Congressional Research Service
Informing the legislative debate since 1914

Next Farm Bill Primer Series

Updated April 29, 2025

Congressional Research Service
https://crsreports.congress.gov
R47313

Contents

Introduction ... 1
- Overview and Budget ... 2
  - CRS In Focus IF12047, *Farm Bill Primer: Background and Status*, by Jim Monke and Megan Stubbs ... 2
  - CRS In Focus IF12233, *Farm Bill Primer: Budget Dynamics*, by Jim Monke ... 2
  - CRS In Focus IF12115, *Farm Bill Primer: Programs Without a Budget Baseline*, by Jim Monke ... 2
- Animal Health ... 3
  - CRS In Focus IF12934, *Farm Bill Primer: Animal Disease Management and Prevention*, by Lia Biondo ... 3
- Commodity Programs and Farm Support ... 3
  - CRS In Focus IF12218, *Farm Bill Primer: Farm Safety Net Programs*, by Stephanie Rosch ... 3
  - CRS In Focus IF12114, *Farm Bill Primer: PLC and ARC Farm Support Programs*, by Stephanie Rosch ... 3
  - CRS In Focus IF12140, *Farm Bill Primer: MAL and LDP Farm Support Programs*, by Stephanie Rosch ... 3
  - CRS In Focus IF12195, *Farm Bill Primer: Support for Cotton*, by Stephanie Rosch ... 4
  - CRS In Focus IF12202, *Farm Bill Primer: Support for the Dairy Industry*, by Christine Whitt ... 4
  - CRS In Focus IF12201, *Farm Bill Primer: Federal Crop Insurance Program*, by Stephanie Rosch ... 4
  - CRS In Focus IF12101, *Farm Bill Primer: Disaster Assistance*, by Christine Whitt ... 4
- Conservation ... 5
  - CRS In Focus IF12024, *Farm Bill Primer: Conservation Title*, by Megan Stubbs ... 5
- Energy ... 5
  - CRS In Focus IF10639, *Farm Bill Primer: Energy Title*, by Kelsi Bracmort ... 5
- Forestry ... 5
  - CRS In Focus IF12054, *Farm Bill Primer: Forestry Title*, by Anne A. Riddle ... 5
- Horticulture, Specialty Crops, and Organic Farming ... 5
  - CRS In Focus IF12017, *Farm Bill Primer: Horticulture Title and Related Provisions*, by Renée Johnson ... 5
  - CRS In Focus IF12278, *Farm Bill Primer: Hemp Industry Support and Regulation*, by Renée Johnson ... 6
- New, Beginning, Underserved, and Veteran Farmers and Ranchers ... 6
  - CRS In Focus IF12096, *Farm Bill Primer: Beginning and Underserved Producers*, by Jim Monke ... 6
  - CRS In Focus IF12160, *Farm Bill Primer: Support for Tribal Food and Agriculture*, by Jim Monke ... 6
- Nutrition Assistance ... 6
  - CRS In Focus IF12255, *Farm Bill Primer: SNAP and Nutrition Title Programs*, by Randy Alison Aussenberg and Kara Clifford Billings ... 6
- Research, Extension, and Related Matters ... 7
  - CRS In Focus IF12023, *Farm Bill Primer: Agricultural Research and Extension*, by Eleni G. Bickell ... 7

CRS In Focus IF12275, *Farm Bill Primer: USDA Support for Aquaculture Operations*, by Eleni G. Bickell 7
Rural Development 7
CRS In Focus IF12038, *Farm Bill Primer: Rural Development Title*, by Lisa S. Benson 7
CRS In Focus IF12041, *Farm Bill Primer: Rural Broadband Provisions*, by Lisa S. Benson 7
Trade and Export Promotion 8
CRS In Focus IF12155, *Farm Bill Primer: Trade and Export Promotion Programs*, by Benjamin Tsui 8

Contacts

Author Information 8

Introduction

This report constitutes a guide to a series of two-page "primers" examining the various programs and policies that comprise periodic omnibus legislation on farm and food policy, commonly known as "the farm bill." The President signed the 2018 farm bill, the Agriculture Improvement Act of 2018 (P.L. 115-334), into law on December 20, 2018. The 2018 farm bill generally authorizes programs for five years. Congress enacted a one-year extension in November 2023 for 2024 (P.L. 118-22, Division B, §102) and a second one-year extension in December 2024 to cover FY2025 and the 2025 crop year (P.L. 118-158, Division D). Many farm bill programs will expire in 2025 unless Congress extends their authorization through a new farm bill or other legislation.

The 2018 farm bill authorized a broad array of programs and policies across 12 titles that define much of the federal government's role in the agricultural sector. It also established the parameters for key domestic and foreign nutrition assistance programs. The 2018 farm bill authorizes a wide range of agriculture and food programs and policies that address commodity support; conservation; trade; foreign and domestic nutrition assistance; farm credit and rural development; research, extension, and education; forestry; energy; horticulture; crop insurance; and livestock-related matters, among others

There are 23 primers summarized in this report and organized under descriptive headings rather than by farm bill titles to facilitate accessibility for those who are not familiar with the 2018 farm bill. The concept behind these primers is to provide relevant information on key programs and policy initiatives authorized by the 2018 farm bill in a concise format that serves as a quick reference resource for Members of Congress and congressional staff. To this end, the primers describe many of the leading programs and policies within the 2018 farm bill. They also identify some of the higher-profile policy issues that may arise as Congress engages in the process of writing a new farm bill and highlight some policy options that Congress could consider as it undertakes this task. The titles of the primers are hyperlinked for easy access.

The primers listed herein also identify CRS subject matter analysts and provide references to related CRS reports for those who want to explore a specific topic area within the 2018 farm bill in greater depth or who seek additional analysis on an individual program or policy. For an overview of the entire 2018 farm bill, see CRS Report R45525, *The 2018 Farm Bill (P.L. 115-334): Summary and Side-by-Side Comparison*. For a history of farm bill legislation, see CRS Report R45210, *Farm Bills: Major Legislative Actions, 1965-2024*. For a discussion of the consequences of farm bill expiration, see CRS Report R47659, *Expiration of the 2018 Farm Bill and Extension for 2025*. For analysis of the farm bill markup in 2024, see CRS Report R48167, *The 2024 Farm Bill: H.R. 8467 Compared with Current Law*.

This report summarizes the farm bill primers listed below. The headings of the summaries contain hyperlinks to the full CRS In Focus products.

- *Farm Bill Primer: What Is the Farm Bill?*
- *Farm Bill Primer: Budget Dynamics*
- *Farm Bill Primer: Programs Without Baseline Beyond FY2024*
- *Farm Bill Primer: Animal Disease Management and Prevention*
- *Farm Bill Primer: Farm Safety Net Programs*
- *Farm Bill Primer: PLC and ARC Farm Support Programs*
- *Farm Bill Primer: MAL and LDP Farm Support Programs*
- *Farm Bill Primer: Support for Cotton*
- *Farm Bill Primer: Support for the Dairy Industry*

- *Farm Bill Primer: Federal Crop Insurance Program*
- *Farm Bill Primer: Disaster Assistance*
- *Farm Bill Primer: Conservation Title*
- *Farm Bill Primer: Energy Title*
- *Farm Bill Primer: Forestry Title*
- *Farm Bill Primer: Horticulture Title and Related Provisions*
- *Farm Bill Primer: Selected Hemp Industry Issues*
- *Farm Bill Primer: Beginning and Underserved Producers*
- *Farm Bill Primer: Support for Native Agricultural Producers*
- *Farm Bill Primer: SNAP and Nutrition Title Programs*
- *Farm Bill Primer: Agricultural Research and Extension*
- *Farm Bill Primer: USDA Support for Aquaculture Operations*
- *Farm Bill Primer: Rural Development Title*
- *Farm Bill Primer: Rural Broadband Provisions*
- *Farm Bill Primer: Trade and Export Promotion Programs*

Overview and Budget

CRS In Focus IF12047, *Farm Bill Primer: Background and Status*, by Jim Monke and Megan Stubbs

This CRS In Focus provides an overview of the multiyear, omnibus legislation known as the farm bill. In particular, it describes the breadth of agriculture and nutrition policy that the farm bill authorizes while providing a brief history of the evolution of the farm bill to the present day. It further reviews estimated costs of the 2018 farm bill by title at the time of enactment and an updated estimate of the budget baseline for mandatory programs for a next farm bill. The House markup of a farm bill in 2024 is discussed in the context of current issues.

CRS In Focus IF12233, *Farm Bill Primer: Budget Dynamics*, by Jim Monke

Congress may consider a new farm bill in 2025 because provisions authorized in the 2018 farm bill (P.L. 115-334) begin expiring at the end of FY2025. From a budgetary perspective, many farm bill programs are assumed to continue. This report discusses the two types of funding—mandatory spending and discretionary authorizations—and the implications of each for farm bill budgeting and program continuity. Farm bill programs have nearly $1.4 trillion of mandatory funding available for the next 10 years. The In Focus also addresses supplemental funding in recent years, which may influence policy expectations for a new farm bill.

CRS In Focus IF12115, *Farm Bill Primer: Programs Without a Budget Baseline*, by Jim Monke

In preparation for a next farm bill, Congress may consider a subset of 21 programs in the 2018 farm bill that do not have a budget baseline for funding beyond FY2024. This In Focus identifies these 21 programs, which received a total of $906 million of mandatory funding during the five years (FY2019-FY2023) of the 2018 farm bill and $177 million in FY2024 for the first one-year extension. The second one-year extension for FY2025 did not provide additional funding for these programs. Programs that receive mandatory funding do not require annual discretionary appropriations. Reauthorizing farm bill programs without baseline would have a positive score (cost) and therefore would likely need to be offset by reductions elsewhere.

