over the past year. Federal purchases contributed 5.7% to this growth, while state and local governments added 4.2%. The Congressional Budget Office forecasts a 5% increase in direct Federal spending on goods and services for fiscal 2024, adjusted for inflation. Federal pandemic aid was a revenue bonanza for state and local governments. That's over, so inflation-adjusted state and local spending growth should slow to normal in 2024, which is about 2%.

The Federal government's budget deficit grew to $2 trillion in fiscal 2023, about 8% of GDP. The CBO says that part of the reason was a large drop in income tax receipts, which had several causes, including postponed IRS deadlines due to natural disasters. This included most taxpayers in California. Another reason, though, was the increase in interest payments on the national debt. Rising interest rates increased the cost of refinancing the debt, which raised interest from 7.6% of the total budget to 10.2%. Lower interest rates and back-payments of income taxes should reduce the size of the deficit in 2024, but its share of GDP will remain historically large.

Exports and Imports. Inflation-adjusted export and import spending have both fallen over the past year. Imports fell 1.5% and exports fell 0.2%, so net exports (exports minus imports) increased. Trade made a small net addition to output growth.

The exchange value of the dollar rose in 2022 in response to the rise in U.S. interest rates. International lenders increased their demand for dollars to take advantage. Once the Fed stopped raising rates, the exchange value fell. The dollar is down 6% relative to the euro over the past year.

A lower dollar exchange value makes U.S. imports more expensive and U.S. exports cheaper. Imports usually rise with consumption spending, but with the lower dollar value, the increase should be modest. The world economy is expected to grow more slowly in 2024, which could reduce export growth. But with the weaker dollar, exports should grow somewhat faster. Again, net exports will contribute a little to GDP growth.

GDP growth in 2024. GDP grew 3% above inflation in the past year. Growth seems likely to slow, a little. Consumer spending should grow more slowly in 2024 than this past year. Investment spending should grow modestly. Both federal government and state and local government purchases will increase less. Trade should add a little to growth, on net. Add it up, and **real GDP should grow about 2.2% in 2024**, slower than in 2023.

Employment and Unemployment

Employment growth slowed in 2023, to 2.8 million jobs, compared to 4.8 million in 2022. Perhaps the Federal Reserve's interest rate hikes worked to dampen the labor market. Or, perhaps employment was constrained by labor force growth, which was about 2.9 million in 2023. Population and labor force participation increased, but with the unemployment rate about as low as it can go, there simply aren't enough new people available to fill more job openings.

The labor market ended 2022 with 11.2 million job openings and only 5.7 million unemployed people searching for work. The unemployment rate was 3.6%. The most recent data from September showed that openings had fallen to 9.4 million, and the number of searchers had risen to 6.4 million. Openings still exceeded searchers by 3 million at in September 2023. The unemployment rate remained near its 50-year low of 3.7%.

GDP growth of 2.2% should be enough to keep job openings above unemployed job searchers. That should keep the unemployment rate from rising very much. **Expect the unemployment rate to be about 4.0% by the end of 2024.**

Inflation

The Consumer Price Index inflation rate peaked in June 2022 at 8.9% over June 2021. As of November 2023 the 12-month CPI inflation rate was 3.1%. This is substantial progress, but still higher than the 1999 to 2019 average of 2.2% per year.

The prices of durable goods, such as cars, appliances and electronics, fell an average of 1% per year in the two decades from 1999 to 2019. Durable goods deflation was the norm. But with the pandemic prices of durables shot upward, by 18.8% as of February 2022. Supply chain problems created shipment delays and shortages, and consumers shifted their spending from services to goods. Consumers have continued to favor goods purchases, but delays and shortages have disappeared as the supply chain recovered. As of November 2023 durable goods *deflation* had returned, with prices 1.6% lower than in November 2022.

Non-durable goods include food, energy and medicines, but the non-durable inflation rate is most influenced by the highly unstable price of gasoline. The monthly average gas price peaked at $4.93 in June 2022. By November 2022 the gas price had fallen to $3.69, and a year later in November 2023 it averaged $3.32. That gas price decrease explains the 0.7% non-durable goods inflation rate, which is lower than the two decade average of 2.1%. The U.S. Energy Information Administration projects a small 1.7% increase in gasoline prices in 2024.

Durable and non-durable goods inflation have returned to normal. Service inflation has not. Service inflation averaged 2.7% per year during 1999-2019, but as of November 2023 it was 5.2%. Services include medical care and entertainment, but the biggest expense is the cost of housing.

The CPI measures housing costs with average rent. Rent tends to lag the price changes of goods, partly because rents are set in leases that last a year or more. Durable goods prices peaked in February 2022; the rent index peaked 13 months later in March 2023, at 8.8% over March 2022. It has fallen in each of the eight months since then, but only to 6.9%.

The Bureau of Labor Statistics' experimental index of New Tenant Rents—rents on new leases—rose only 2.8% in the past four quarters. As this information is incorporated into the CPI index, rent inflation show continue to fall, and so will services inflation. The long-term trend of durable goods deflation should continue. The small rise in gasoline prices should result in an equally small increase in non-durable goods inflation. Combining these changes leads to **Consumer Price Index inflation forecast for 2024 of 2.7%**.

Federal Reserve Policy and Interest Rates

Inflation was rising at the beginning of 2022. The Federal Reserve began raising the federal funds rate—their policy interest rate—in March of that year. It had reached the 5.25%-5.5% range in July 2023. The intent was to decrease borrowing and spending, slow the economy, and bring inflation down. Inflation did fall. Fed policy probably helped, but the main cause of reduced inflation was the recovery of the global supply chain.

Inflation is on a trajectory towards the 2% inflation rate target. The Fed likely has finished raising interest rates. Federal Reserve Board members published their expectations for the economy after the December policy meeting, and their median prediction for the federal funds rate by the end of 2024 was 4.6%. Since the rate is 5.3% at the end of 2023, this implies three quarter-point rate reductions, probably in the second half of 2024.

The 3-month Treasury security interest rate is also 5.3% as of November. It usually follows the federal funds rate, so **expect the 3-month Treasury rate to be 4.6% by the end of 2024**. The 10-year Treasury bond rate averaged 4.5% in November. It usually averages 2 percentage points higher than the 3-month rate. The 10-year rate was been less than the 3-month rate for the past year, a rate spread inversion that is often an indicator of a coming recession. Whether or not a recession occurs, the 3 month rate should approach the 10-year rate by the end of 2024. **Expect the 10-year Treasury bond interest rate to be 4.4% by December 2024.**

2024 shapes up as a pretty good year. GDP will grow modestly. The unemployment rate will remain low. Inflation should continue to edge downward. Interest rates should edge lower by the end of the year. The leading indicators are still signaling recession. They fooled us last year. So: Fool me twice, shame on me. No recession in 2024.

PURDUE AGRICULTURAL ECONOMICS REPORT

Trade & Trade Policy Outlook

Russell Hillbery, Professor of Agricultural Economics

Summary: *Professor Hillberry reviews trade and trade policy developments from 2023 including responses to the Russia-Ukraine war. Looking ahead he identifies the potential for trade disputes and how the election may shape US merchandise and agriculture trade.*

In last year's outlook (Hillberry, 2023), the implications of the Russia/Ukraine war for international trade in agriculture were a major focus. Nearly-comprehensive sanctions on Russia and Belarus, as well as war-generated disruptions in Ukraine and Russia's exports of agricultural commodities, had disrupted many markets relevant to U.S. export-oriented agriculture. While both the war and the sanctions remain, their economic consequences for agriculture seem to have been mitigated in the last year.

Fertilizer prices were one of the markets most disrupted by the war. Russia and Belarus are major suppliers of fertilizers, especially potash. Reduced supplies of natural gas to Europe also disrupted the production of other fertilizers there. Fertilizers prices fell through-out 2023 (Quinn, 2023). It seems that fertilizer markets have largely adjusted to the shock, through increased output of alternative suppliers, and the rearranging of international supply chains in this input (Lvovskiy, 2023).

Prior to the war, Ukraine and Russia were both large exporters of agricultural commodities, especially wheat. Wheat prices fell throughout 2023, and now sit below their prewar levels (USDA, 2023). Supply chains in wheat markets have also been spatially reallocated, with Ukrainian wheat often now travelling through Europe rather than the Black Sea. Associated disruptions to the European market generated some trade policy disputes in 2023, including the filing of a World Trade Organization (WTO) complaint by Ukraine against protective measures taken by Poland, Hungary and the Slovak Republic (WTO, 2023).

Figure 1. Retail Price of Diesel Fuel (on Highway), in Dollars per Gallon.

Source: St. Louis Federal Reserve FRED database

Oil and gas markets were also disrupted by the Russian invasion of Ukraine. Prices in these markets also appear to have normalized. The retail price of diesel in the U.S. for example, sits very near its pre-war levels, as can be seen in Figure 1.

Last year's review noted that the rapid increase in US interest rates associated with an inflationary spike had led the U.S. dollar to appreciate against other world currencies. Other things equal, an appreciating dollar should reduce the costs of foreign inputs, but make US exports less competitive on foreign markets. Last year at this time, this author conjectured that subsiding inflation would lead to U.S. interest rate cuts, which might have been expected to lead to a dollar depreciation, reversing earlier moves. While inflation has subsided, the Federal Reserve has yet to begin cutting interest rates. It seems likely that this will happen in 2024, though the scale of such cuts is difficult to forecast (Moore 2024). If the cuts are sizable - which would be more likely if the economy were to slow – they would probably lead to dollar depreciation. 2023 saw the value of the dollar fluctuate, but finished the year at basically unchanged from the same time last year.

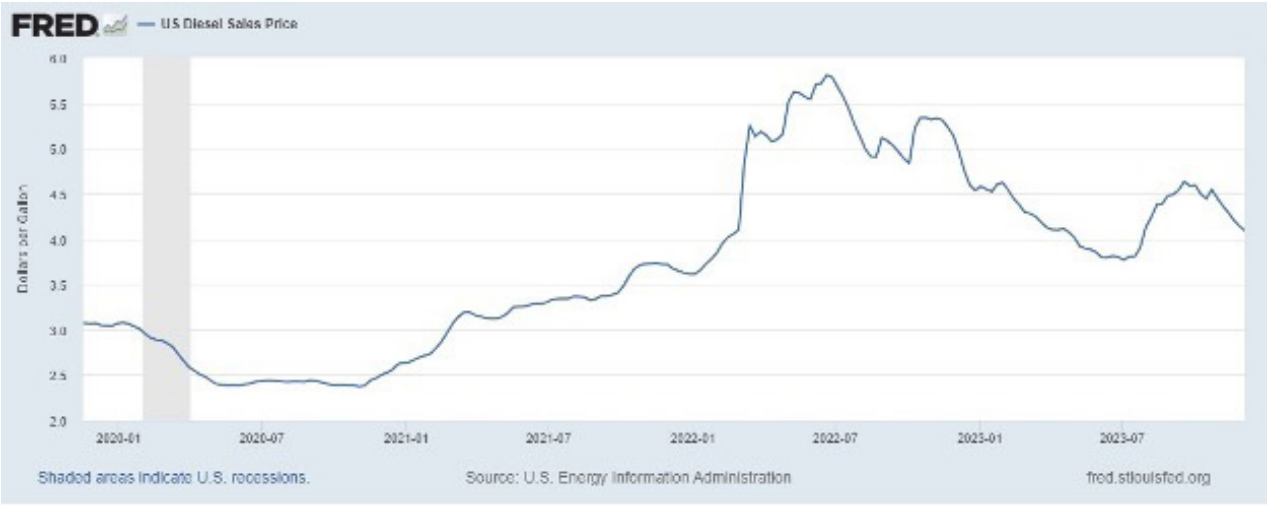
The most significant trade policy developments of 2023 were not directly related to agriculture. Under President Biden, the U.S. has offered large federal subsidies to manufacturers (and prospective manufacturers) of semiconductors and electric vehicles. Purchasers of electric vehicles also qualify for federal subsidies. All of these subsidies come with strings attached, namely requirements to use U.S. domestic content, or in some cases the content of preferred U.S. trading partners.

While the subsidies have their purposes, from a trade policy perspective they pose important problems. First, they appear to be inconsistent with the U.S. WTO commitments, and they have angered long-time U.S. trading partners (Rappeport, 2023). Second, subsidies of this size have consequences similar to tariffs; they push U.S. economic activity away from sectors where the U.S. has comparative advantage (including agriculture) and towards sectors that may not be cost competitive absent the subsidy. Third, the subsidies must also be financed, generating an eventual tax liability on other sectors of the economy. As with tariffs, U.S. subsidies have also generated responses by foreign policymakers, which undermine some of the benefits that U.S. subsidies might have otherwise generated (Swanson et al., 2023).

What are the implications for export-oriented agriculture? There are several. First, trade policy makers in foreign governments who are frustrated by US trade policies in other dimensions are unlikely to look favorably on U.S. requests for improved market access in agriculture. Second, the focus of U.S. trade policymakers has clearly shifted away from pursuing the interests of export-oriented agriculture; improving market access for agriculture has been a secondary consideration, at best. Finally, resource allocation costs associated with policies aimed to support favored manufacturing sectors are relevant. Policy-induced expansion of one sector of the economy implies reduced activity in the others.

Although the bright spots in this environment are few, a 2023 WTO agreement limiting fishing subsidies suggests that, despite setbacks in the last decade, the multilateral body can still play an important role in international economic relations. In the agreement, countries agreed to limit their subsidization of commercial fishermen in ocean waters. If it is successful in reducing overfishing, the agreement should benefit aquaculture, at least in the

Figure 2.