Animal Health

CRS In Focus IF12934, *Farm Bill Primer: Animal Disease Management and Prevention*, by Lia Biondo

Animal agriculture accounts for about half of the total value of U.S. agricultural products. The current highly pathogenic avian influenza outbreak illustrates how animal diseases can be costly to control, disrupt domestic supply and international trade of animal products, and affect human health. USDA's Animal and Plant Health Inspection Service (APHIS) is responsible for protecting and improving animal health in the United States. Congress provides APHIS approximately $400 million annually to administer several programs to prevent and respond to animal disease. This CRS In Focus describes those APHIS programs and identifies selected issues of potential interest to Congress.

Commodity Programs and Farm Support

CRS In Focus IF12218, *Farm Bill Primer: Farm Safety Net Programs*, by Stephanie Rosch

The so-called federal "farm safety net" is a collection of programs administered by the U.S. Department of Agriculture (USDA) that provide risk protection and income support to farmers in the United States who experience natural disasters, adverse growing conditions, and/or low market prices. Farm safety net programs fall into three categories: the federal crop insurance program (FCIP), standing agricultural disaster programs, and agricultural commodity support programs. The FCIP and standing agricultural disaster programs are permanently authorized under various laws. The commodity support programs are authorized through the 2025 crop year.

CRS In Focus IF12114, *Farm Bill Primer: PLC and ARC Farm Support Programs*, by Stephanie Rosch

The Price Loss Coverage (PLC) and the Agriculture Risk Coverage (ARC) programs provide income support to producers of certain eligible commodities. The amount of support varies by commodity and from year-to-year based on program enrollments and market conditions. These programs are authorized through the 2025 crop year. The 2018 farm bill reauthorized these programs with relatively minor changes that expanded support available to producers. This CRS In Focus addresses significant features of these programs and identifies selected issues that Congress could consider as it debates a next farm bill.

CRS In Focus IF12140, *Farm Bill Primer: MAL and LDP Farm Support Programs*, by Stephanie Rosch

The Marketing Assistance Loan (MAL) program has been a significant feature of U.S. farm policy since the 1930s. The MAL program provides loans to farmers that are collateralized by eligible stored commodities and provides price support to borrowers when market prices drop below levels specified in statute. Congress has authorized the Loan Deficiency Payment (LDP) program since the 1980s. The LDP program provides payments to farmers eligible to receive price support under the MAL program. Farmers must meet eligibility requirements for these programs and cannot receive both MAL and LDP benefits for the same commodity. These programs are authorized through the 2025 crop year.

CRS In Focus IF12195, *Farm Bill Primer: Support for Cotton*, by Stephanie Rosch

The United States is the world's third-largest cotton producer and the leading cotton exporter, accounting for nearly one-third of global trade in raw cotton. Between 2000 and 2020, U.S. cotton production decreased by more than 15%, and U.S. textile mill usage decreased by more than 80%. Title I of the 2018 farm bill reauthorized commodity support for domestic producers of cotton, including support that had been previously eliminated in the Agricultural Act of 2014 (2014 farm bill; P.L. 113-79). Titles I and XII of the 2018 farm bill reauthorized support for domestic users of cotton for various periods. Certain programs are authorized through the 2025 crop year. In addition, the Secretary of Agriculture has taken measures, outside of the farm bill programs, to support cotton producers.

CRS In Focus IF12202, *Farm Bill Primer: Support for the Dairy Industry*, by Christine Whitt

The 2018 farm bill provides support to the dairy industry through a variety of programs. The Dairy Margin Coverage (DMC), enacted in the 2018 farm bill, is the primary program that provides income support to milk producers. The DMC allows milk producers to buy a guaranteed margin—calculated as the all milk price minus feed costs—for their milk production. Each year, participating dairy producers choose a margin coverage level and the share of their milk production history to cover. They receive DMC payments for months in which the margin is triggered based on USDA's calculation of the milk-feed margin. This program is authorized through December 31, 2025.

CRS In Focus IF12201, *Farm Bill Primer: Federal Crop Insurance Program*, by Stephanie Rosch

The federal crop insurance program (FCIP) helps make insurance coverage available to farmers from private sector insurers to help mitigate potential financial consequences of adverse growing and market conditions. USDA regulates the policies offered and subsidizes the premiums that farmers pay in order to encourage farmer participation in the program. Premium subsidies covered about 60% of the total premium on average for all policies sold in 2024. Since its inception in 1938, the FCIP has grown from an ancillary program with low participation to a central pillar of federal farm support, with more than 543 million acres and $192 billion in crop and livestock value insured in 2024. The FCIP is permanently authorized, but Congress has modified it in various ways in periodic farm bills.

CRS In Focus IF12101, *Farm Bill Primer: Disaster Assistance*, by Christine Whitt

A number of federal programs help agricultural producers recover from the effects of natural disasters, including federal crop insurance, the Noninsured Crop Disaster Assistance Program, livestock and fruit tree disaster programs, and emergency disaster loans. All programs are permanently authorized, and most receive "such sums as necessary" through mandatory spending authority. As such, these programs did not require reauthorization in the 2018 farm bill.

Conservation

CRS In Focus IF12024, *Farm Bill Primer: Conservation Title*, by Megan Stubbs

The conservation title of a farm bill generally contains a number of reauthorizations, amendments, and new programs that encourage farmers and ranchers to implement resource-conserving practices on private land. Starting in 1985, farm bills have addressed a broader range of topics as "conservation." Conservation programs administered by USDA can be grouped into the following categories based on similarities: working land programs, land retirement programs, easement programs, partnership programs, conservation compliance, and other overarching provisions.

Energy

CRS In Focus IF10639, *Farm Bill Primer: Energy Title*, by Kelsi Bracmort

The 2018 farm bill contains 12 titles that address agricultural and food programs and Title IX, the energy title. The 2018 farm bill was the fourth farm bill to contain an energy title. The energy title is primarily focused on support for renewable energy—particularly agriculture-related energy, energy efficiency, and bioproducts (e.g., cleaning supplies). This In Focus summarizes the 2018 farm bill energy title, including mandatory versus discretionary funding amounts, as a basis for informing discussions on a next farm bill while identifying issues that Congress could consider as part of that process.

Forestry

CRS In Focus IF12054, *Farm Bill Primer: Forestry Title*, by Anne A. Riddle

Forest management generally, as well as forest research and forestry assistance, is often considered by the agriculture committees in Congress. Although most forestry programs are permanently authorized, forestry is often addressed in the periodic farm bills to reauthorize many agriculture programs. The 2018 farm bill included a separate forestry title, and this In Focus summarizes some of the forestry provisions addressed in the 2018 farm bill and related issues that Congress may debate as it considers a next farm bill.

Horticulture, Specialty Crops, and Organic Farming

CRS In Focus IF12017, *Farm Bill Primer: Horticulture Title and Related Provisions*, by Renée Johnson

The 2018 farm bill reauthorized and expanded funding for many of the existing USDA programs supporting fruits, vegetables, and other specialty crops while providing support for many locally sourced products (not limited to crops) and hemp cultivation. Support for these sectors is not limited to the horticulture title; it is also contained within other farm bill titles, covering a range of programs administered by USDA. This In Focus provides an overview of selected 2018 farm bill provisions and issues for a next farm bill related to specialty crops, organically produced and locally sourced products, and hemp.

CRS In Focus IF12278, *Farm Bill Primer: Hemp Industry Support and Regulation*, by Renée Johnson

The 2018 farm bill legalized hemp by removing *hemp* from the definition of marijuana in the Controlled Substances Act. It also directed USDA to create a framework to regulate hemp cultivation under federal law and facilitate commercial cultivation, processing, marketing, and sale of hemp and hemp-derived products. Other 2018 farm bill provisions made hemp producers eligible for federal crop insurance and agricultural research programs. A number of hemp stakeholders are advocating for additional changes via a next farm bill, such as relaxing some USDA regulatory requirements and reducing the Drug Enforcement Administration's role in regulating hemp.

New, Beginning, Underserved, and Veteran Farmers and Ranchers

CRS In Focus IF12096, *Farm Bill Primer: Beginning and Underserved Producers*, by Jim Monke

Beginning farmers and ranchers—generally defined as having operated a farm or ranch for no more than 10 years—comprise a significant part of the U.S. agricultural sector. They contribute to rural and non-rural economies and are considered to be critical given ongoing concerns about the aging U.S. farm population, the "disappearing middle" (i.e., mid-sized farms both in terms of farm numbers and value of sales), and general trends toward increasing consolidation and fewer, larger farms. The 2018 farm bill reauthorized and expanded programs administered by USDA that support new farmers and ranchers. These programs targeted new farmers within specific farm demographic groups based on age, race, and gender, as well as socially disadvantaged (underserved) farmers and farmers who are military veterans.

CRS In Focus IF12160, *Farm Bill Primer: Support for Tribal Food and Agriculture*, by Jim Monke

In 2017, Native agricultural producers accounted for 2% of all U.S. producers. The 2018 farm bill (P.L. 115-334) expanded federal farm program support for Native agricultural producers and tribal communities. Congress further enhanced community and economic development for tribes in the Indian Community Economic Enhancement Act of 2020 (P.L. 116-261) and provided additional support for historically underserved agricultural producers, including Native producers, in the American Rescue Plan Act of 2021 (P.L. 117-2).

Nutrition Assistance

CRS In Focus IF12255, *Farm Bill Primer: SNAP and Nutrition Title Programs*, by Randy Alison Aussenberg and Kara Clifford Billings

The nutrition title of a farm bill typically reauthorizes a number of nutrition or domestic food assistance programs, including the Supplemental Nutrition Assistance Program (SNAP, formerly the Food Stamp Program). These programs were reauthorized by the 2018 farm bill and extended by P.L. 118-22. They are authorized through September 30, 2025. In a subsequent farm bill's nutrition title, policymakers might revisit 2018 debates and decisions and consider new challenges and questions, including temporary changes made during the COVID-19 pandemic.