Source: St. Louis Federal Reserve FRED database

short run. More broadly, its implications for agriculture are that the WTO is still a potentially effective venue for negotiating reductions in subsidies around the globe. Further global progress on reduced subsidies in agriculture would be useful for those U.S. producers who are able to compete on international markets without them.

Trade Policy and the 2024 U.S. Presidential election

The 2024 event that is most likely to affect trade policy is the 2024 Presidential election. While voting in the primaries has not yet begun, it seems likely that the candidates chosen by their prospective parties will be President Joe Biden and Former President Donald Trump, a rematch of the 2020 campaign. When election season rolls around, most national candidates bow to pressure to protect uncompetitive industries that are important in politically sensitive states. These two candidates have proven histories that make them more likely than most recent candidates to do so. Those involved in export-oriented agriculture should certainly be paying attention, since those actions typically undermine their the interests of export oriented agriculture.

For what follows we take as given the proposition that the US trade policy orientation that best suits the interests of export-oriented agriculture are conditions similar to those that existed in 2000, with most of those conditions still in place as late as 2016. This means that U.S. trade policy is largely stable and predictable, with low tariffs and broad adherence to the rules-based global trading system that has done so much since World War II to advance global peace and prosperity, while at the same time enabling U.S. farmers to increase their exports around the world. Good-faith negotiation of preferential trade agreements with countries that offer sizable prospects for growth in agricultural exports are probably good for the agricultural sector, even if not ideal for the economy as a whole.

Former President Trump's trade policy was almost entirely antithetical to these ideals. His first act as President was to withdraw from the Trans-Pacific Partnership, a preferential trade agreement including most of large economies in the Asia-Pacific (ex-China). U.S. producers lost the improved market access commitments made in the agreement by large prospective agricultural markets such as Japan and Korea. Agricultural producers in countries that remained in the agreement (Australia, Canada and New Zealand, among others) instead benefited from the new commitments, many of which the U.S> had helped to negotiate. Trump then moved on to starting a trade war with China, generating retaliatory tariffs by China on U.S. soybeans and other products. Next Trump broadened his trade war, raising tariffs on long-standing US allies and trading partners like Japan and the European Union. While the retaliatory tariffs from Europe and other trade partners were less obviously consequential for large commercial agriculture than were China's tariffs, they reduced U.S. agricultural exports nonetheless (Morgan, 2022). Trump next set out to undermine the World Trade Organization's dispute settlement mechanism, refusing to allow any appointments to the appellate panel that is necessary for penalties against countries that violate trade rules (Packard, 2020). In his efforts to renegotiate NAFTA, his impulse to tear up the agreement altogether had to be restrained by agricultural interests in Washington (Baxter, 2017). While the fallout from his policies for agricultural producers finally began to register with him near the end of his administration, his efforts to undo the consequences of his own policies were limited in their effectiveness (Bown, 2022).

One might have hoped that President Biden would return U.S. trade policy to its pre-2017 settings. Early moves to normalize trade relations with longstanding allies like Europe and Japan were important steps in this regard, but much of the rest of Trump's trade policy was left in place. As a result, many of the countermeasures that other countries took in response to Trump's tariffs are also still in place. Despite recovering somewhat from the depths observed during the trade war, the U.S. share of China's agricultural imports has plateaued below its prior levels (Bown and Wang, 2023). While the Biden administration has touted its efforts to revive the WTO's dispute settlement mechanism (Bade, 2023), critics argue that the rhetoric rings hollow (Bacchus, 2023). Biden's expansion of "Buy American" policies, together with his green subsidies and associated trade restrictions also seem inconsistent with current WTO rules (Kaufman et al., 2023). Agricultural interests in Washington are pushing the Biden Administration to try to negotiate improved market access through the WTO, though this is clearly not a centerpiece of his agenda (Palmer, 2023),

It will be interesting to see the degree to which trade policy becomes an issue in the 2024 campaign. President Biden rarely speaks about this issue directly, though his approach to the issue has begun to come into focus, and it seems reasonable to expect him to continue on the path he has already taken. President Trump seems primed to raise the prominence of trade policy again, recently proposing 10 percent tariffs on virtually all imports to the United States (Stein, 2023). Should Trump be elected once again, one might expect consequences for U.S. agriculture that are similar to those that occurred in his previous term.

In the post World War II period, U.S. Presidents of both parties traditionally supported the expansion of global trade

through negotiation with U.S. trading partners. A key U.S. goal of these negotiations has often been to increase market access for U.S. agricultural producers. It is thus surprising that in 2024 we should see once again the match-up that nearly everyone expects. On the one hand we have a sitting president who seems indifferent to the market access goals of U.S. agriculture. On the other hand we have a former President, unchastened by the fallout of the trade policies of his first term, promising more of the same if he is returned to office. Perhaps the more relevant question is this: why have the interest groups and politicians who represent rural midwestern voters been so far so unsuccessful in raising the salience of trade policy in the Republican Presidential primary campaign?

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PURDUE AGRICULTURAL ECONOMICS REPORT

Will 2024 Bring A New Farm Bill?

Roman Keeney, Associate Professor of Agricultural Economics

Summary: *Congress failed to pass new farm legislation in 2023, instead continuing the 2018 Farm Bill for one more year. In a 2024 election year, the time to produce a new five-year bill for agriculture may be short.*

Background

One year ago, this column discussed factors that would complicate the drafting and passage of new legislation replacing the 2018 Farm Bill before its expiration. Prime among those factors was the 2022 election yielding a division in the Congress with Democrats holding the Senate and a new Republican majority in the House of Representatives.

As expected, conflict on spending issues dominated the economic policy debate in 2023. The first clash was over raising the debt ceiling so that the US could continue to meet spending obligations. A last-minute deal was struck in July to avert a default. The debt ceiling deal brushed up against the farm bill debate with its inclusion of changes to SNAP work requirements designed to reduce rolls and reduce spending. While much of the first half of the year was complicated by debt ceiling negotiations, the second part of the year was dominated by the appropriations process. Government shutdowns were averted with two rounds of continuing resolutions. The first of these triggered a change in Republican leadership in the House and in November a second continuing resolution was passed extending the debate on federal spending into early 2024. As part of that November continuing resolution, the 2018 Farm Bill had its termination date extended to September 30, 2024 with no changes to its functionality.

Issues to be resolved by a 2024 Farm Bill

In May of 2023, the Congressional Budget Office (CBO) published the spending projections that serve as the baseline budget for a replacement farm bill. As expected, those numbers indicated that continuing the 2018 Farm Bill forward for ten years would cost more than $1.4 trillion with 84 percent of that being claimed by nutrition programs. Updated total federal spending estimates in May projected increasing deficits for the ten-year horizon eventually raising to nearly 7% of GDP. The prominence of federal spending cuts in the 2023 debt ceiling and budget battles indicates that we should expect the projected cost of the farm bill to feature prominently when deliberations begin in agricultural committees this year.

Farm Bill priorities remain much as they were one year ago. Being allowed to spend the full baseline amount is imperative to meeting the multiple priorities of a large omnibus food and agriculture package. A number of interest groups were advocating farm bill changes that follow the Inflation Reduction Act's lead on favored climate smart agriculture. Farm production, finance, and risk management groups all have keyed on maintaining the current crop insurance model. Concerns about the performance of direct farm payments delivered through the Price Loss Coverage (PLC) and Agricultural Risk Coverage (ARC) in the face of inflated output and input prices have marked the reference prices used in those programs as a key area that could divide farm and conservation groups. Finally, the continued marriage of nutrition spending with farm income and agricultural conservation in a large omnibus bill is viewed as necessary to maintaining the broad bipartisan support that has been the hallmark of past farm bill passages.

Potential outcomes

In sum, we have a host of priorities for this legislation that would likely require all the projected spending in a political climate where the size of government spending has become a primary point of conflict. New farm legislation is unlikely to come to the fore ahead of some resolution to the fiscal 2024 spending bills. It is possible that some changes to mandatory spending programs in the 2018 farm bill (e.g. crop insurance premium subsidies, allowed acreage in the CRP, or size and eligibility of SNAP benefits) could be brokered as part of the budget process as was seen in the most recent debt ceiling negotiation. It would be more likely that the spending cuts were applied to the total spending leaving drafters of the farm bill to work out the tradeoffs and cuts necessary to curtail spending projections. In either case, the delay in passing federal spending bills for 2024 means that the farm bill debate is going to be pushed into the meat of a general election year where debates in Congress serve proxy for broader agenda items (e,g. immigration or international aid) making compromises more difficult to achieve.

At an optimistic extreme, it's possible that legislators look to the Farm Bill as a last chance before the general election to demonstrate the ability to work together for a large constructive compromise on a bill that is critical to farm and rural economies as well as the poorest households in the nation. At the opposite extreme, the year could feature continued policy brinksmanship with the only agreements being made when consequences of delay are most dire, increasing uncertainty for markets and households that are served by farm bill programs. In that event we would almost certainly reach October 2024 with no replacement farm bill and face the same questions we did throughout 2023.

The PAER will continue to monitor the farm bill situation via the policy brief series as was done throughout spring 2023.

PURDUE AGRICULTURAL ECONOMICS REPORT

Impacts of the Russian-Ukraine War on Global Agriculture: Spillover Effects & Policy Responses

Maksym Chepeliev, Research Economist

Summary: *Food-security implications of the war in Ukraine are exacerbated by adverse weather events, energy and fertilizer market disruptions, and food export restrictions, disproportionally impacting low-income households. Proactive trade policies, such as trade facilitation measures and the reduction of import tariffs on agricultural and food commodities, could largely mitigate the impacts of the war on global agriculture.*

An important role of the Black Sea region in the global commodity markets

The war in Ukraine has spurred considerable disruptions in the global supply of agricultural, food and energy commodities, leading to significant escalations in prices, especially during the first months following the conflict (Behnassi and Haiba, 2022; Benton et al., 2022). In a world still recovering from the COVID-19 pandemic, these additional pressures and uncertainties exacerbate an environment already grappling with heightened food insecurity, poverty, and malnutrition (Dasgupta and Robinson, 2022; Laborde et al., 2021).

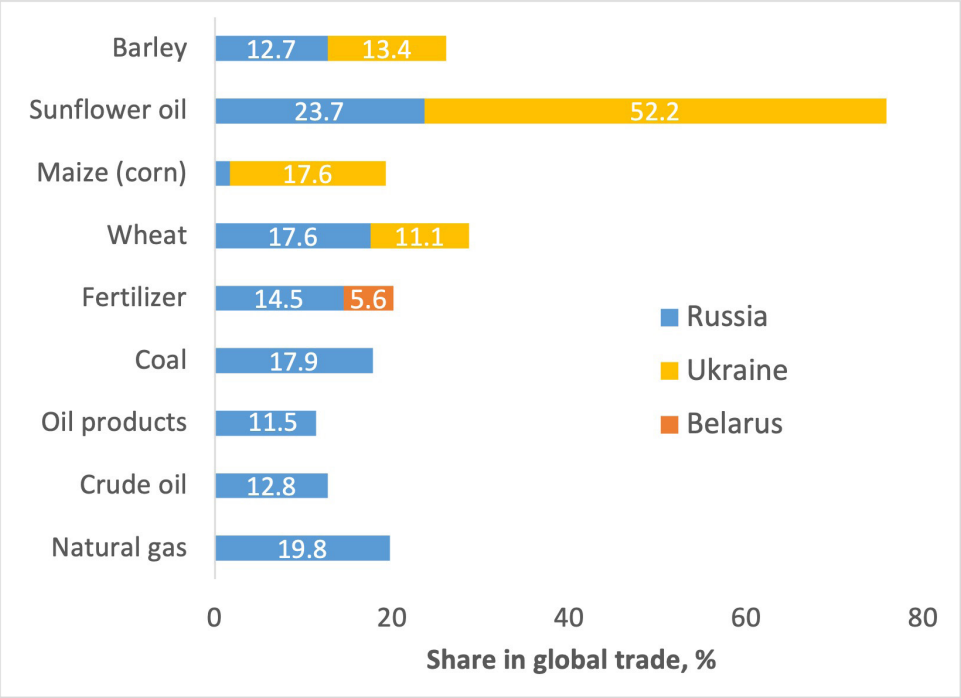

Figure 1. Black Sea region share in global trade
Source: Chepeliev et al. (2023a).

Notes: Estimates of the global trade shares for food and agriculture correspond to the trade volumes in 2019; fertilizers trade is based on the value flows in 2019; trade in energy commodities represents volume shares for the 2021 reference year.

Countries in the Black Sea region (Belarus, Russia and Ukraine) have become key global suppliers of grains, oilseeds and vegetable oils over the last three decades. Russia and Ukraine rank in the top seven global producers and exporters of wheat, corn and barley (Figure 1).

Russia and Belarus are the world's second and third-largest producers of potash fertilizer, respectively. Brazil, for example, the world's largest soybean producer, buys approximately half of its potash fertilizers from these two countries. The majority of Brazil's soybeans are sold to China, which utilizes much of the crop to feed livestock. As a result, a disruption in fertilizer supplies impacts meat prices in China and around the world. The EU has banned all imports of potash from Belarus as of March 4th 2022 (Euractiv, 2022).