Research, Extension, and Related Matters

CRS In Focus IF12023, *Farm Bill Primer: Agricultural Research and Extension*, by Eleni G. Bickell

The research title addresses research, extension, and education at land-grant universities and other nonfederal institutions, as well as departmental policies, programs, and research within USDA. Most of the research title programs require annual discretionary appropriations; a few programs receive mandatory spending. This In Focus provides background information and discusses selected 2018 farm bill provisions and issues for a next farm bill related to agricultural research, extension, and education, including funding.

CRS In Focus IF12275, *Farm Bill Primer: USDA Support for Aquaculture Operations*, by Eleni G. Bickell

Aquaculture facilities that grow aquatic animal and plant species in controlled or selected environments are generally eligible for the same support from USDA that is available to all U.S. farmers, ranchers, and producers. The 2018 farm bill reauthorized and expanded provisions specifically related to USDA's aquaculture research and assistance programs. Aquaculture producers are also eligible for other USDA competitive grants available to all U.S. agricultural producers. Aquaculture stakeholders have identified a number of policy recommendations in support of the industry, some of which Congress could address in a next farm bill.

Rural Development

CRS In Focus IF12038, *Farm Bill Primer: Rural Development Title*, by Lisa S. Benson

Omnibus farm bills are the major modern legislative vehicle for addressing many rural development issues. Since 1973, omnibus farm bills have included a rural development title, which has included USDA Rural Development programs focused on rural utility systems (i.e., water, waste disposal, electricity, and broadband), rural business, and rural housing. The USDA Rural Business-Cooperative Service, USDA Rural Utilities Service, and USDA Rural Housing Service administer these programs. Most USDA Rural Development programs rely on discretionary funding, which Congress authorizes in farm bills and funds through the annual appropriations process.

CRS In Focus IF12041, *Farm Bill Primer: Rural Broadband Provisions*, by Lisa S. Benson

Congress has included provisions addressing rural broadband (i.e., high-speed internet access) in the rural development title of omnibus farm bills since 2002. The 2018 farm bill amended and reauthorized many of the rural broadband programs administered by USDA. This In Focus provides background information on USDA rural broadband programs and an overview of selected rural broadband provisions in the 2018 farm bill and identifies some issues that Congress could consider as it debates a next farm bill.

Trade and Export Promotion

CRS In Focus IF12155, *Farm Bill Primer: Trade and Export Promotion Programs*, by Benjamin Tsui

Agricultural exports are significant to farmers and the U.S. economy. With the productivity of U.S. agriculture growing faster than domestic demand, farmers and agriculturally oriented firms rely on export markets to sustain prices and revenue. The trade title of the 2018 farm bill (P.L. 115-334) authorizes programs to expand foreign markets for U.S. farmers and food manufacturers through export market development programs and export credit guarantee programs. These programs are authorized through FY2025.

Author Information

Jim Monke, Coordinator
Specialist in Agricultural Policy

Megan Stubbs, Coordinator
Specialist in Agricultural Conservation and Natural Resources Policy

Disclaimer

Congressional Research Service
Informing the legislative debate since 1914

Retaliatory Tariffs on U.S. Agriculture and USDA's Responses: Frequently Asked Questions

May 27, 2025

Congressional Research Service
https://crsreports.congress.gov
R48548

CRS REPORT
Prepared for Members and
Committees of Congress

Congressional Research Service
Informing the legislative debate since 1914

Retaliatory Tariffs on U.S. Agriculture and USDA's Responses: Frequently Asked Questions

R48548

May 27, 2025

Benjamin Tsui
Analyst in Agricultural Policy

Stephanie Rosch
Analyst in Agricultural Policy

SUMMARY

In 2025, the Trump Administration imposed several rounds of tariffs against trading partners under the under the International Emergency Economic Powers Act (IEEPA) and Section 232 of the Trade Expansion Act of 1962, commonly referred as "Section 232." The first IEEPA tariffs targeting Canada, the People's Republic of China, and Mexico were in response to what President Trump identified as the "failures" of the three countries to address issues such as drug and human trafficking and transnational crime. Subsequently, under IEEPA, the Trump Administration imposed a 10% tariff on most trading partners, imposed additional tariffs on China, and proposed country-specific "reciprocal tariffs" addressing bilateral trade deficits. The Trump Administration also expanded steel and aluminum tariffs and imposed new tariffs on automobile and automobile parts under Section 232.

In response to these U.S. tariffs, some countries have imposed or announced potential retaliatory tariffs on U.S. goods, including U.S. agricultural products. In March 2025, Canada imposed retaliatory tariffs that included U.S. agricultural goods. In March 2025, China imposed retaliatory tariffs that included U.S. agricultural goods and, in April 2025, further increased tariffs on all U.S. goods. In May 2025, China temporarily decreased its retaliatory tariffs on U.S. goods following an agreement with the United States. In April 2025, the European Union released a list of U.S. products targeted for retaliatory tariffs effective June 2025.

During the first Trump Administration, beginning in 2018, certain trading partners imposed retaliatory tariffs on U.S. agricultural products in response to tariffs imposed by the United States. In response to the retaliatory tariffs, the U.S. Department of Agriculture (USDA) used administrative authorities to provide approximately $25.7 billion in direct income support payments to farmers, for purchases for agricultural commodities, and in additional support for trade promotion activities.

This report discusses frequently asked questions about retaliatory tariffs on U.S. agriculture and USDA's response to the retaliatory tariffs since 2018. It addresses the agricultural context of recent tariff actions by the United States and subsequent retaliatory tariffs by trading partners, what retaliatory tariffs were imposed on U.S. agriculture in 2018 and 2019 and their effects on trade flows for select agricultural commodities, rationales why foreign trading partners target U.S. agricultural products for retaliation, and the agricultural provisions of the U.S.-China Phase One Agreement. The report also discusses the 2018 and 2019 USDA responses to retaliatory tariffs and the views of these responses.

Contents

Introduction....1
Background....1
What Are Tariffs? 1
What Agricultural Products Does the United States Export and Import? 2
Why Would Trading Partners Target U.S. Agricultural Products with Retaliatory Tariffs? 4
2025 Trade Actions 5
What U.S. Trade Actions Precipitated Retaliatory Tariffs in 2025?....5
International Emergency Economic Powers Act (IEEPA) Tariffs 5
Section 232 Steel, Aluminum, and Automotive Tariffs....8
What Retaliatory Tariffs Have Been Imposed on U.S. Agriculture in 2025? 9
Canada's Retaliatory Tariffs 9
Mexico's Retaliatory Tariffs 9
China's Retaliatory Tariffs....10
European Union Retaliatory Tariffs....11
2018 Through 2023 Trade Actions 12
What Retaliatory Tariffs Were Imposed on U.S. Agriculture in 2018 and 2019? 12
Were U.S. Agricultural Exports Affected by Retaliatory Tariffs?....14
Soybeans 14
Corn....15
Tree Nuts 16
Pork 17
Were U.S. Farm Sector Sales Affected by Retaliatory Tariffs? 18
What Were the Economic Losses to the U.S. Agricultural Sector from Retaliatory Tariffs in 2018 and 2019? 19
What Were the U.S.-China Phase One Agreement Provisions for Agriculture? 22
USDA's Response to Retaliatory Tariffs 23
How Did USDA Respond to Retaliatory Tariffs in 2018 and 2019? 23
How Were Market Facilitation Program Funds Distributed?....24
How Were Food Purchase and Distribution Program Funds Distributed? 26
How Were Agricultural Trade Promotion Program Funds Distributed?....29
How Have Agricultural Stakeholders and Oversight Agencies Assessed USDA's Response to Retaliatory Tariffs Imposed in 2018 and 2019? 29
For More Information 31

Figures

Figure 1. Value of U.S. Agricultural Exports and Imports, 2015-2024 3

Tables

Table 1. U.S. Agricultural Exports to Top Five Markets, 2015 to 2024 3
Table 2. U.S. Agricultural Imports from Top Five Suppliers, 2015 to 2024....4

Table 3. U.S. Agricultural Exports to Retaliating and Non-Retaliating Trading Partners, 2017 to 2020 ... 14
Table 4. U.S. Soybean Exports, 2017 to 2020 ... 15
Table 5. U.S. Corn Exports, 2017 to 2020 ... 16
Table 6. U.S. Tree Nut Exports, 2017 to 2020 ... 17
Table 7. U.S. Pork and Pork Product Exports, 2017 to 2020 ... 18
Table 8. Value of Crops, Livestock, and Animal Products Sold, 2017 to 2020 ... 18
Table 9. Marketing Year Average Prices for Selected Agricultural Commodities, 2017 to 2020 ... 19
Table 10. Funds Available and Program Outlays for USDA Programs Responding to Retaliatory Tariffs ... 24
Table 11. Distribution of Market Facilitation Program Payments, by Commodity Type ... 25
Table 12. Distribution of 2018 Market Facilitation Program Payments ... 25
Table 13. Food Purchase and Distribution Program Targeted Commodities, 2018 and 2019 ... 27

Contacts

Author Information ... 31

Introduction

In March 2025, Canada and the People's Republic of China (hereinafter China) imposed retaliatory tariffs on a range of U.S. exports, including agricultural products, in response to U.S. tariffs imposed in February and March 2025 under the International Emergency Economic Powers Act (IEEPA; 50 U.S.C. §§1701 et seq.).[1] The U.S. tariffs were a response to what President Trump identified as "failures" on the part of Canada, China, and Mexico to address issues such as drug and human trafficking and transnational crimes.[2] Many Members of Congress have an interest in the impact that foreign retaliatory tariffs have on the U.S. agricultural and food sectors, which rely on export markets for additional revenue and economic activity. In addition to the February and March 2025 IEEPA tariffs, the United States has taken other tariff actions that faced retaliatory or threats of retaliatory tariffs on U.S. agricultural exports.