In addition, Russia is a major producer and supplier of fossil fuels, such as crude oil and natural gas. In 2019 Russia accounted for 18 percent of global exports of coal and 13 percent of crude petroleum (the second biggest exporter of this commodity). Russia is also a major exporter of refined petroleum products and natural gas, accounting for respectively 12 and 20 percent of global exports. Petroleum is a vital component of the transportation sector, while natural gas accounts for over half of the cost of producing ammonia fertilizer; and prices of both energy commodities have increased due to the war.

Apart from the direct commodity market disruptions, the impacts of sanctions against Russia, domestic policies that countries around the world have implemented in pursuit of food security and adverse weather events are further exacerbating the adverse implications of the war in Ukraine.

In a world of highly integrated global value chains, the interdependencies across countries and commodity markets play a major role in both transmitting the negative shocks as well as spreading the benefits of the policy responses. It is important to properly represent these complex interactions when capturing the implications of market disruptions, such as the war in Ukraine, and understanding the impacts of potential policy measures.

Capturing the spillover effects and policy responses requires a comprehensive assessment framework

In a series of recent studies (Chepeliev et al., 2022; Chepeliev et al., 2023a; Chepeliev et al., 2023b), we develop a comprehensive computational framework by linking a global computable general equilibrium model ENVISAGE (van der Mensbrugghe, 2019) with a Global Trade Analysis Project (GTAP) database (Aguiar et al., 2019) and the GTAP nutritional module (Chepeliev, 2022). Using this framework, we explore a set of policy scenarios that combine the impact of the war, sanctions and other disruptions, such as adverse weather events and export restrictions. The developed approach allows us to disentangle the impacts of various sets of shocks distinguishing between channels of impacts. We then analyze trade policy responses in the form of reductions in tariff barriers on agricultural and food commodities, as well as the implementation of the trade facilitation measures (TFMs) that can be used to ease the adverse implications of the war. Table 1 provides a summary of the applied scenario framework, while additional details available in (Chepeliev et al., 2023a) and (Chepeliev et al., 2023b).

Grouping	Shock channel
War-related agricultural shock	Agricultural productivity shock in Ukraine
Trade restrictions shock	Food and fertilizer export restrictions imposed by countries around the world (bans or export taxes) during 2022
Fertiliser-related and weather shocks	An increase in the price of imported fertilizer
	Weather-related agricultural productivity change
Energy-related shocks and sanctions (other shocks)	Economy-wide productivity shock in the Black Sea Region
	Restrictions on exports of electronics to Russia
	Restrictions on exports of electronics and manufacturing production from Russia
	Restrictions on imports of metals and chemicals from Russia and Belarus by the European countries
	Restrictions on imports of fossil fuels from Russia by the US and UK
	Restrictions in the global fossil fuel supply capturing the observed evolution of fossil fuel prices
	Restrictions on energy imports by the EU from Russia
Trade policy responses	Elimination of import tariffs on agricultural and food commodities
	Implementation of the trade facilitation measures: reduction in non-tariff barriers, ranging between 12 and 16 percent across regions

Table 1. Scenario framework

The impacts of the war on agricultural value chains are exacerbated by other shocks

The war in Ukraine, when combined with other disruptions in the commodity markets, leads to an overall reduction in agricultural trade. As estimated by the implemented modeling framework, global exports of grains and crops decline by around 1.2 percent, while exports of processed food drop by 0.4 percent. At the same time, rising agricultural commodity prices create incentives for agricultural exporters to expand production and replace some of the exports from the Black Sea region (Figure 2).

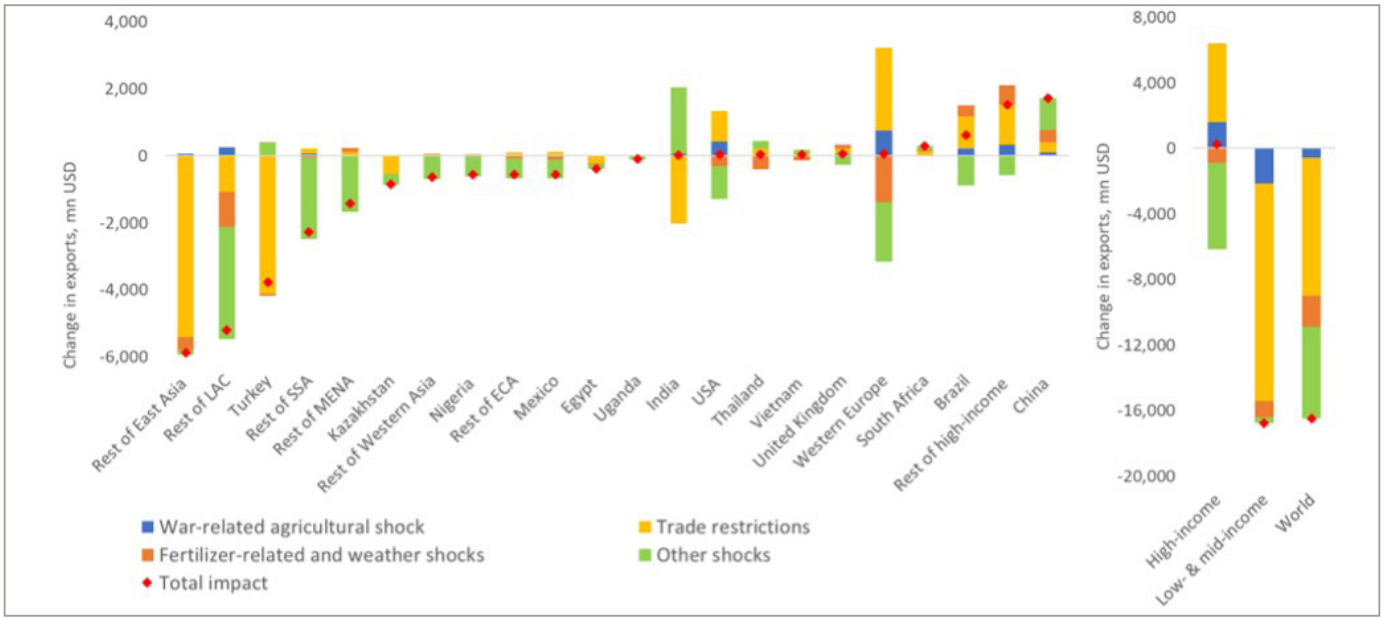

Figure 2. Change in agricultural and food exports across countries and regions, million $2014

Notes: Selected agricultural exporters are reported as individual countries or regions on the figure. Reporting of changes across composite aggregates on the right panel includes all countries/regions represented in the modelling framework.

When decomposed across drivers of the trade impacts, the results suggest that at the global level, the contribution of agricultural trade restrictions and that of other shocks, such as energy price increases (indicated in yellow and green in Figure 2 respectively), is substantially more significant than the direct war-related agricultural shock (Figure 2). The latter substantially reduces exports from Ukraine (indicated by blue bars in Figure 2), however, these reductions are to a large extent offset by increasing exports from other countries, in particular, high-income regions. Agricultural export-restricting policies implemented by many developing countries in an attempt to ensure domestic food security, on the other hand, have a substantially higher magnitude of impacts on global trade and are only partly offset by increasing exports from non-restricting countries (indicated by yellow bars on Figure 2). Increasing energy prices, fertilizer-related and weather shocks further adversely contribute to the global agricultural trade. When all these impact channels are combined, our results suggest that the direct disruption of the agricultural supply from Ukraine contributes less than 4% of the total reduction in global agricultural and food exports, while agricultural and fertilizer trade restrictions account for around 51%, followed by the energy-related shocks and sanctions (other shocks) (34%), and fertilizer-related and weather shocks (11%) (Figure 2).

When estimated changes in the trade value flows are translated to the calories supplied via international trade channels, the impact of the imposed trade restrictions is around 7–8 times larger than the impact of the agricultural supply shock in Ukraine. At the same time, while food supply disruptions in Ukraine have less adverse implications on global food exports compared to the applied trade restrictions, the geography of Ukraine's exports of grains and crops includes many low-income countries. Agricultural importers in Sub-Saharan Africa, such as Cameroon, Uganda, Yemen, Senegal, Niger and Tanzania, are the most vulnerable under the ongoing crises. These countries substantially rely on grain imports from the Black Sea region (Chepeliev et al., 2022) and they are also ranked among the bottom 25 least food-secure countries in the world according to the Global Food Security Index 2022 developed by The Economist.

Reductions of import tariffs and trade facilitation measures could mitigate the adverse impacts of commodity market disruptions

The observed commodity market disruptions have major adverse implications for the global economy in general, as well as for the agricultural and food sectors in particular. However, if countries implement policies toward reducing trade barriers, they could to a large extent mitigate the estimated negative impacts.

Results suggest that at the macro level, eliminating tariffs on imported agricultural and food commodities together with an implementation of TFMs, could have substantial benefits, in particular for developing economies. Out of the top 15 countries and regions that gain the most (in terms of per-capita income) from the reduction in trade barriers, two are low-income countries, seven are lower-middle income economies and five are upper-middle income.

Considered trade policies lead to substantial export expansions, as the overall value of agricultural and food trade increases by over 91 billion USD (or by around 6%) – more than five times overweighing the decline observed due to the war in Ukraine and related market disruptions. While high-income countries account for around 70% of total export increases, net agricultural importers in the developing world also benefit from the reduction in trade barriers. As a result, when measured in terms of the overall caloric supply, considered trade policies fully mitigate the adverse implications of the observed market disruptions and increase net daily per capita caloric supply by around 99 kcal (by 4%) in the low- and middle-income countries (Figure 3). Due to on average higher initial level of non-tariff barriers, an implementation of TFMs has a more substantial impact on increasing global food supply than the elimination of import tariffs – in a ratio of around 55% to 45% (Figure 3). The composition of impacts between the elimination of import tariffs and TFMs, though, differs across countries depending on the initial level of tariff barriers. We find that in such countries and regions like the Rest of Western Asia, Tunisia, Senegal, India and Thailand over half of the expansion in additional caloric supply is driven by the elimination of import tariffs. In addition, the elimination of import tariffs, on average, plays a more important role in increasing the food supply for low- and middle-income regions as opposed to high-income countries. In the former case, this policy instrument contributes around half of the additional supply, while the corresponding contribution is around one-third for the high-income economies.

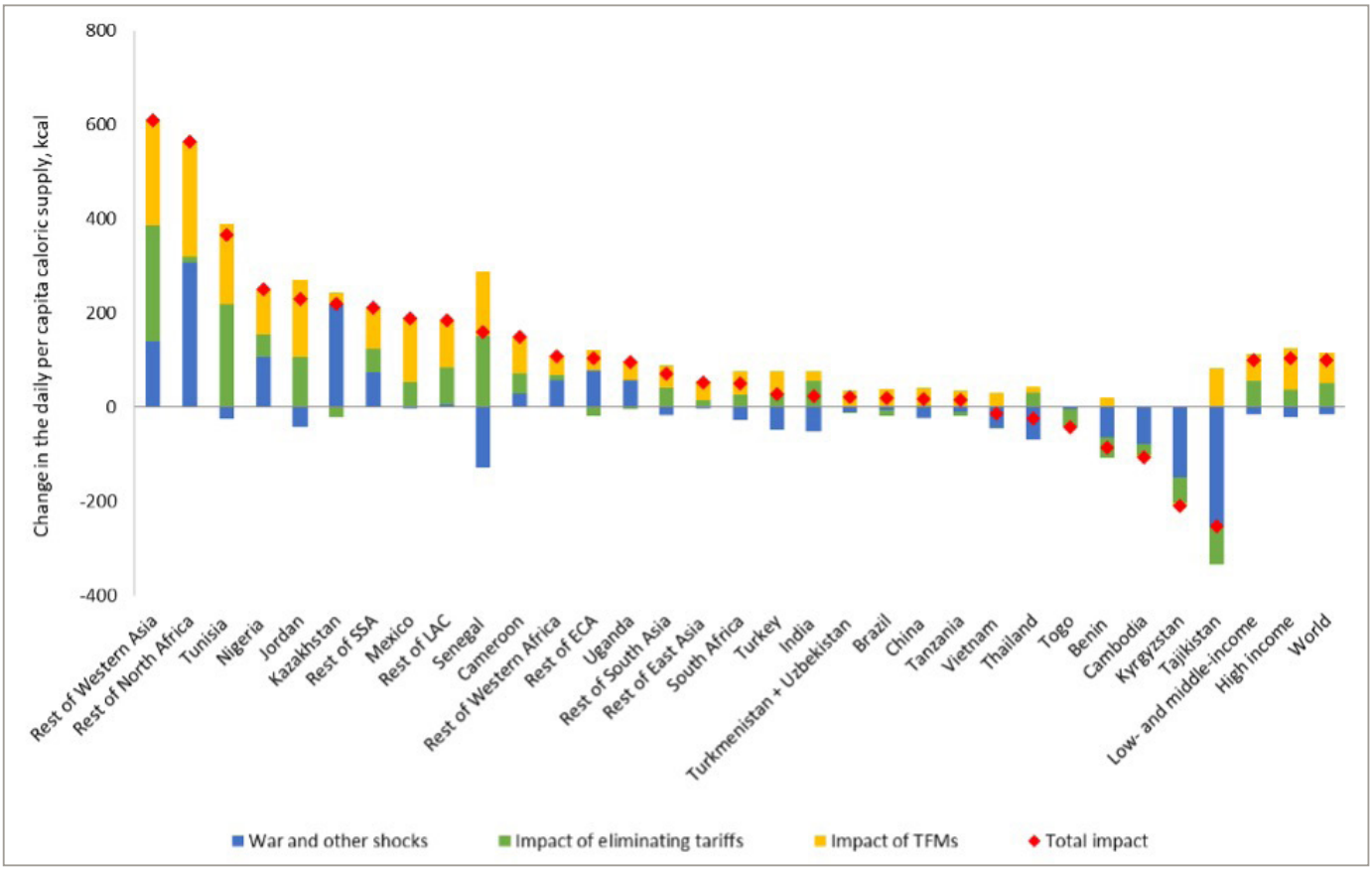

Figure 3. Impacts of trade policies on the caloric food supply in selected developing countries/regions and regional aggregates

However, not all developing countries benefit equally from the considered trade policy measures. Selected countries in Central and Southeast Asia, such as Kyrgyzstan and Tajikistan, as well as in Sub-Saharan Africa – Togo, Benin and Cambodia, tend to experience moderate reductions in food supply following and implementation of the global agricultural trade liberalization and facilitation policies (Figure 3). This result is driven by the reallocation of trade patterns across countries following the considered policy measures. In the case of Kyrgyzstan and Tajikistan, key reductions in food supply are related to the declining food imports from Kazakhstan, as the latter reallocates its exports of wheat toward the Rest of Western Asia. In the cases of Togo, Benin and Cambodia, the observed reductions are primarily driven by an expansion in exports. This stresses the importance of accounting for the second-order effects when analyzing agricultural trade policies.

Lessons learned

Our analysis provides several crucial policy insights. First, when analyzing the impacts of agricultural market disruptions, such as from the war in Ukraine, it is important to consider a broad context of the ongoing policies, climate impacts and market disruptions. As we show, in many cases, the latter substantially exacerbates the direct impacts of the war.

Second, with rapidly increasing food prices, some countries have started imposing agricultural trade restrictions to protect domestic consumers. Our results suggest that such actions should be avoided, as they only further jeopardize global food security. Emergency restrictions, if deemed necessary, should be targeted, transparent, proportionate, temporary, and in alignment with the World Trade Organization rules. They should also account for the impact on other countries, especially the least developed – a point largely overlooked during the analyzed food crisis.

Third, the consequences of the war in Ukraine have already put disproportionate pressure on lower-income households in developing countries, who spend a large share of their budget on food and energy. Buffering the impacts on poor households via targeted support measures, such as direct lump-sum payments, is a crucial step to ease the burden on the most vulnerable.

Finally, the analysis shows that the implementation of trade facilitation measures and the reduction of import tariffs on agricultural and food commodities could mitigate the impacts of the war and other market distortions by boosting agricultural trade and increasing overall food availability. We also find that developing countries tend to benefit the most from such trade policies. Considering that tariffs account for only a small fraction of costs, long-term measures should focus on improving poor shipping connectivity, inefficient logistics infrastructure and cumbersome border processes.

Going forward, greater transparency on the evolution and impact of trade policy actions, and on the global supply of food staples, would reduce uncertainty and lower the risk of escalating measures and countermeasures. It would also ensure that financial markets don't overreact to shocks or changes in trade policies. International organizations should better cooperate to provide real-time information on trade policy changes and their implications for global production and trade.

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PURDUE AGRICULTURAL ECONOMICS REPORT

NCR-Stat: Generational Gap in Rural North Central Region

Zuzana Bednarik, Research and Extension Specialist & Maria I. Marshall, Jim and Lois Ackerman Professor of Agricultural Econmics

Summary: *A generation gap revealed differences in diversity and trust in institutions.*

We've heard a lot about GenZ being the most diverse generation (Pew Research Center, 2018). There has also been more discussion about the generational gaps in subjective well-being, social inclusion, and trust in institutions. The North Central Regional Center for Rural Development's (NCRCRD) NCR-Stat: Baseline survey data concur with these national trends.

A generation gap refers to differences between generations in terms of their attitude, beliefs, actions, behaviors, or perspectives (Soni and Ashish, 2016). The differences across generations as demographic groups matter because their position in the life cycle shapes their views of the world. The members of particular age groups can express different opinions on most aspects of their lives, including social and economic equality, politics, social justice, technology, access to information, mental health, or trust.

We used the Pew Research Center's generational categories to learn about generation gaps in the North Central Region (NCR): GenZ, Millennials, GenX, Boomers, and Silent Generation (Pew Research Center, 2019). We also looked at what the different generations thought about their communities and their trusted sources, specifically community equity and belonging, trust in institutions, life satisfaction, and mental health.

The NCRCRD collects data to understand the challenges facing rural and urban communities within the NCR. Data are collected across households and focus on demographics, economics, health, housing, community development, and social behavior. NCR-Stat: Baseline Survey (Bednarikova et al., 2022) includes data collected on 4,668 households for the 12[1] states in the NCR. Although the NCRCRD surveys households in rural and urban areas, we concentrate only on the rural respondents in this article.

1 The 12 states include: IA, IN, IL, KS, MI, MO, MN, ND, NE, OH, SD, and WI.

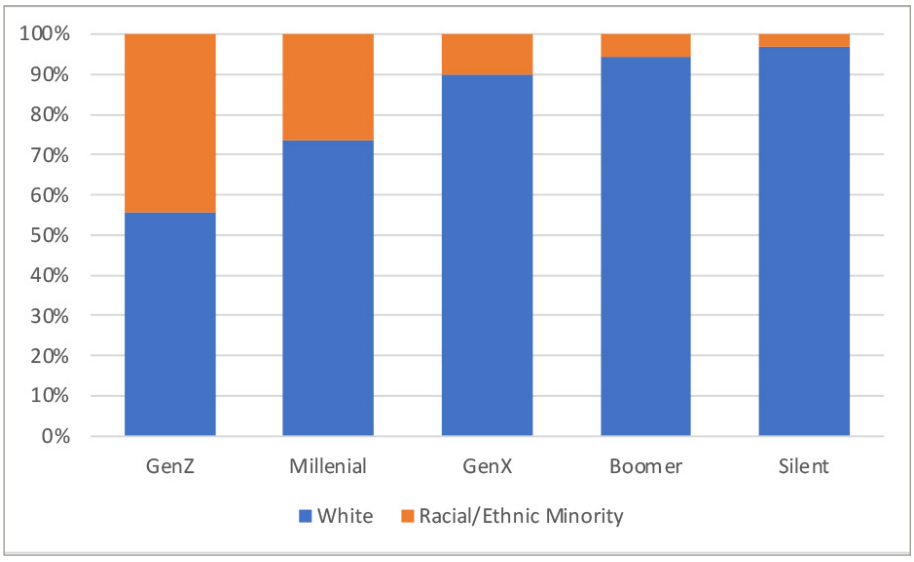

Figure 1. Diversity by generation
Source: Bednarikova et al. (2022). NCR-Stat: Baseline Survey

Overall, 16% of the respondents identified as either a racial or ethnic minority and 12% stated they were in multiracial or multiethnic households. Only 6% of white respondents were in multiracial/ethnic households compared to 46% of racial/ethnic minority respondents. Figure 1 shows the racial diversity across generations and demonstrates how each subsequent generation has become more diverse. In fact, 44% of GenZers are identified as a racial/ethnic minority compared to 5% of Boomers and 3% of the Silent Generation.

Community belonging and security

Younger generations (GenZ and Millennials) agreed at a higher rate than older generations with the statement that their local rural community made all residents feel welcome (Figure 2). However, only 45% of rural GenZ respondents reported that their community provided a safe and secure environment for residents of all backgrounds. It is a disconcerting result, especially compared to responses of older generations that felt otherwise (Figure 3).

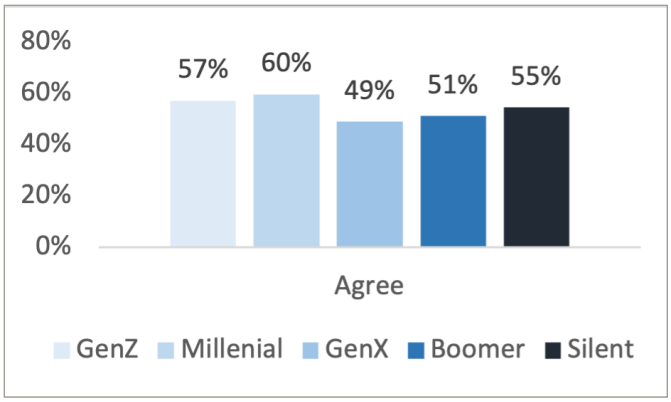

Figure 2. Community belonging
Source: Bednarikova et al. (2022). NCR-Stat: Baseline Survey

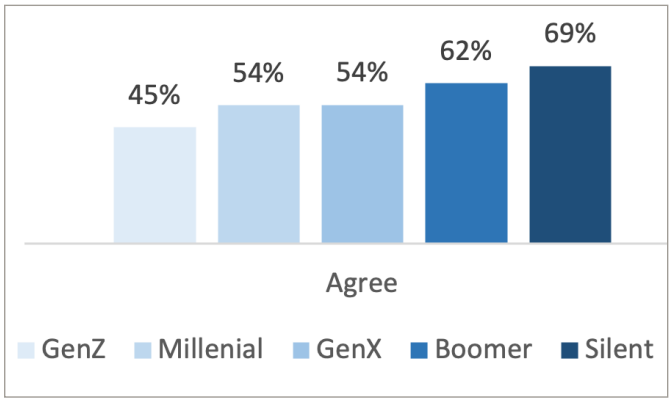

Figure 3. Community is safe and secure for all
Source: Bednarikova et al. (2022). NCR-Stat: Baseline Survey

Trust in local institutions

We measured trust in local institutions by asking how much the respondents trusted their local government and police. Only 19% of GenZ members trusted their local government compared to 58% of Silent Generation (Figure 4). About one-third of GenZ trusted their local police, which is again the lowest share among the generations, as each older generation reported higher trust in the local police (Figure 5). The results regarding the younger generation's mistrust concur with national trends (Harvard Youth Poll, 2023)

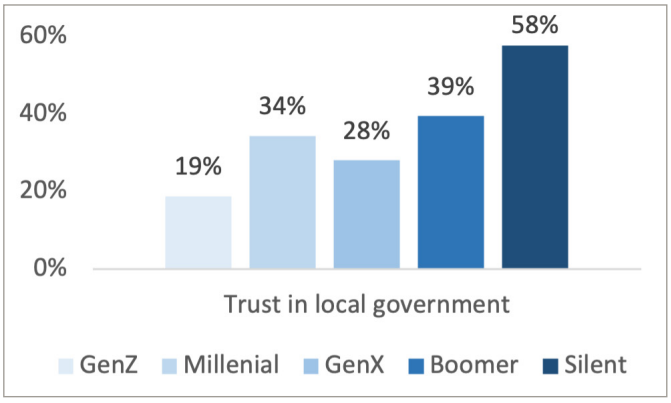

Figure 4. Trust in local government
Source: Bednarikova et al. (2022). NCR-Stat: Baseline Survey

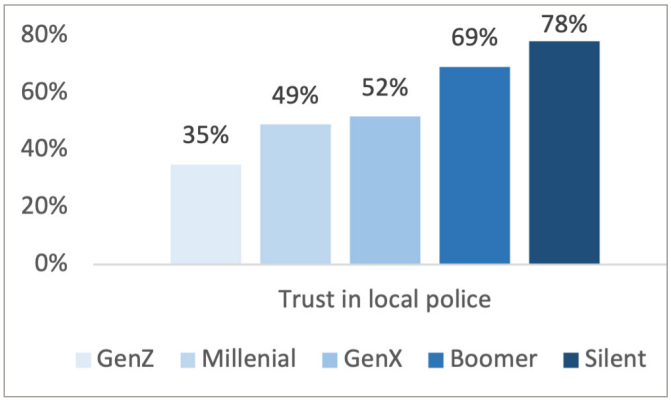

Figure 5. Trust in local police
Source: Bednarikova et al. (2022). NCR-Stat: Baseline Survey

Life Satisfaction

In the NCR-Stat: Baseline Survey, we asked respondents how satisfied they felt at the time of the survey. We used a Likert scale to measure self-reported life satisfaction, with 0 representing "not at all satisfied" and 10 as "extremely satisfied." The value of 5 is considered the midpoint, meaning "neither unhappy nor happy." The rural Silent

Generation was clearly the most satisfied with their lives among all generations, followed by the Boomers (7.9 and 7.2, respectively). On the contrary, GenZ reported the lowest level of life satisfaction (6.3) (Figure 6). This result suggests the existence of various factors that may influence the life satisfaction of the younger generations but may not necessarily be a concern for older generations.

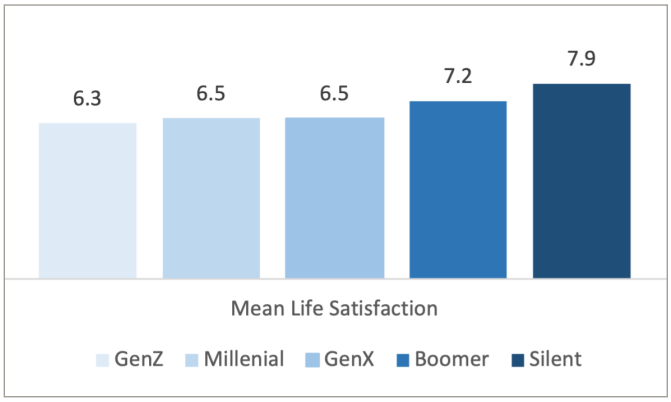

Figure 6. TMean life satisfaction by generation
Source: Bednarikova et al. (2022). NCR-Stat: Baseline Survey

Mental health

Mental health includes our psychological, emotional, and social well-being. Mental health is important in every stage of life as it affects our everyday living – how we feel, think, and act. It also helps determine how we relate to others, make choices, and handle stress. Figure 7 shows that younger adults – GenZ and Millennials tend more often than other generations to feel down, depressed, or hopeless. This trend reflects the national situation, showing that people between the ages of 18 and 44 reported the highest share of those living with symptoms of depression and anxiety (U.S. Census Bureau, 2021).