In 2018 and 2019, during the first Trump Administration, China, the European Union (EU), Canada, Mexico, Turkey, and India responded to U.S. tariff actions with retaliatory tariffs on U.S. imports that included agricultural products. In response, the U.S. Department of Agriculture (USDA) used administrative authorities to distribute about $25.7 billion through three programs that, respectively, provided direct income support payments to farmers, purchased agricultural commodities, and supported trade promotion activities. In April 2025, Secretary of Agriculture Brooke Rollins indicated that it would take months to determine whether payments for producers are needed in response to retaliatory tariffs but that USDA is "setting up the infrastructure" to address trade damages.[3]

This report addresses some frequently asked questions (FAQs) grouped into four categories: background, trade actions in 2025, trade actions in 2018-2023, and USDA's response to retaliatory tariffs.

Background

What Are Tariffs?

Tariffs are taxes or duties levied on imported goods. Foreign retaliatory tariffs on U.S. exports make U.S. goods less competitive in foreign markets compared to goods not subject to tariffs, such as substitutable goods produced in the foreign country and goods from other suppliers. Tariffs on agricultural products are commonly applied either at an ad valorem basis (i.e., a

---

[1] For purposes of this report, *agricultural product* refers to the U.S. Department of Agriculture's (USDA's) definition, which follows the World Trade Organization's (WTO's) definition. The WTO's definition includes most food products but excludes those such as seafood and forestry products. For more information about U.S. tariff authorities and policies in general and the International Emergency Economic Powers Act (IEEPA), see CRS Report R48435, *Congressional and Presidential Authority to Impose Import Tariffs*; CRS In Focus IF11030, *U.S. Tariff Policy: Overview*; CRS Report R45618, *The International Emergency Economic Powers Act: Origins, Evolution, and Use*; and CRS Insight IN11129, *The International Emergency Economic Powers Act (IEEPA), the National Emergencies Act (NEA), and Tariffs: Historical Background and Key Issues*.

[2] Executive Order 14193 of February 1, 2025, "Imposing Duties to Address the Flow of Illicit Drugs Across Our Northern Border," 90 *Federal Register* 9113, February 7, 2025; Executive Order 14194 of February 1, 2025, "Imposing Duties to Address the Situation at Our Southern Border," 90 *Federal Register* 9117, February 7, 2025; and Executive Order 14195 of February 1, 2025, "Imposing Duties to Address the Synthetic Opioid Supply Chain in the People's Republic of China," 90 *Federal Register* 9121, February 7, 2025.

[3] Secretary Rollins is quoted in Marcia Brown, "'We Just Haven't Seen Anything Like This': Farmers Brace for Trump's Trade War," *Politico*, April 4, 2025; see also Andy Castillo, "USDA Says Farm Impact of New Tariffs Unknown Until Fall," *Farm Progress*, April 4, 2025.

percentage of the value of the imported goods) or at a specific basis (i.e., assessed at a fixed amount of money per unit of an imported good).

What Agricultural Products Does the United States Export and Import?

The United States is one of the top exporters of agricultural products in the world, with exports totaling $176.0 billion in 2024. Exports account for about 20% of total U.S. agricultural and food production by value.[4] The USDA Foreign Agricultural Service groups agricultural products into three broad categories:

- Bulk: raw and unprocessed commodities sold in large quantities that are mostly used as inputs (e.g., corn, wheat, cotton, soybeans)
- Intermediate: processed commodities used as inputs in the manufacturing of other products (e.g., soybean meal, ethanol, vegetable oils, essential oils, hides and skins)
- Consumer oriented: a larger collection of agricultural and food products for consumers and retailers (e.g., fruits, vegetables, meat, poultry, dairy, alcoholic beverages)

Bulk commodities are the leading U.S. farm exports. In 2024, over 60% of U.S. agricultural exports by value were to Mexico, Canada, China, the EU, and Japan.

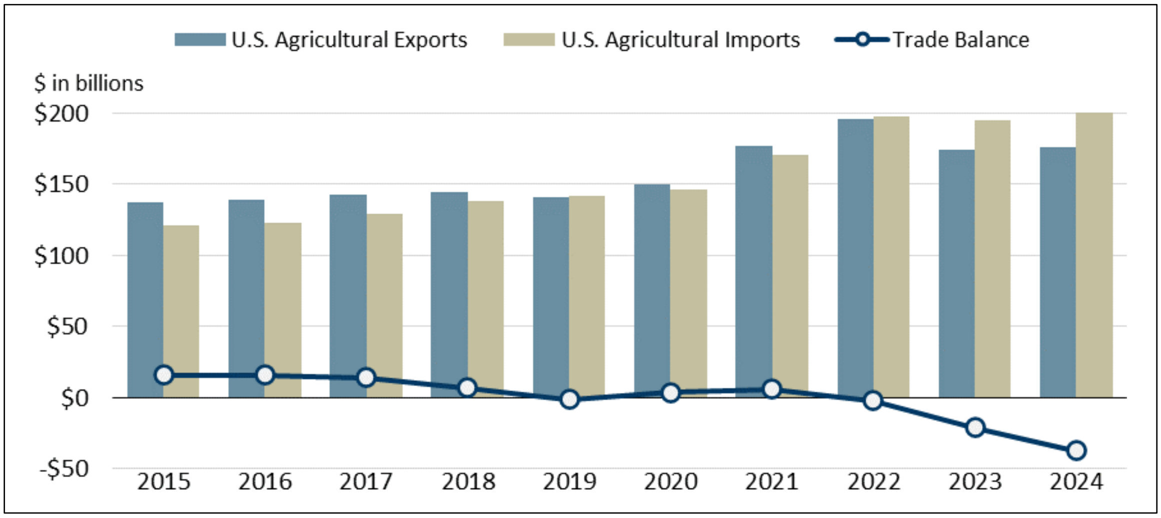
The share of U.S. production that is exported varies by year and type of agricultural product. On average, for the past decade on a quantity basis, for bulk commodities, the United States exported 15% of corn, 46% of rice, 47% of soybeans and wheat, 55% of sorghum, and 84% of cotton produced. For meat products, about 11% of beef and veal, 16% of chicken meat, and 23% of swine meat produced were exported.[5] For tree nuts, the United States exported on average nearly 70% of almonds and walnuts and 64% of pistachios produced. For fresh fruits, the United States exported on average 5% of tangerines/mandarins, 17% of apples, 19% of cherries, and 33% of table grapes produced.

In 2024, the United States imported $213.0 billion in agricultural products, which provided U.S. consumers more choice, variety, and product availability year-round as well as increased competition for certain U.S. producers. Leading imports included fruits, vegetables, vegetable oils, alcoholic beverages (e.g., distilled spirits, wine, beer), beef, and coffee. The top sources of U.S. agricultural imports were Mexico, Canada, and the EU, which accounted for 60% of total agricultural imports. Comparing the value of U.S. agricultural trade exports with imports reveals that the U.S. agricultural trade surplus peaked at $40.1 billion in 2011 and has since fallen, becoming trade deficits in 2019, 2022, 2023, and 2024. In 2024, the agricultural trade deficit was $37.0 billion. See **Figure 1** for U.S. agricultural trade trends in the past decade. See **Table 1** and **Table 2** for trade statistics for the top five U.S. agricultural export markets and top five U.S. agricultural import suppliers for the past decade.

[4] USDA, Economic Research Service (ERS), "U.S. Agricultural Trade – U.S. Agricultural Trade at a Glance," January 7, 2025, https://www.ers.usda.gov/topics/international-markets-us-trade/us-agricultural-trade/us-agricultural-trade-at-a-glance.

[5] Calculated by CRS from USDA production, supply, and distribution quantity data at USDA, Foreign Agricultural Service (FAS), "PSD Online," https://apps.fas.usda.gov/psdonline/app/index.html#/app/home.

Figure 1.Value of U.S.Agricultural Exports and Imports, 2015-2024



Source: Figure created by CRS using U.S. Census Bureau international trade data via U.S. Department of Agriculture (USDA), Foreign Agricultural Service (FAS), "Global Agricultural Trade System Online: GATS Home," https://apps.fas.usda.gov/gats/default.aspx. See Bulk, Intermediate, and Consumer-Oriented Harmonized System-10 (BICO-10) groupings.

Notes: Data are not adjusted for inflation. Trade balance is calculated as imports subtracted from exports.

Table 1. U.S.Agricultural Exports to Top Five Markets, 2015 to 2024

In Billions of Dollars (nominal)

Trading Partner	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Mexico	17.9	18.0	18.8	19.3	19.4	18.3	25.5	28.5	28.4	30.3
Canada	22.2	21.4	21.7	22.0	21.9	22.3	25.3	28.7	28.4	28.4
China	20.4	21.7	19.6	9.2	13.9	26.4	32.8	38.1	28.8	24.7
EU-27	11.0	10.2	10.5	12.5	10.8	10.4	11.0	12.3	12.6	12.8
Japan	11.6	11.4	12.1	13.1	12.0	11.7	14.2	14.7	11.9	12.0
Rest of world	54.2	56.2	60.1	68.5	63.1	60.5	67.9	73.4	64.1	67.8
World total	**137.2**	**138.9**	**142.9**	**144.7**	**141.1**	**149.7**	**176.6**	**195.7**	**174.2**	**176.0**

Source: CRS from USDA, Global Agricultural Trade System (GATS) data (BICO-10).

Notes: Data are not just adjusted for inflation. Values may not sum to totals shown because of rounding. EU-27 = the European Union customs union and its 27 member countries.

Table 2. U.S.Agricultural Imports from Top Five Suppliers, 2015 to 2024

In Billions of Dollars (nominal)

Trading Partner	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Mexico	22.2	24.1	25.9	27.5	30.2	32.9	38.0	43.3	45.4	48.6
Canada	22.4	22.2	22.9	23.7	24.4	25.3	31.2	37.5	40.1	41.0
EU-27	22.8	23.6	25.1	27.1	28.4	27.4	32.0	35.8	32.9	36.4
Brazil	4.0	3.8	3.9	3.9	4.1	4.0	4.7	6.2	6.2	7.9
China	4.3	4.3	4.5	4.9	3.7	3.8	4.1	4.7	4.7	5.8
Rest of world	45.4	44.6	46.9	50.8	50.8	52.7	60.6	70.6	65.6	73.2
World total	**121.1**	**122.6**	**129.2**	**138.0**	**141.6**	**146.3**	**170.6**	**198.2**	**194.8**	**213.0**

Source: CRS from USDA, GATS data (BICO-10).

Notes: Data are not just adjusted for inflation. Values may not sum to totals shown because of rounding. EU-27 = the European Union customs union and its 27 member countries.

All states export agricultural products, but a fraction of states account for the majority of farm export sales. For calendar year 2023, USDA estimated that over half of total U.S. agricultural exports based on value came from the eight leading agricultural exporting states, which were California, Iowa, Illinois, Minnesota, Nebraska, Texas, Indiana, and Missouri.[6]

Why Would Trading Partners Target U.S. Agricultural Products with Retaliatory Tariffs?

Foreign governments may target U.S. agricultural products for any of several reasons. The United States is one of the largest exporters of agricultural products, and these products represent a large target for retaliation for many trading partners. The value of agricultural products exported to U.S. trading partners that imposed retaliatory tariffs on U.S. agricultural products during the first Trump Administration was more than $76 billion in 2017.

Another reason U.S. trading partners may target U.S. agriculture is because agricultural commodities may be sourced globally from multiple suppliers. Trading partners could source agricultural imports from suppliers other than the United States. Australia, Brazil, Canada, and the EU are examples of major agricultural exporters that compete with the United States for foreign markets.

Retaliating trade partners may consider U.S. domestic politics when determining tariff targets, choosing products from specific regions or states to maximize political pressure. For example, some observers assert that bourbon whiskey was targeted in the 2018 retaliatory tariffs because it was produced in the then-Senate Majority Leader's home state of Kentucky.[7]

[6] USDA, ERS, "State Agricultural Trade Data," January 9, 2025, https://www.ers.usda.gov/data-products/state-agricultural-trade-data.

[7] Thiemo Fetzer and Carlo Schwarz, "Tariffs and Politics: Evidence from Trump's Trade Wars," *The Economic Journal*, vol. 131, no. 636 (May 2021), pp. 1717-1741; and Rob Gillie, "Canada Announces Billions in Retaliatory Tariffs Against US," Associated Press, June 30, 2018.

2025 Trade Actions

What U.S. Trade Actions Precipitated Retaliatory Tariffs in 2025?

Beginning in 2025, the United States has imposed tariffs under IEEPA and Section 232 of the Trade Expansion Act of 1962 (19 U.S.C. §1862), commonly referred as "Section 232."[8] These trade actions provoked foreign retaliatory tariffs that targeted U.S. agriculture as well as other sectors of the U.S. economy. The United States has also proposed additional trade actions under these and other statutory authorities that, if implemented, may lead to further retaliatory actions from U.S. trading partners.

International Emergency Economic Powers Act (IEEPA) Tariffs

Addressing Drug Trafficking and Illegal Immigration

On February 1, 2025, President Trump signed three executive orders imposing tariffs of 25% on imports from Canada (with a lower 10% tariff on energy resources) and Mexico, and a 10% tariff on imports from China, all beginning February 4, 2025.[9] These executive orders cited IEEPA as the underlying authority to impose tariffs. The executive orders cited the "failure" of the three governments in addressing issues such as drug trafficking and other criminal activities. On February 3, President Trump issued executive orders delaying the duties until March 4, citing steps taken by Canada and Mexico to address U.S. concerns on illegal migration and illicit drugs.[10] On March 3, President Trump increased the tariff on imports from China from 10% to 20% effective March 4, stating that China had not adequately addressed the illicit drug crisis.[11]

On March 6, President Trump issued executive orders further amending the original February 1 executive orders for Canada and Mexico by not imposing the additional 25% duties on goods that claim and qualify for preferential treatment under the U.S.-Mexico-Canada Agreement (USMCA) and lowering tariffs for potash imports to 10%.[12] Potash, the main source of potassium in

---

[8] For more background, see CRS Report R45618, *The International Emergency Economic Powers Act: Origins, Evolution, and Use*; CRS Report R48549, *Presidential 2025 Tariff Actions: Timeline and Status*; CRS Insight IN11129, *The International Emergency Economic Powers Act (IEEPA), the National Emergencies Act (NEA), and Tariffs: Historical Background and Key Issues*; CRS Infographic IG10012, *The International Emergency Economic Powers Act (IEEPA) and the National Emergencies Act: Key Facts*; and CRS Insight IN12519, *Expanded Section 232 Tariffs on Steel and Aluminum*. For more information about U.S.-China tariff actions, see CRS In Focus IF12990, *U.S.-China Tariff Actions Since 2018: An Overview*.

[9] Executive Order 14193 of February 1, 2025, "Imposing Duties to Address the Flow of Illicit Drugs Across Our Northern Border," 90 *Federal Register* 9113, February 7, 2025; Executive Order 14194 of February 1, 2025, "Imposing Duties to Address the Situation at Our Southern Border," 90 *Federal Register* 9117, February 7, 2025; and Executive Order 14195 of February 1, 2025, "Imposing Duties to Address the Synthetic Opioid Supply Chain in the People's Republic of China," 90 *Federal Register* 9121, February 7, 2025. For more information about U.S.-Canada relations and the IEEPA tariffs, see CRS Insight IN12533, *U.S.-Canada Relations amid Tariffs Under the International Emergency Economic Powers Act*.

[10] Executive Order 14197 of February 3, 2025, "Progress on the Situation at Our Northern Border," 90 *Federal Register* 9183, February 10, 2025; and Executive Order 14198 of February 3, 2025, "Progress on the Situation at Our Southern Border," 90 *Federal Register* 9185, February 10, 2025.

[11] Executive Order 14228 of March 3, 2025, "Further Amendment to Duties Addressing the Synthetic Opioid Supply Chain in the People's Republic of China," 90 *Federal Register* 11463, March 7, 2025.

[12] Executive Order 14231 of March 6, 2025, "Amendment to Duties to Address the Flow of Illicit Drugs Across Our Northern Border," 90 *Federal Register* 11785, March 11, 2025; and Executive Order 14232 of March 6, 2025, "Amendment to Duties to Address the Flow of Illicit Drugs Across Our Southern Border," 90 *Federal Register* 11787, March 11, 2025.

fertilizer, is a key input for U.S. farmers. The United States imports about 97% of its potash fertilizer used each year, with Canada accounting for about 85% of imports by quantity.[13] U.S. tariff rates on fertilizer are generally duty-free, including under the United States' USMCA tariff schedule.[14]

China (in February) and Canada (in March) initiated World Trade Organization (WTO) dispute consultations with the United States in response to the IEEPA tariff actions.[15] In the March 24-25, 2025, WTO Committee on Agriculture meeting, Canada questioned whether the United States had considered the negative effects of the tariffs on factors such as food security, economic growth, agricultural sector supply chains, and inflation for food prices.[16] For more information about the WTO and the Agreement on Agriculture, see the text box below.

What Is the World Trade Organization and Agreement on Agriculture?

The World Trade Organization (WTO) is an international organization that administers the rules and agreements negotiated among its members to eliminate trade barriers and govern trade. The WTO provides for a "common institutional framework" to address multilateral trade relations among WTO members and to facilitate trade agreement negotiations, resolve trade disputes, administer trade rules, monitor trade policies, and provide technical assistance. The United States was a leading force behind the WTO's establishment in 1995.

As part of the results of the multilateral negotiations that established the WTO, several agreements covering trade in goods were agreed to among negotiating members. The WTO Agreement on Agriculture's main objective is to "reform agricultural trade so that it is closer to competitive market conditions." Under the Agreement on Agriculture, national agricultural policies—including domestic farm support, agricultural export subsidies, and restrictive import controls—were placed under a multilaterally agreed-upon set of disciplines. WTO members agreed to reform their domestic agricultural support policies, increase access to imports, and reduce export subsidies. The agreement also established a Committee on Agriculture. The Committee on Agriculture oversees and monitors the implementation of the agreement and provides a forum for members to consult with each other on agricultural trade issues as well as raise and address questions related to the agreement.

Source: WTO, *The WTO Agreements Series: Agriculture*, 3rd ed. (WTO, 2016).

Note: For more background on the WTO, see CRS In Focus IF10002, *World Trade Organization*.

"Reciprocal Tariffs" Addressing Trade Deficits

On April 2, 2025, President Trump signed an executive order imposing additional tariffs of 10% on most imports from most U.S. trading partners effective April 5, 2025, and additional country-specific tariffs on 57 trading partners effective April 9, 2025.[17] The April 2 executive order also

13 Potassium fertilizer usage data from USDA, FAS, "Global Fertilizer Dashboard," September 10, 2024, https://www.fas.usda.gov/data/visualization-global-fertilizer-trade-dashboard. Potassium fertilizer import data from USDA, FAS, Global Agricultural Trade System Online, "Foreign Agricultural Trade of the United States" product grouping.