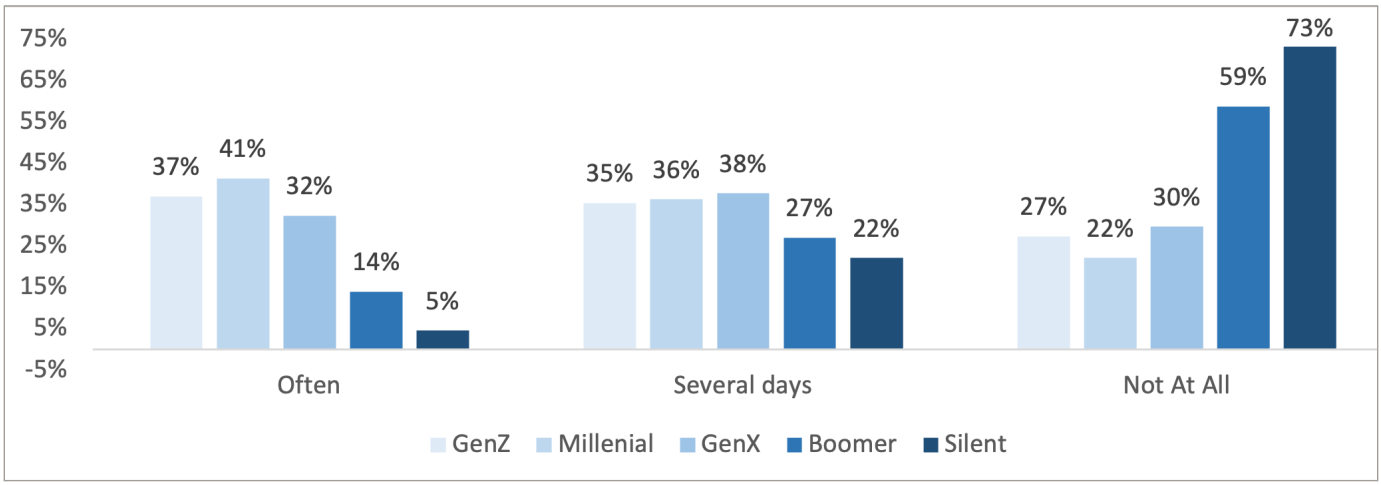

Figure 7. Frequency of feeling down, depressed, or hopeless by generation
Source: Bednarikova et al. (2022). NCR-Stat: Baseline Survey

Summary

Rural communities across the NCR are seeing the same demographic changes as the rest of the nation. The GenZ and Millenial generations are the most diverse. While younger generations feel more community belonging that older generations, they do not feel that their communities provide a safe and secure environment for all residents. Our data show that rural communities in the NCR are suffering from the same trust and mental health challenges as others across the country. The Boomer and Silent generation feel more life satisfaction than other generations. However, younger generations seem to be feeling disconnected and distrustful of institutions. The national mental health crisis is also affecting rural communities and in particular GenZ and Millenials.

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PURDUE AGRICULTURAL ECONOMICS REPORT

Biofuel production & policy: Contributions to economic and environmental analyses and policy decision

Farzad Taheripour, Professor of Agricultural Economics

Summary: Professor Taheripour reviews the growth of energy and biofuels policy as a key component of agricultural policy research. Explore the impactful contributions made by Purdue Ag Econ in this critical domain.

During the past two decades, biofuel production has surged globally due to market forces and policy interventions. Throughout this period, the faculties, researchers, and graduate students of Purdue University's Department of Agricultural Economic have made significant contributions in advancing national and international research on the economic and environmental consequences of biofuel production and policy.

Their extensive research, comprising over 100 peer-reviewed papers, book chapters and official reports, spans a wide range of biofuel-related topics. These include, but are not limited to:

1. **Techno-Economic Analysis (TEA):** Assessing the economic feasibility and viability of biofuel production.

2. **Supply Change and Life-Cycle Analysis (LCA):** Examining the entire life cycle of biofuels, from production to consumption to understanding environmental impacts.

3. **Economic Impacts:** Assessing both long-term and short-term economic effects of biofuel production and policy on agricultural and non-agricultural activities at local, national, and global scales.

4. **Land-Use Change Effects:** Evaluating land-use change implications of producing biofuels from various feedstocks, including conventional crops like corn and soybeans and dedicated energy crops such as miscanthus and switch grass.

While these research efforts have helped the research community to better understand the economic and environmental impacts of biofuel production and policy, they have also contributed toward policy design and debates in this area.

The biofuel research conducted by Purdue's Department of Agricultural Economic has been instrumental in shaping biofuel polices, defining low carbon fuel standards, and receiving widespread citation in official reports from various national and international agencies. Notably, the California Air Resources Board has adopted emissions estimates related to Induced Land Use Change (ILUC) from Purdue's GTAP-BIO model. The Argonne National Laboratory utilizes Purdue's ILUC estimates to assess the carbon intensity of biofuel pathways in its carbon model (GREET). Several states set their biofuel policies using this model.

Additionally, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) of the International Civil Aviation Organization (ICAO) relies on Purdue's GTAP-BIO model to evaluate ILUC greenhouse gas (GHG) emission values for Sustainable Aviation Fuel (SAF) pathways. The US Environmental Protection Agency (EPA) has cited various papers and reports from Purdue in its Third Triennial Report to Congress on Biofuels (RtC3), emphasizing

the significant contributions of researchers such as Alla Golub, Roman Keeney, Thomas Hertel, Farzad Taheripour, and late Wallace E. Tyner.

In a model comparison exercise conducted in 2023, the EPA has used five models to evaluate the potential of biofuels in reducing GHG emissions, with the GTAP-BIO model being one of them. The results of this practice will be used to define new goals for the US Renewable Fuel Standard (RFS).

PURDUE AGRICULTURAL ECONOMICS REPORT

Food Prices

Caitlinn Hubbell, Market Research Analyst & Joe Balagtas, Professor of Agricultural Economics

Summary: *Hubbell and Balagtas examine data from 2023 and explain the factors that drove changes to food prices. Looking to 2024 they highlight macro factors that will determine whether food price inflation continues to slow.*

Food price inflation slowed in 2023, rising by 2.3% over the course of the year (see Figure 1). That was the slowest growth in food prices since 2019, before the onset of the COVID-19 pandemic and related disruptions to the economy. Prices of Food at Home (FAH, or groceries) rose by 0.7%, while prices for Food Away from Home (FAFH, or food service, including restaurant meals) rose by 5.2%.

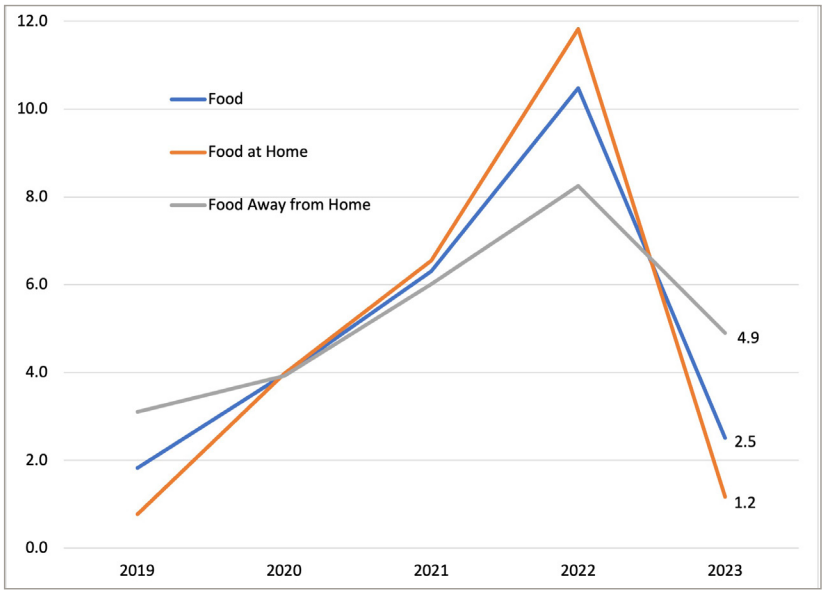

Figure 1. Annual Changes in the Consumer Price Index for Food, Food at Home, and Food Away from Home
Source: author's calculations from Bureau of Labor Statistics data

In addition to higher prices for Food Away from Home, the items with the largest price increases were beef and sugar and sweets. Beef prices were 9.7% higher this December than they were a year ago, driven by strong demand and low cattle inventories. Sugar prices were 5.2% higher than a year ago, as droughts in key producing areas around the world, including the U.S. South, have limited sugar production.

Meanwhile, prices for some food staples fell in the past year. Egg prices fell by 23.8%, as the incidence of highly pathogenic avian influenza (HPAI) faded through the last half of the year. Prices of fresh vegetables fell by 5.3%, and prices of cheese products fell by 3.3%.

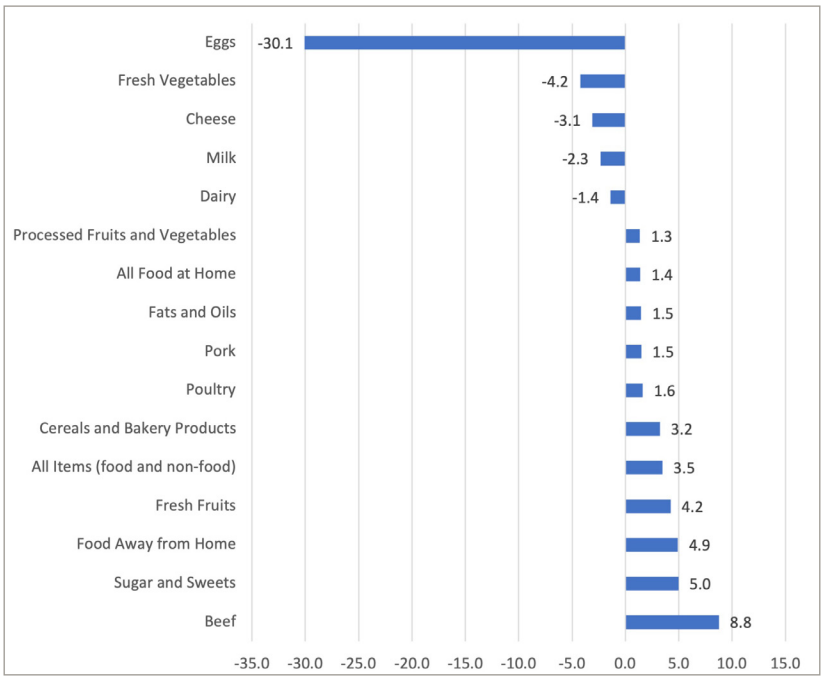

Figure 2. Price Changes in 2023
Source: author's calculations from Bureau of Labor Statistics data

While food price inflation eased in 2023, the combined effect of inflation over the past several years has left food prices significantly higher than they were pre-pandemic. Food prices are 25% higher than they were in 2019, before the onset of the COVID-19 pandemic. Those price increases, together with higher prices in general, have eroded consumer purchasing power. As a result, consumer confidence in the economy is lower than it was even at the height of the COVID-19 pandemic.

But economic conditions started to improve in the last half of 2023. Historic interest rate hikes by the Fed starting in Spring 2022 seem to be having their intended effect of slowing inflation. Inflation has slowed not only for food prices, but across the rest of the economy, as well. Energy prices have fallen 2% in 2023 and core inflation (that is, prices of all items excluding food and energy), while not yet at the Fed's 2% target rate, is moving in that direction. Core inflation was 3.1% through December 2023, and had slowed in the last half of the year.

At the same time, overall economic growth has contributed to increased incomes. Average wages rose by 4.1% through November, more than offsetting inflation. This marks the first year since 2020 that consumer purchasing power increased.

So, what's on the horizon for 2024?

Macroeconomic uncertainty will continue to exist through 2024 (LINK TO MACRO OUTLOOK HERE). The Fed is focused on bringing inflation down, so hopefully the worst of inflation is behind us. However, higher rates may also slow economic growth, causing higher unemployment and slower wage growth. Thus far we have avoided the recession that some economists have been predicting for more than a year, but it still remains to be seen whether the Fed can pull off the so-called "soft landing."

In food market news, highly pathogenic avian influenza (HPAI) has shown some signs of re-emerging, resulting in the loss of 1.5 million birds in December 2023. Should this resurgence continue, we could see higher poultry and egg prices, similar to what was seen in 2022. (To keep up to date on egg prices, visit the dashboard published by the Center for Food Demand Analysis and Sustainability.)

The U.S. Department of Agriculture Economic Research Service is forecasting food prices will continue to "decelerate" in 2024, with Food at Home prices decreasing by 0.6% and food away from home prices predicted to increase by 4.9%. ERS predicts the highest price increases in beef and veal (4.8% increase) and sugar and sweets (4.9% increase) for 2024.

Respondents to our recent Consumer Food Insights (CFI) survey also expect a decline in the rate of food inflation during 2024. In December 2023, consumer inflation expectations for the next 12 months (3.5%), was 0.6% lower than the 12-month expectation in December 2022. A recent decrease in consumer food inflation expectations from our CFI survey suggest a similar outlook to the ERS report.

Whether or not these forecasts will play out to be true remains to be seen, but we are optimistic that with the increase in overall income and purchasing power over the next year, it will hopefully lead to consumers seeing relief on their wallets.

PAER-2024-08

January 2024

PURDUE AGRICULTURAL ECONOMICS REPORT

What To Watch in Dairy Markets in 2024?

Nicole Olynk Widmar, Interim Department Head and Professor of Agricultural Economics

Summary: *Professor Widmar reviews key changes to dairy market fundamentals and how consumer and producer prices have responded. Looking ahead, tight supplies are expected to persist but limited demand growth could limit price increases.*

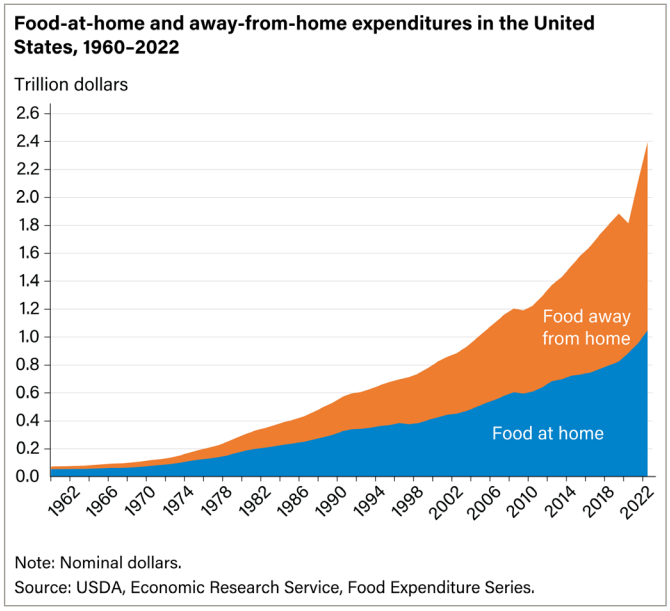

Image from USDA, Economic Research Service (ERS) graphic

While the supply (milk production) and demand for milk and dairy products are clearly the fundamentals of the dairy marketplace, there are a number of other economic and socioeconomic factors impacting milk markets. Inflation is front of mind for U.S. households and volatility in energy prices alongside uncertainty in housing and other necessity costs has put increasing pressure on household budgets, potentially prompting changes in buying behavior surrounding grocery store item purchases, decisions for eating at-home versus away-from-home, and challenging purchasing power of U.S. households for both consumables and durable goods.

Spending on food away from home has long been part of the conversation surrounding demand for various dairy products. Cheese is a significant component of pizza, for example. And, many of us routinely consume more butter and cheese in meals away from home than those we cook ourselves. The USDA, Economic Research Service (ERS) released in July 2023 the graphic showing food away from home versus at home since 1960 (See https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=58364) . The impacts of COVID-19 are readily visible with a sharp decline in eating out during the initial impacts of the pandemic, although by 2022 food away from home comprised 56% of total food expenditures. Inflationary pressures were lightening, but still present, as we closed 2023. How spending on food at home versus away from home changes (or doesn't change) in 2024, especially in light of inflationary pressures increasing the costs of the food baskets purchased by households, remains to be seen.

The end of 2023 saw downward trends in both butter and cheese prices (See USDA, ERS Livestock, Dairy, and Poultry Outlook from December 2023). Nonfat dry milk was adjusted higher, but the Class IV 2023 overall was lower to close out 2023 as the decrease in butter prices outweighed the increase in nonfat dry milk.

The end of 2023 was marked with softening prices for many dairy products and overall lowered expectations of milk prices. Lower cheese prices are expected to persist in 2024, while butter prices are expected to be consistent to slightly higher. Following those expectations, the Class IV projection for 2024 (released by ERS in December 2023) was adjusted higher to $18.90 while the Class III price forecast for 2024 was lowered to $16.85 per cwt. Yet, the all milk price forecast for 2024 was lowered $0.55 cents from the November forecast to $20.25 per cwt.

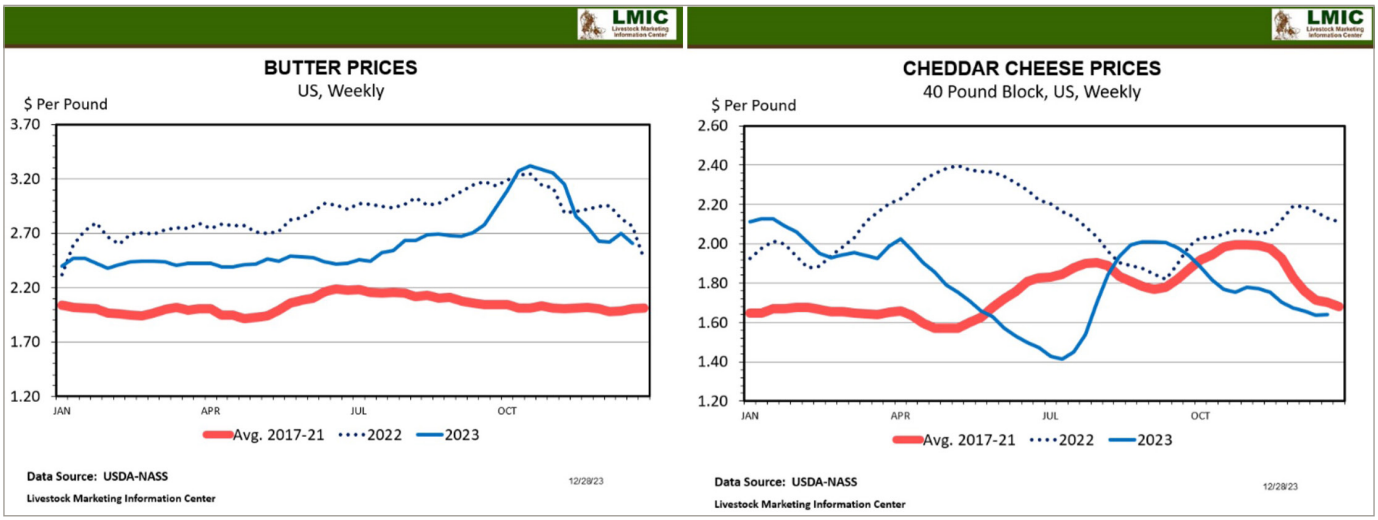

Image from Livestock Marketing Information Center

Ultimately dairy demand remains an open-ended question on multiple fronts, both domestically and globally. Global milk supply is expected to increase very modestly, but unrest in various regions and strained trade relationships potentially hinder growth in demand for our dairy products. Taken all together we have a relatively tight supply but rather limited expectations of growth in demand; essentially the global markets sit in a somewhat precarious balance. Feed costs, labor availability and costs, and weather remain as key "factors to watch" for U.S. dairy markets in 2024. Additionally, geopolitical instability, inflationary pressures, and macroeconomic concerns broadly should be part of the 2024 watch list as they are expected to impact demand, and especially the prospects of "new" demand for dairy products.

PURDUE AGRICULTURAL ECONOMICS REPORT

2024 Farmland and Cash Rent Outlook

Todd Kuethe, Professor and Schrader Endowed Chair in Farmland Economics

Summary: The growth rate of Indiana farmland prices is expected to moderate in 2024. Cash rental rates are expected to hold steady or increase in 2023.

Farmland Values

While the farmland market has been robust in recent years, there are signs that price growth may ease in 2024. In 2023, farmland prices across Indiana again set a new record high, at $13,739 per acre for top quality land, $11,210 for average quality land, and $8,689 for poor quality land. Price growth was robust, but muted compared to the record growth between 2022 and 2023.

The Purdue Farmland Values and Cash Rent survey is conducted in June of each year. The most recent iteration of Iowa State University's land value survey, released in December 2023, found that farmland values across Iowa increased by 3.5% between November 2022 and November 2023, a muted growth rate compared to the 17% and 31% increases observed in the preceding years. In addition, the most recent agricultural banker survey by the Federal Reserve Bank of Chicago suggest that land value growth has slowed across their district, which includes northern portions of Indiana and Illinois, southern Wisconsin, the lower peninsula of Michigan, and all of Iowa.

The recent growth in farmland prices across the Corn Belt was supported by higher commodity prices, increased demand for land conversion to nonagricultural uses, and the overall strength of the farm economy. But price growth has been muted by rising costs of borrowing. While the overall picture remains optimistic compared to long run averages, it appears the rapid growth of the past two years may be coming to a close.

Cash Rental Rates

The recent 2024 Purdue Crop Cost & Return Guide suggests that the contribution margin, the difference between market returns and variable costs, will increase relative to 2023 levels for both rotation corn (up 20.6%) and rotation soybeans (up 8.1%). Increasing margins generally signals upward pressure on cash rental rates, as farm operators will have additional revenues to allocate to labor, investment, and land. However, in 2023, the cash rental rate exceeded the contribution margin for rotation corn, which puts downward pressure on 2024 rental rates for corn acreage. In addition, farmers will no doubt stress the increased costs and concerns for lower commodity prices when trying to negotiate less aggressive cash rent hikes.

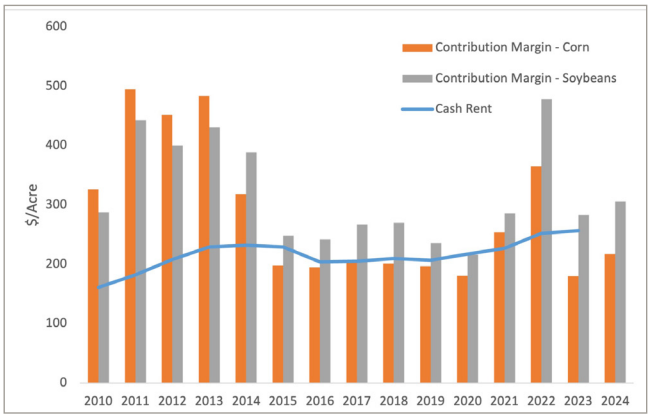

Figure 1. Cash rental rate and contribution margin for rotation corn and soybean for average quality land, 2010-2023

Similar to the farmland sales market, the cash rental market shows a variety of positive and negative price pressures but the overall conditions suggest modest positive price pressure.

PAER-2024-10

January 2024

PURDUE AGRICULTURAL ECONOMICS REPORT

2024 Agricultural Credit Outlook

Brady Brewer, Associate Professor of Agricultural Economics & Todd Kuethe, Professor and Schrader Endowed Chair in Farmland Economics

Summary: *Increasing interest rates, higher demand for loans, lower repayment rates, and fund availability suggest agricultural credit markets trending downward for 2023.*

2023 saw increasing interest rates, stable land values and lower farm profits relative to the year before. Overall, it was a good year for farmers balance sheets for both short-term and long-term assets. Overall, farmers have benefited from several years of higher net incomes, meaning that liquidity is high. This has resulted in some farmers decreasing operating loans to avoid higher interest rate costs which has pushed the demand for loans downward. This article examines the trends in three key parts of the agricultural credit markets: interest rates, the demand for loans, and non-performing loans. We examine data obtained from the two Federal Reserve banks that serve Indiana. As shown in Figure 1, 68 counties in northern and central Indiana are part of the Federal Reserve Bank of Chicago region, and the remaining 24 counties in southern Indiana are part of the Federal Reserve Bank of St. Louis.

Figure 1. Chicago and St. Louis Federal Reserve Districts

Both Federal Reserve banks conduct quarterly surveys of agricultural bankers in their region. The surveys address important issues in farmland and agricultural credit markets. It is important to note that both Federal Reserve regions cover a large areas with diverse agricultural sectors. Thus, local conditions may deviate from broad, regional trends. At the time of writing, data for the St. Louis Federal Reserve district were available through the third quarter of 2023 through the Federal Reserve Bank of Kansas City's Agricultural Finance Updates, and data for the Chicago Federal Reserve district were available through the third quarter of 2023 through the bank's AgLetter publication.

Interest Rates

Interest rates have increased around 4 percentage points from 2022 to the end of 2023. The Federal Open Market Committee (FOMC), a twelve person committee consisting of members of the board of Governors from the Federal Reserve System and presidents from the eleven Reserve Banks, raised the Fed Funds Rate[1] four times in 2023, this was after 7 consecutive increases in 2022. Figure 2 plots the average interest rate on farm operating loans since the first quarter of 1991 for the Chicago fed district and the second quarter of 2012 for the St. Louis Fed district.

1 The Fed Funds Rate is the interest rate at which deposit granting institution (i.e. banks) trade federal funds with each other.

Farm operating loans are defined as those used primarily to finance current crop production expenses and the care and feeding of livestock (including poultry). Data for the St. Louis district does not go back as far as the data for the Chicago district does; however, the longer time period is being shown as it helps put perspective on the increases in interest rates that were experienced in 2023.