14 United States International Trade Commission, "Chapter 31: Fertilizers," in *Harmonized Tariff Schedule (2025)*, March 14, 2025, https://hts.usitc.gov/; and Office of the U.S. Trade Representative (USTR), "Tariff Schedule of the United States," agreement between the United States of America, the United Mexican States, and Canada, July 1, 2020.

15 WTO, "DS633: United States—Additional Tariff Measures on Goods from China," https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds633_e.htm; and WTO, "DS634:United States—Additional Import Duties on Goods from Canada," https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds634_e.htm.

16 WTO, "View Question & Answer," in *Agriculture Information Management System*, accessed March 17, 2025, https://agims-qna.wto.org/public/Pages/en/ViewQnA_Validated.aspx?officialID=111129&caller=https://agims-qna.wto.org/public/Pages/en/SearchResult.aspx.

17 Executive Order 14257 of April 2, 2025, "Regulating Imports with a Reciprocal Tariff to Rectify Trade Practices That Contribute to Large and Persistent Annual United States Goods Trade Deficits," 90 *Federal Register* 15041, April 7, 2025. A list of the country-specific tariffs (inclusive of the 10% imposed on most other trading partners) can be found at https://www.whitehouse.gov/wp-content/uploads/2025/04/Annex-I.pdf.

cited IEEPA as the underlying authority to impose tariffs. The executive order declared a national emergency due to

> underlying conditions, including a lack of reciprocity in our bilateral trade relationships, disparate tariff rates and [nontariff] barriers, and U.S. trading partners' economic policies that suppress domestic wages and consumption, as indicated by large and persistent annual U.S. goods trade deficits.[18]

The April 2 executive order's additional tariffs do not apply to Canada or Mexico. If the February 1 executive orders that imposed the drug-trafficking and illegal-immigration-related IEEPA tariffs on both countries are terminated, then both countries' imports would face a 12% tariff as a result of the April 2 executive order. The April 2 executive order excludes some key agricultural inputs such as potash, peat, veterinary vaccines, and certain pesticides.[19] Tariffs on China are cumulative to previous tariffs imposed. On April 8, 2025, President Trump signed an executive order increasing the "reciprocal tariff" on China from the original 34% to 84% effective April 10 in response to China's April 4 announcement of 34% retaliatory tariffs that went into effect April 10.[20] On April 9, President Trump signed another executive order raising the "reciprocal tariffs" on China to 125% effective April 10 in response to the April 9 announcement by China that it was increasing its retaliatory tariffs from 34% to 84% effective April 10.[21] See "China's Retaliatory Tariffs" for further background.

The April 9 executive order also suspended the country-specific tariffs effective April 10 until July 9, 2025, a total of 90 days. The additional 10% tariff for most trading partners is still in effect.

The Trump Administration applied a novel methodology to calculate the tariffs imposed in accordance with the April 2 executive order. Although the April 2 executive order cites nontariff barriers, including technical barriers to trade (TBT) and "sanitary and phytosanitary [SPS] measures that unnecessarily restrict trade without furthering safety objectives," as factors contributing to the persistent U.S. trade deficit, the methodology of calculating the country-specific "reciprocal tariffs" is not based on estimates of tariff and nontariff barriers implemented by countries on U.S.-specific or broader categories of products.[22] Instead, the "reciprocal tariff" calculations are based on the 2024 bilateral trade deficit with a country divided by the 2024 value of that country's imports into the United States, divided by two, making the assumption that the resulting tariff rate would "offset" any tariff and nontariff policies applied by the foreign country.[23] Many economists have questioned both the use of this methodology to calculate

[18] Executive Order 14257 of April 2, 2025, "Regulating Imports with a Reciprocal Tariff to Rectify Trade Practices That Contribute to Large and Persistent Annual United States Goods Trade Deficits."

[19] Oliver Ward, "Some Key Ag Inputs Exempt from Sweeping New Duties," April 4, 2025; and Ryan Hanrahan, "Key Ag Inputs Exempt from New Reciprocal Tariffs," *Farm Policy News*, April 7, 2025. A full list of products exempt from the April 2 tariffs can be found at https://www.whitehouse.gov/wp-content/uploads/2025/04/Annex-II.pdf.

[20] Executive Order 14259 of April 8, 2025, "Amendment to Reciprocal Tariffs and Updated Duties as Applied to Low-Value Imports from the People's Republic of China," 90 *Federal Register* 15509, April 14, 2025.

[21] Executive Order 14266 of April 9, 2025, "Modifying Reciprocal Tariff Rates to Reflect Trading Partner Retaliation and Alignment," 90 *Federal Register* 15625, April 15, 2025.

[22] USTR, "Reciprocal Tariff Calculations," accessed May 27, 2025, https://ustr.gov/sites/default/files/files/Issue_Areas/Presidential%20Tariff%20Action/Reciprocal%20Tariff%20Calculations.pdf. *Technical barriers to trade (TBT) measures* are related to mandatory compliance with regulatory requirements, voluntary standards, and conformity assessment procedures required by regulations or standards. *Sanitary and phytosanitary (SPS) measures* are laws, regulations, standards, and procedures that governments enforce to protect human, animal, or plant life or health.

[23] USTR, "Reciprocal Tariff Calculations," accessed April 4, 2025, https://ustr.gov/issue-areas/reciprocal-tariff-calculations.

country-specific tariffs and the Administration's claim that the tariff rates capture barriers to U.S. exports.[24] In the past, USDA's Economic Research Service (ERS) and other researchers have estimated the tariff equivalent of TBT and SPS measures for specific agricultural products or product groups, such as in a 2015 study on nontariff measures between the United States and EU.[25]

On May 12, 2025, the United States and China issued a joint statement that reduced U.S. "reciprocal tariffs" to 10% and China's retaliatory tariffs to the "reciprocal tariffs" to 10% effective May 14 for 90 days.[26]

Section 232 Steel, Aluminum, and Automotive Tariffs

On February 10, 2025, President Trump issued proclamations effective March 12, 2025, that modified tariffs on steel and aluminum, authorized under Section 232 of the Trade Expansion Act of 1962.[27] These tariffs were originally imposed during the first Trump Administration. The changes included eliminating country exemptions from tariffs negotiated during the Biden and first Trump Administrations. Effective April 4, 2025, certain beer products as aluminum derivative products were added to the list of imports subject to a Section 232 tariff of 25%.[28]

---

[24] Glenn Kessler, "Trump White House Cited Economists for Its Tariff Formula. They Pan It," *Washington Post*, April 4, 2025; Robert Farley and D'Angelo Gore, "Fact Check: Trump's Misleading Tariff Chart," *Roll Call*, April 4, 2025; Peter Foster and Sam Fleming, "Donald Trump Baffles Economists with Tariff Formula," *Financial Times*, April 3, 2025; Kevin Corinth and Stan Veuger, "President Trump's Tariff Formula Makes No Economic Sense. It's Also Based on an Error," American Enterprise Institute, April 4, 2025; Brent Neiman, "The Trump White House Cited My Research to Justify Tariffs. It Got It All Wrong," *New York Times*, April 7, 2025; Anjali V. Bhatt, "PIIE Experts React to Trump's Tariffs Announced April 2," Peterson Institute for International Economics, April 3, 2025; and Alan Cole, "Trump's Reciprocal Tariff Calculations Are Nonsense, Will Punish Mutually Beneficial Trade," Tax Foundation, April 3, 2025.

[25] Shawn Arita et al., *Estimating the Effects of Selected Sanitary and Phytosanitary Measures and Technical Barriers to Trade on U.S.-EU Agricultural Trade*, USDA, ERS, November 10, 2015. Other examples of studies estimating tariff equivalents on on-tariff measures include Olivier Cadot et al., *Estimating Ad Valorem Equivalents of Non-Tariff Measures: Combining Price-Based and Quantity-Based Approaches*, Organisation for Economic Co-operation and Development (OECD), OECD Trade Policy Papers No. 215, May 16, 2018; Xin Ning and Jason H. Grant, "New Estimates on the Ad-Valorem Equivalents of SPS Measures: Evidence from Specific Trade Concerns," selected paper prepared for presentation at the International Agricultural Trade Research Consortium's 2019 Annual Meeting, Washington, DC, December 2019; and Rui Mao et al., "Economic and Environmental Impacts of Agricultural Non-Tariff Measures: Evidence Based on *Ad Valorem* Equivalent Estimates," *International Food and Agribusiness Management Review*, vol. 26, no. 3 (2023), pp. 379-396.

[26] White House, "Joint Statement on U.S.-China Economic and Trade Meeting in Geneva," May 12, 2025, https://www.whitehouse.gov/briefings-statements/2025/05/joint-statement-on-u-s-china-economic-and-trade-meeting-in-geneva/.

[27] Proclamation 10896 of February 10, 2025, "Adjusting Imports of Steel into the United States," 90 *Federal Register* 9817, February 18, 2025; and Proclamation 10895 of February 10, 2025, "Adjusting Imports of Aluminum into the United States," 90 *Federal Register* 9807, February 18, 2025. For more information on Section 232 steel and aluminum tariffs, see CRS Insight IN12519, *Expanded Section 232 Tariffs on Steel and Aluminum*.

[28] Department of Commerce, Bureau of Industry and Security, "Implementation of Duties on Aluminum Derivatives Beer and Empty Aluminum Cans Pursuant to Proclamation 10895 Adjusting Imports of Aluminum into the United States," 90 *Federal Register* 14786, April 2025; and U.S. Customs and Border Protection (CBP), *Cargo Systems Messaging Service # 64639013—Guidance: Section 232 Additional Aluminum Derivative Products*, April 3, 2025, https://content.govdelivery.com/bulletins/gd/usdhscbp-3da5025?wgt_ref=usdhscbp_widget_2. CBP indicated that beer classified under the Harmonized Tariff Schedule of the United States not in glass containers would be subject to the 25% tariff under Section 232.