The latest data available for each of the two Federal Reserve's that cover Indiana is from the 3rd quarter of 2023. Operating loan interest rates for the Chicago Fed district were 8.77% while operating loan interest rates for the St. Louis Fed district were 8.5%. At the beginning of 2023, operating loan interest rates were 7.9% for the Chicago Fed district and 7.99% for the St. Louis Fed district. Interest rates increased 0.60 percentage points for the Chicago Fed district and 0.78 percentage points in the St. Louis Fed district. In comparison, this same time period for last year, in 2022, saw 1.9 and 1.25 percentage point increases for the Chicago Fed district and St. Louis Fed district, respectively. This is the highest interest rates the Chicago Fed district has seen since the 2nd quarter of 2007. This is the highest interest rates the St. Louis Fed district has seen in the recorded data which goes back to the 1st quarter of 2012.

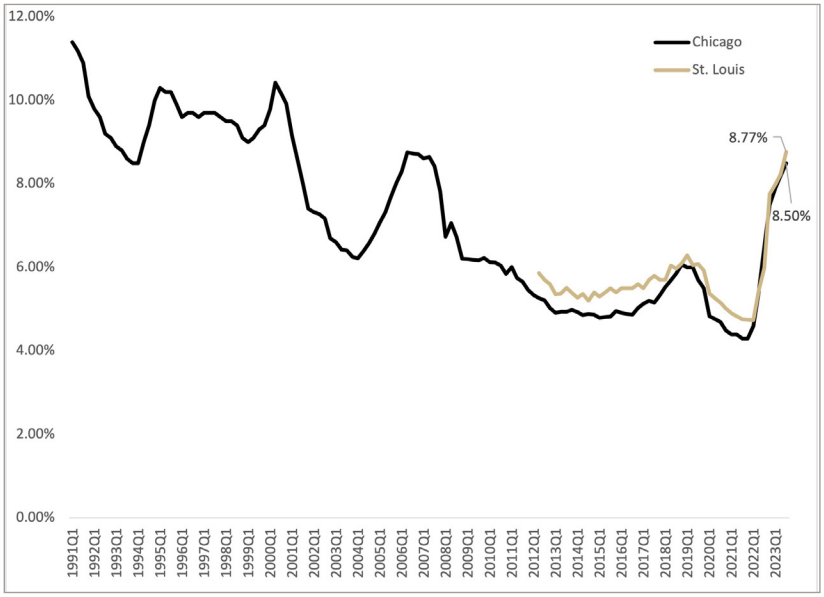

Figure 2. Average Fixed Interest Rate on Operating Loans, 1991Q1-2023Q3

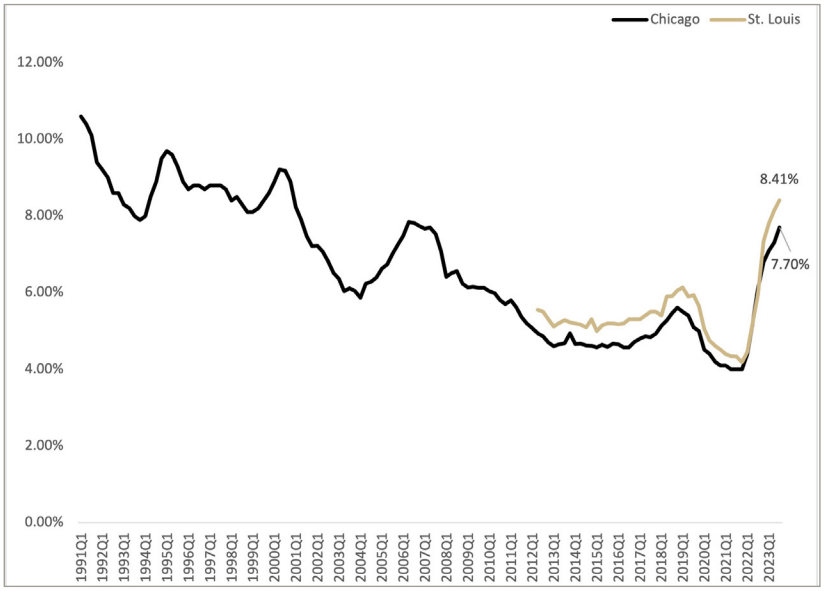

Figure 3. Average Fixed Interes Rate on Long Term Farm Real Estate Loans, 1991Q1-2023Q3

Figure 3 plots the average fixed interest rates on long-term farm real estate loans. The most recent survey results suggest an average farm mortgage rate of 7.7% in the Chicago Fed district and 8.41% in the St. Louis Fed district. These interest rates are up 0.6 percentage points in the Chicago Fed district from the 1st quarter of 2023 where they averaged 7.1% and they are up 0.5 percentage points in the St. Louis Fed district where they averaged 7.81% in the first quarter of 2023. While 2023 saw interest rate increases for farm real-estate loans, the size of the increase is less than what farmers saw in 2022. This is the highest farm real estate interest rate since the 2nd quarter of 2007 in the Chicago Fed district and the highest interest rate since the data has been collected which started in the 2nd quarter of 2012.

One key predictor of where interest rates will go is the Fed Funds rate. Every other FOMC meeting, the "Summary of Economic Conditions" is released. This summary represents the views on certain economic indicators by the FOMC committee. In this summary, it is expected that the Fed Funds rate will decrease in 2024 to a target range of 4.5% to 4.75%

Whether we see a decrease in the Fed Funds comes to fruition will in large part rest on if the US economy continues to see inflation impacting consumers purchasing power along with the labor market remaining strong. While it is unlikely that inflation will return to the Fed Reserves target of 2% in 2024, if it eases enough, we may see the Fed be more aggressive in returning the Fed Funds rate toward

their long-run target of 2.5% to 2.75% as reported in the "Summary of Economic Conditions".

Demand for Loans And Bank Condition

The Federal Reserve Bank surveys ask agricultural bankers to rate the demand for loans at their institution relative to a year earlier. Respondents report whether the demand for loans is "higher," "lower," or the "same." These responses are summarized by a loan demand index, calculated as the share of lenders reporting "higher" minus those reporting "lower" plus 100. Thus, when the loan demand index is less than 100, the demand for agricultural loans is decreasing. Figure 4 shows that the demand for agricultural loans decreased in 2023 relative to 2022, which continued the trend that started in 2022. Agricultural bankers reporting lower demand for agricultural loans has remained steady over the past two years. This is in large part due to ample amounts of liquidity at the farm level along with higher interest rates for operating and farm real-estate loans.

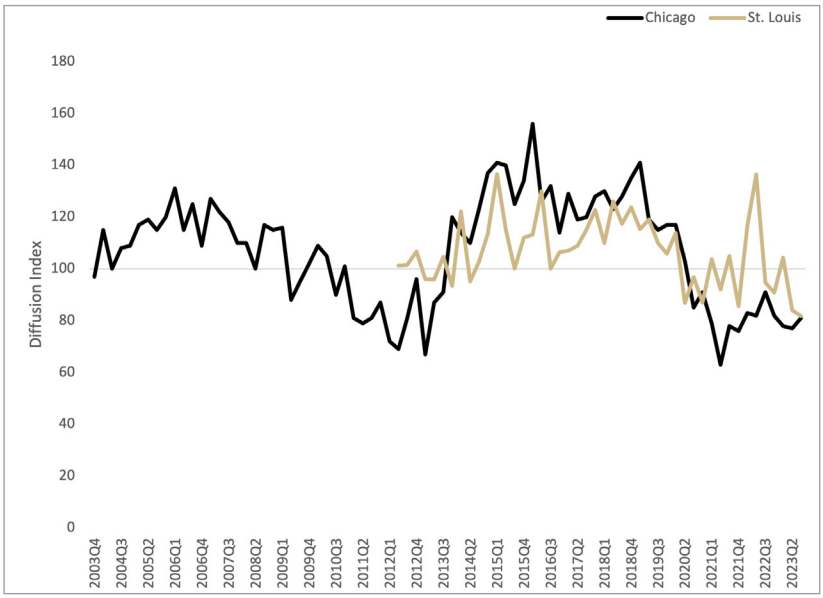

Figure 4. Demand for Agricultural Loans, 2003Q3-2023Q3

A trend that started in 2022 was that bankers reported less funds available to loan out than in previous years. This trend has continued through 2023 as agricultural bankers in the Chicago Fed district and the St. Louis Fed district continue to report lower amount of funds available to loan out. This is in large part driven by lower deposits at lending institutions as the rate of return for certain investments has increased, incentivizing customers to withdraw cash to invest in other assets. However, there isn't, to date, any indication that banks are stressed, but does show that there may be a tightening of deposits and other funds that have been available. This will be something to keep an eye on throughout 2024.

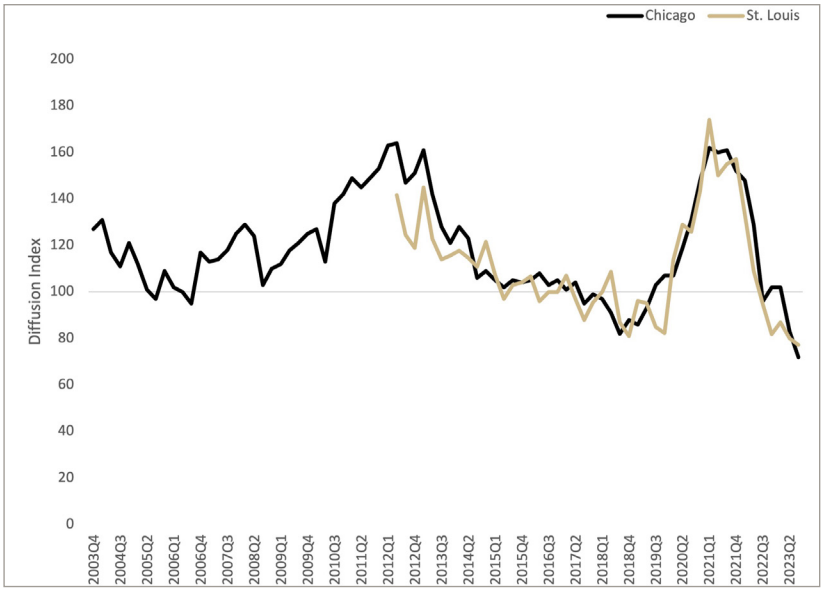

Figure 5. Availability of Funds at Agricultural Banks, 2003Q3-2023Q3

Non-Performing Loans

Farmers' rate of loan repayment declined in 2023, a continuation of a trend that started in 2021. However, the index is still above 100, indicating that loan repayment is still strong, it has just fallen from the highs that were seen in 2021. The index is similarly constructed based on lenders reported repayment rates relative to the same quarter of the previous year. Given that the loan repayment rate index for Chicago is exactly 100, the index suggests that farmers saw no change in their ability to pay off debts relative to a year ago. The St. Louis Fed index is 104 for the 3rd quarter of 2023, indicating farmers were able to pay off slightly more of their debts relative to a year ago. This suggests that repayments rates are still strong in agriculture, although this index has fallen from a year ago.

Overall, the data shows a positive story for the 2024 agricultural credit market. Farm incomes were down in 2023 relative to 2022, but liquidity remains strong in the agricultural sector. Despite the decrease in farm income, bankers stable to slightly higher rates of repayment from farmers they lend to. Additionally, demand for loans is

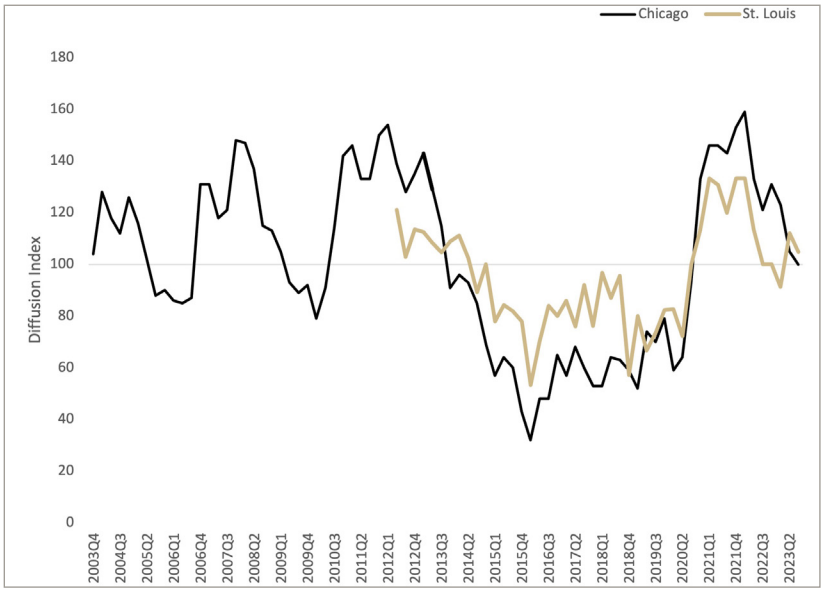

Figure 6. Loan Repayment Index, 2003Q3-2023Q3

on a trajectory such that farmers will have lower amounts of operating loans for the 2024 growing season, which means that if farm incomes do fall and cash flow were to be an issue, there is less debt out that may become troubled. Interest rates are also on an downward trajectory as well. If the Fed Funds Rate does indeed start to fall in 2024, we can expect the interest rate the farmers pays to decrease similarly. Even if the ag credit market takes a step back, or even two, it is still well positioned to serve the agricultural sector.

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PURDUE AGRICULTURAL ECONOMICS REPORT

2024 Purdue Crop Cost and Return Guide

Michael Langemeier, Professor of Agricultural Economics

Summary: Production costs are expected to decline from 2023 record levels. However, production costs are still considerably higher than what they were prior to the advent of COVID-19.