Separately, on March 26, 2025, President Trump announced Section 232 tariffs on U.S. imports of automobiles effective April 3 and certain automobile parts effective May 3.[29]

Some U.S. trading partners, such as Canada and the EU, announced retaliatory tariffs in response to Section 232 steel, aluminum, and automotive tariffs. To date, only the EU retaliatory tariffs have stated plans to target U.S. agricultural exports.[30]

What Retaliatory Tariffs Have Been Imposed on U.S. Agriculture in 2025?

In 2025, Canada, China, and the EU announced and/or imposed retaliatory tariffs that targeted U.S. agriculture.[31]

Canada's Retaliatory Tariffs

On March 4, 2025, Canada implemented retaliatory tariffs of 25% on select U.S. imports in response to the IEEPA tariffs on Canadian imports that went into effect the same day.[32] According to analysis of 2024 Canadian import statistics, these tariffs targeted approximately $5.9 billion in U.S. agricultural goods.[33] By value, about 90% of the U.S. products facing retaliatory tariffs were consumer-oriented goods, including coffee, tea, orange juice, alcoholic beverages (i.e., beer, wine, distilled spirits), pasta, fruits (e.g., oranges, peaches), vegetables (e.g., tomatoes, preserved cucumbers), pecans, poultry, sausages, condiments (e.g., ketchup, mayonnaise, soy sauce), confections, dairy products (e.g., whey, cheese, milk), and tobacco products.

Canada announced its intention to implement a second round of tariffs on a proposed list of additional U.S. goods to be subject to a 25% tariff.[34] Products proposed for additional retaliation include meat (e.g., beef, pork, poultry), additional dairy products (e.g., butter, cheese), baked goods (e.g., toasted bread, waffles), nonbeverage ethanol, additional fruits (e.g., apples, cherries, strawberries), additional vegetables (e.g., onions, asparagus, lettuce), and tree nuts (e.g., almonds, walnuts).

Mexico's Retaliatory Tariffs

President of Mexico Claudia Sheinbaum reportedly planned to announce tariff and nontariff measures in response to the IEEPA tariffs on March 9 but instead held a "festival" to celebrate the

---

[29] Proclamation 10908 of March 26, 2025, "Adjusting Imports of Automobiles and Automobile Parts into the United States," 90 *Federal Register* 14705, April 3, 2025. For more background, see CRS Insight IN12545, *Section 232 Automotive Tariffs: Issues for Congress*.

[30] In May 2025, the United Kingdom and India notified the WTO of a proposed increase in tariffs on U.S. imports in response to the U.S. Section 232 steel and aluminum tariffs. Similarly, Japan notified the WTO of a proposed increase in tariffs on U.S. imports in response to the U.S. Section 232 tariffs on steel, aluminum, automobiles, and automobile parts. Neither country has released a list of products targeted for retaliation nor imposed retaliatory tariffs.

[31] For more background, see CRS Report R48549, *Presidential 2025 Tariff Actions: Timeline and Status*.

[32] Government of Canada, "List of Products from the United States Subject to 25 Per Cent Tariffs Effective March 4, 2025," March 4, 2025, https://www.canada.ca/en/department-finance/news/2025/03/list-of-products-from-the-united-states-subject-to-25-per-cent-tariffs-effective-march-4-2025.html. Canada originally planned to implement retaliatory tariffs on February 4, 2025, but delayed for another month after the United States delayed its 25% tariffs on Canada.

[33] CRS calculations from Trade Data Monitor and Statistics Canada.

[34] Government of Canada, "Notice of Intent to Impose Countermeasures in Response to United States Tariffs on Canadian Goods," March 7, 2025, https://www.canada.ca/en/department-finance/programs/consultations/2025/notice-intent-impose-countermeasures-response-united-states-tariffs-on-canadian-goods.html.

suspension of U.S. tariffs.[35] On March 7, President Sheinbaum stated that Mexico "would like to avoid imposing reciprocal tariffs" on U.S. goods and continue its dialogue with the United States but also would not rule out retaliatory tariffs.[36]

China's Retaliatory Tariffs

On February 10, China imposed retaliatory tariffs on certain U.S. goods in response to the 10% IEEPA tariffs on imports from China. These included a 10% tariff on U.S. agricultural machinery.[37] On March 10, China imposed additional tariffs of 10% or 15% in response to the United States' March 3 announcement of a 10% increase of tariffs on imported goods from China.[38] These tariffs included mostly agricultural products. According to 2024 import statistics of China, these tariffs targeted about $21.2 billion worth of U.S. agricultural imports.[39] By value, about 80% of the products facing retaliatory tariffs are bulk commodities, such as soybeans, cotton, sorghum, wheat, corn, and pulses. Consumer-oriented products targeted for retaliatory tariffs include beef, pork, poultry, dairy products (e.g., milk albumin, ice cream, cheese), fruit (e.g., cherries, oranges, apples), and tree nuts (e.g., pistachios, almonds, walnuts). Most of these products had faced retaliatory tariffs imposed by China during the first Trump Administration.

On April 4, 2025, in response to the United States' 34% IEEPA "reciprocal tariff" on imports from China, China announced an additional 34% tariff on all U.S. goods effective April 10.[40] On April 9, following the U.S. announcement that the "reciprocal tariff" on imports from China was increasing from 34% to 84%, China announced that it was increasing its original additional 34% tariff on U.S. goods to 84% effective April 10.[41] On April 11, China further increased tariffs on U.S. goods from 84% to 125% effective April 12 in response to the United States' April 10 increase of "reciprocal tariffs" on imports from China from 84% to 125%.[42] On May 12, 2025,

[35] Fabiola Sánchez, "Tens of Thousands of Mexicans Rally with President to Celebrate US Decision to Delay Tariffs," Associated Press, March 9, 2025.

[36] Government of Mexico, "Versión estenográfica. Conferencia de prensa de la presidenta Claudia Sheinbaum Pardo del 7 de abril de 2025 [Stenographic Version. Press Conference of President Claudia Sheinbaum Pardo]," April 7, 2025, https://www.gob.mx/presidencia/articulos/version-estenografica-conferencia-de-prensa-de-la-presidenta-claudia-sheinbaum-pardo-del-7-de-abril-de-2025?idiom=es; and Raul Cortes and Kylie Madry, "Mexico Seeks to Avoid Retaliatory Tariffs Against US, but Not Ruling Them Out," Reuters, April 7, 2025.

[37] Ministry of Finance of the People's Republic of China, "国务院关税税则委员会关于对原产于美国的部分进口商品加征关税的公告 [Announcement of the Customs Tariff Commission of the State Council on Imposing Additional Tariffs on Certain Imported Goods from the United States]," February 4, 2025, https://www.mof.gov.cn/zhengwuxinxi/caizhengxinwen/202502/t20250204_3955222.htm. For more information about U.S.-China tariff actions, see CRS In Focus IF12990, *U.S.-China Tariff Actions Since 2018: An Overview*.

[38] Ministry of Finance of the People's Republic of China, "国务院关税税则委员会关于对原产于美国的部分进口商品加征关税的公告 [Announcement of the Customs Tariff Commission of the State Council on Imposing Additional Tariffs on Certain Imported Goods from the United States]," March 4, 2025, https://gss.mof.gov.cn/gzdt/zhengcefabu/202503/t20250304_3959228.htm.

[39] CRS calculations from Trade Data Monitor and China Customs Statistics.

[40] Ministry of Finance of the People's Republic of China, "国务院关税税则委员会关于对原产于美国的进口商品加征关税的公告 [Announcement of the Customs Tariff Commission of the State Council on Imposing Additional Tariffs on Imported Goods from the United States]," April 4, 2025, https://gss.mof.gov.cn/gzdt/zhengcefabu/202504/t20250404_3961451.htm.

[41] Ministry of Finance of the People's Republic of China, "国务院关税税则委员会关于调整对原产于美国的进口商品加征关税措施的公告 [Announcement of the Customs Tariff Commission of the State Council on Adjusting Tariff Measures on Imported Goods from the United States]," April 9, 2025, https://gss.mof.gov.cn/gzdt/zhengcefabu/202504/t20250409_3961684.htm.

[42] Ministry of Finance of the People's Republic of China, "国务院关税税则委员会关于调整对原产于美国的进口商
(continued...)

China and the United States issued a joint statement that reduced China's retaliatory tariffs to the U.S. "reciprocal tariffs" to 10%, while the United States reduced its "reciprocal tariffs" to 10% effective May 14, 2025, for 90 days.[43] See ""Reciprocal Tariffs" Addressing Trade Deficits" for further background.

European Union Retaliatory Tariffs

On March 12, 2025, the EU announced that it would allow the suspension of its 2018 and 2020 tariff countermeasures against the United States to lapse on April 1, in response to U.S. steel and aluminum tariffs.[44] These tariffs targeted about $1.3 billion worth of U.S. agricultural imports, according to 2024 EU import data.[45] Whiskey products, which were targeted with a 50% tariff, accounted for nearly half of the value of targeted imports. Other products targeted included corn, rice, tobacco products, peanut butter, cranberries, kidney beans, and peanut butter, all of which were subject to a 25% tariff, and essential oils, subject to a 10% tariff.