The 2024 Purdue Crop Cost and Return Guide, which is available for free download from the Center for Commercial Agriculture website, gives estimated costs for planting, growing and harvesting a variety of crops, as well as estimated contribution margins and earnings. The guide is updated frequently as grain futures prices change and the costs of inputs, such as seed, fertilizer, pesticides and fuel, fluctuate. This paper discusses estimates made in early December.

The guide presents cost and return information for low, average, and high productivity soils. The discussion in this paper will focus on the estimates for average productivity soil. Table 1 presents crop budget information for continuous corn, rotation corn, rotation soybeans, wheat, and double-crop soybeans for average productivity soil. Double-crop soybeans are typically planted after wheat so it is typical to combine the contribution margin

Table 1. 2024 Purdue Crop Budget for Average Productivity Soil.

	Continuous Corn	Rotation Corn	Rotation Soybeans	Wheat	Double-Crop Soybeans
Expected Yield per Acre	179	190	58	80	41
Harvest Price	4.90	4.90	12.40	6.15	12.40
Market Revenue	$877	$931	$719	$492	$508
Less Variable Costs					
Fertilizer	209	190	76	119	56
Seed	124	124	74	44	86
Pesticides	111	105	66	40	57
Dryer Fuel	48	38	0	0	5
Machinery Fuel	24	24	15	15	11
Machinery Repairs	45	45	40	40	25
Hauling	19	20	6	8	4
Interest	32	31	17	15	15
Insurance and Miscellaneous	48	48	41	9	9
Total Variable Costs	$660	$625	$335	$290	$268
Contribution Margin	$217	$306	$384	$202	$240
Earnings	-$178	-$79	-$1	-$183	$240
Breakeven Price	$5.89	$5.32	$12.41	$8.44	$6.54

See ID-166-W for more detail, December 2023 Estimates.

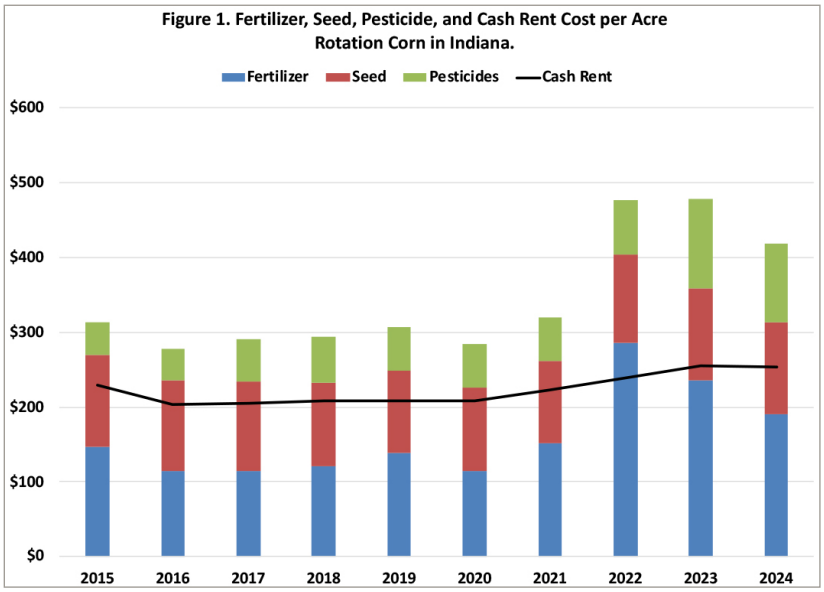

Figure 1. Fertilizer, Seed, Pesticide, and Cash Rent Cost per Acre Rotation Corn in Indiana

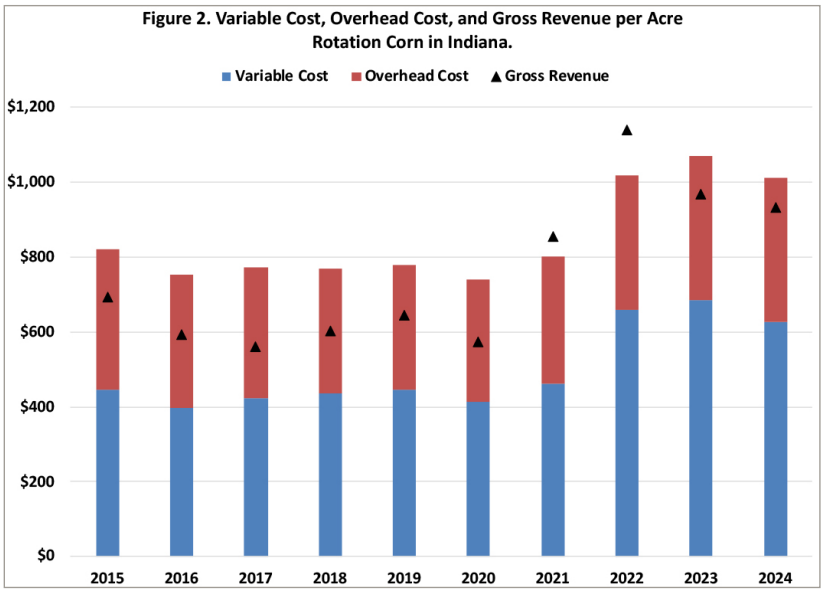

Figure 2. Variable Cost, Overhead Cost, and Gross Revenue per Acre Rotation Corn in Indiana

for these two crops when comparing to continuous corn, rotation corn, and rotation soybeans. The yield estimates reflect trend yields for Indiana for each crop. The contribution margin, obtained by subtracting total variable cost from market revenue, ranges from $217 per acre for continuous corn to $442 per acre for wheat/double-crop soybeans. The contribution margins for rotation corn and rotation soybeans on average productivity soil are $306 and $384 per acre, respectively. The contribution margin is used to cover overhead costs such as machinery ownership costs, family and hired labor, and cash rent. Failure to adequately cover these overhead costs typically puts downward pressure on cash rent and land values.

From 2007 to 2013, the contribution margin for rotation corn on average productivity soil was higher than the contribution margin for rotation soybeans. The average difference in the contribution margin was $38 per acre during the 2007 to 2013 period. The situation was considerably different from 2014 to 2023. The average difference in the contribution margin during this period was an advantage for soybeans of $55 per acre. The projected difference in contribution margins between corn and soybeans for 2024 is $78 per acre in favor of rotation soybeans.

Figure 1 illustrates the trends in fertilizer, seed, pesticide, and cash rent costs for rotation corn on average productivity soil from 2015 to 2024. Fertilizer costs in 2024 are expected to be approximately 19 percent lower than what they were in 2023. However, fertilizer costs are still expected to be $39 per acre ($0.21 per bushel) higher than costs in 2021. Cash rent per acre in 2024 is expected to be $253 per acre ($1.33 per bushel), which is similar to the 2023 cash rent per acre. Herbicide and seed costs are expected to be similar to 2023 levels.

Gross revenue (market revenue plus government payments), variable cost, and overhead cost per acre for rotation corn on average productivity soil is illustrated in figure 2. Government payments are expected to zero in 2024. Variable cost per acre in 2024 is expected to be $58 lower than it was in the 2023 budget, which represents an 8.5 percent decline. Variable cost per bushel in 2024 is estimated to be $3.29. Fixed cost (overhead cost) per acre is projected to be $385, which is similar to last year's cost. The breakeven price needed to cover variable and fixed costs varied from $4.89 to $4.98 per bushel from 2013 to 2015. In 2016 and 2017, the breakeven price declined to approximately $4.55 per bushel. The breakeven prices in 2018 and 2019 were approximately $4.45 per bushel, respectively. Breakeven prices in 2020 and 2021 were approximately $4.20 and $4.45, respectively. The breakeven price for 2022 was $5.60 per bushel, which was 25.6 percent higher than the 2021 breakeven price. In 2023, the breakeven price was $5.82 per bushel or 3.8 percent higher than the 2022 breakeven price. In 2024, the projected

breakeven price is expected to decline to $5.32, which is above projected fall 2024 corn prices. Gross revenue for rotation corn in 2024 is expected to be $931 per acre or 3.6 percent lower than gross revenue in 2023. Combining the expected gross revenue for 2024 with total production costs (variable plus fixed costs) results in an expected loss for rotation corn of $79 per acre.

Figure 3 illustrates the trends in fertilizer, seed, pesticide, and cash rent costs for rotation soybeans from 2015 to 2024. Fertilizer and herbicide costs in 2024 are expected to be approximately $10 per acre lower to costs in 2023, but still substantially above those experienced in 2021.

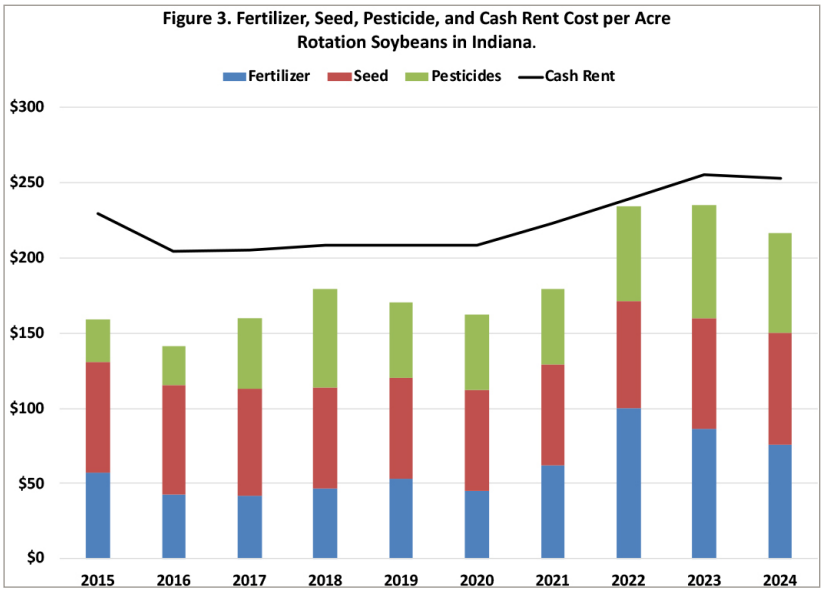

Figure 3. Fertilizer, Seed, Pesticide, and Cash Rent Cost per Acre Rotation Soybeans in Indiana

Gross revenue (market revenue plus government payments), variable cost, and overhead cost per acre for rotation soybeans on average productivity level is illustrated in figure 4. Government payments are expected to be zero in 2024. Variable cost per acre in 2024 is projected to be $335 per acre ($5.78 per bushel), or approximately 3 percent lower than they were in 2023. Fixed cost per acre is projected to be $385 per acre in 2024. The breakeven price needed to cover variable and fixed costs is expected to decrease from $13.07 in 2023 to $12.41 per bushel in 2024, which represents a 5 percent decline. The expected loss in 2024 for rotation soybeans is $1 per acre.

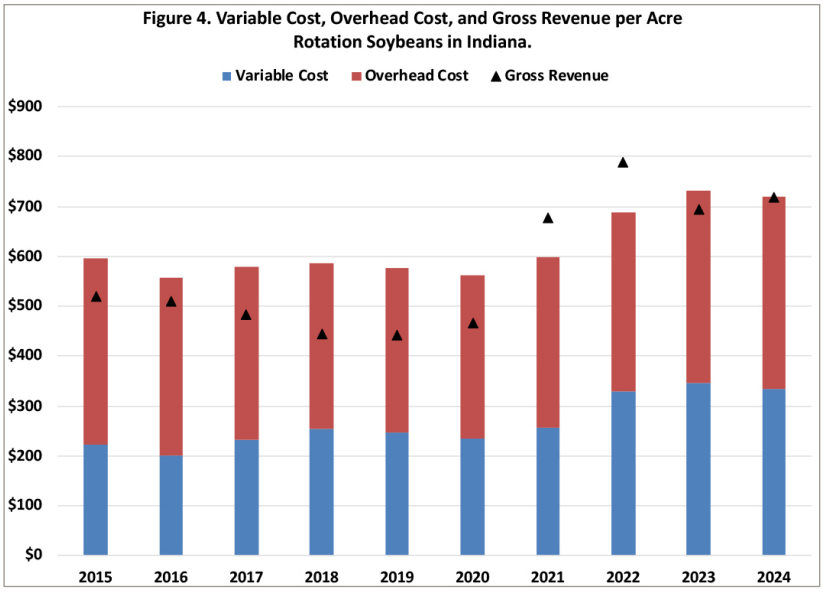

Figure 2. Variable Cost, Overhead Cost, and Gross Revenue per Acre Rotation Soybeans in Indiana

The breakeven prices for rotation corn and rotation soybeans discussed above were for average productivity land. For high productivity land, the breakeven prices for rotation corn and rotation soybeans are expected to be $4.93 and $11.72 per bushel, respectively. Though the difference in relative profits is smaller than it was on average productivity land, rotation soybeans are expected to be more profitable than rotation corn on high productivity land. The breakeven prices for low productivity land are expected to be $5.65 and $13.43 per bushel for corn and soybeans, respectively. Rotation soybeans are expected to be more profitable than rotation corn on low productivity soil.

In summary, despite lower production costs, margins are expected to be relatively tight again in 2024. However, margins for rotation corn and rotation soybeans are close to breakeven on high productivity soil. The relatively high-cost structure along with tight margins, increases the importance of carefully scrutinizing input and crop decisions. Producers are encouraged to create crop budgets and in general improve their record keeping.