Additionally, the EU announced that it would gather information from stakeholders to determine which additional U.S. imports to target with tariffs.[46] Proposed additional targets include agricultural products such as poultry, beef, tree nuts, alcoholic beverages (e.g., beer, wine), dairy products, fruits, and vegetables.[47]

On March 20, the European Commissioner for Trade and Economic Security announced that the EU would postpone the first set of tariffs set to be imposed on April 1 to mid-April.[48] The commissioner explained that the EU is considering aligning the timing of the two sets of countermeasures to consult with EU member states on both lists simultaneously in light of proposed additional U.S. tariffs for April 2.

On April 7, 2025, President of the European Commission Ursula von der Leyen stated that the EU is ready to negotiate with the United States and offered "zero-for-zero tariffs for industrial goods."[49] In past trade negotiations, agriculture has been a contentious issue between the two trading partners because of key differences in agricultural regulatory issues (e.g., EU

品加征关税措施的公告 [Announcement of the Customs Tariff Commission of the State Council on Adjusting Additional Tariff Measures on Imported Goods from the United States]," April 11, 2025, https://gss.mof.gov.cn/gzdt/zhengcefabu/202504/t20250411_3961823.htm.

[43] Ministry of Commerce of the People's Republic of China, "中美日内瓦经贸会谈联合声明 [Joint Statement on China-U.S. Economic and Trade Meeting in Geneva]," May 12, 2025, https://www.mofcom.gov.cn/xwfb/ldrhd/art/2025/art_8055948aadb5450598bf73d1aae6828e.html.

[44] European Commission (EC), "Commission Responds to Unjustified US Steel and Aluminium Tariffs with Countermeasures," March 12, 2025, https://ec.europa.eu/commission/presscorner/detail/en/ip_25_740.

[45] CRS calculations from Trade Data Monitor and Eurostat.

[46] EC, "Information Gathering Notice Under Regulation (EU) No 654/2014 on the New US Tariffs on Steel and Aluminium Products, and Possible EU Rebalancing Measures in Response," March 12, 2025, https://policy.trade.ec.europa.eu/consultations/information-gathering-notice-under-regulation-eu-no-6542014-new-us-tariffs-steel-and-aluminium_en.

[47] EC, "EU Countermeasures on US Steel and Aluminium Tariffs Explained," March 11, 2025, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_25_750/QANDA_25_750_EN.pdf.

[48] EC, "Remarks by Commissioner Šefčovič at the Joint Hearing of the Committee on International Trade on Trade Relations with the United States and a Structured Dialogue," March 20, 2025, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/speech_25_840/SPEECH_25_840_EN.pdf.

[49] EC, "Press Statement by President von der Leyen with Norwegian Prime Minister Støre," April 7, 2025, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/statement_25_996/STATEMENT_25_996_EN.pdf.

biotechnology approval process, use of growth promotants in U.S. meat production, and geographical indications).[50]

On April 10, following the 90-day postponement of the United States' country-specific "reciprocal tariffs," President von der Leyen announced a hold for 90 days on retaliatory tariffs that were set to go into effect April 15.[51] On April 14, the EU released a list of U.S. products to be subject to retaliatory tariffs and suspended all planned tariff measures until July 14, 2025.[52] Bulk commodities targeted include soybeans, corn, durum wheat, and rice. Consumer-oriented products targeted include almonds, beef, processed cranberries, tobacco products, cranberry and orange juices, spices, peanut butter, dried egg yolk, bakery goods and pasta, and ice cream. Tariff rates for agricultural products listed are 25%, except for essential oils, which would face a 10% tariff. The EU-proposed tariffs targeted about $5.3 billion worth of U.S. agricultural products, according to 2024 EU import data.[53]

On May 8, 2025, the EU launched a public consultation on a list of U.S. agricultural and industrial imports that would be subject to retaliatory tariffs.[54] The consultation is in response to U.S. "reciprocal tariffs" and U.S. tariffs on automobiles and certain automobile parts.

2018 Through 2023 Trade Actions

What Retaliatory Tariffs Were Imposed on U.S. Agriculture in 2018 and 2019?

In response to U.S. tariff actions in 2018, certain trading partners of the United States responded with retaliatory tariffs on U.S. goods, including agricultural products.[55] In April 2018, China responded to U.S. Section 232 steel and aluminum tariffs with retaliatory tariffs on certain U.S. imports, including agricultural products (e.g., fruit, ginseng, pork, tree nuts, wine). In June 2018, Mexico, the EU, and Turkey responded to Section 232 tariffs with retaliatory tariffs. The agricultural products targeted included pork products, cheese, apples, potatoes, cranberries, and whiskey by Mexico; corn, rice, sweet corn, kidney beans, certain breakfast cereals, peanut butter, orange juice, cranberry juice, whiskey, cigars, tobacco products, and essential oils by the EU; and tree nuts, rice, and tobacco by Turkey. In July 2018, Canada responded with retaliatory tariffs on U.S. products, including dairy, poultry, and beef products; coffee, chocolate, sugar, and

[50] For more background about U.S.-European Union agricultural trade relations, see CRS Report R47095, *U.S.-EU Trade Relations*; and CRS Report R46241, *U.S.-EU Trade Agreement Negotiations: Trade in Food and Agricultural Products*.

[51] EC, "Statement by President von der Leyen," April 10, 2025, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/statement_25_1036/STATEMENT_25_1036_EN.pdf; and EC, "Commission Proposal to Impose Trade Countermeasures Against US Obtains Necessary Support from EU Member States," April 9, 2025, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/statement_25_1025/STATEMENT_25_1025_EN.pdf.

[52] EC, "EU Pauses Countermeasures Against US Tariffs to Allow Space for Negotiations," April 14, 2025, https://ec.europa.eu/commission/presscorner/detail/en/ip_25_1058. The EU originally planned to implement tranches of retaliatory tariffs effective April 15, May 16, and December 1, 2025, prior to the April 14 postponement announcement.

[53] CRS calculations from Trade Data Monitor and Eurostat.

[54] EC, "Commission Consults on Possible Countermeasures and Readies WTO Litigation in Response to US Tariffs," May 8, 2025, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_25_1149/IP_25_1149_EN.pdf.

[55] For background, see CRS Report R45903, *Retaliatory Tariffs and U.S. Agriculture*; and CRS Report R45929, *China's Retaliatory Tariffs on U.S. Agriculture: In Brief*.

confectionery; prepared food products; condiments; bottled water; and whiskies. India imposed retaliatory tariffs in June 2019 targeting U.S. chickpeas, almonds, walnuts, apples, and lentils.

Separate from the Section 232 tariffs and retaliatory tariffs, the United States also imposed tariffs on China under Title III of the Trade Act of 1974 (19 U.S.C. §§2411-2420), commonly referred as "Section 301," starting in July 2018. Between 2018 and 2019, the United States and China imposed several rounds of tariffs and retaliatory tariffs. Nearly all U.S. agricultural products faced retaliatory tariffs. In September 2019, China announced a tariff exclusion list for certain U.S. products subject to Section 301 retaliatory tariffs, including agricultural products such as alfalfa and whey for feed use.[56] In February 2020, China announced a tariff exclusion process for Chinese companies impacted by the Section 301 retaliatory tariffs on U.S. imports.[57]

According to one analysis, during the 2018/2019 trade conflict, agricultural products accounted for 68% of China's Section 232 retaliation, 22% of China's Section 301 retaliation, 33% of the EU's retaliation, 20% of Canada's retaliation, 79% of Mexico's retaliation, nearly 20% of Turkey's retaliation, and 61% of India's retaliation.[58]

In May 2019, the United States removed Section 232 tariffs on Canada and Mexico, and in turn, Canada and Mexico removed retaliatory tariffs on the United States to facilitate the ratification of USMCA.[59]

Following an October 2021 agreement between the United States and the EU on the Section 232 tariffs, the EU suspended retaliatory tariffs that included U.S. agricultural products from January 2022 to the end of December 2023, and later extended the suspension to the end of March 2025.[60] The EU postponed imposing retaliatory tariffs in order to assess the planned U.S. April 2, 2025, "reciprocal tariffs" announcement and postponed again in response to the U.S. 90-day pause of country-specific "reciprocal tariffs."[61] EU retaliatory tariffs are suspended until July 14, 2025. See "European Union Retaliatory Tariffs" for further background.

The United Kingdom (UK) suspended Section 232 retaliatory tariffs effective June 2022.[62] The UK inherited the original EU retaliatory tariffs when the UK separated from the EU customs union in January 2021.

---

56 USDA, FAS, *Outcome of Batch One of China's Tariff Exclusion Process*, GAIN Report CH19061, September 18, 2019, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Outcome%20of%20Batch%20One%20of%20China%E2%80%99s%20Tariff%20Exclusions%20Process%20_Beijing_China%20-%20Peoples%20Republic%20of_9-17-2019.

57 USDA, FAS, *China Announces a New Round of Tariff Exclusions*, GAIN Report CH2020-0017, February 26, 2020, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=China%20Announces%20a%20New%20Round%20of%20Tariff%20Exclusions_Beijing_China%20-%20Peoples%20Republic%20of_02-18-2020.

58 Jason H. Grant et al., "Agricultural Exports and Retaliatory Trade Actions: An Empirical Assessment of the 2018/2019 Trade Conflict," *Applied Economic Perspectives and Policy*, vol. 43, no. 2 (June 2021), p. 18.

59 Ana Swanson and Dan Bilefsky, "United States Reaches Deal to Lift Metal Tariffs on Canada and Mexico," *New York Times*, May 17, 2019.

60 EC, "EU Prolongs Tariff Suspension for US Products Related to the Steel and Aluminium Dispute," December 19, 2023, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_23_6713/IP_23_6713_EN.pdf.

61 EC, "EU Countermeasures on US Steel and Aluminium Tariffs Explained," March 11, 2025, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_25_750/QANDA_25_750_EN.pdf; and EC, "EU Pauses Countermeasures Against US Tariffs to Allow Space for Negotiations," April 14, 2025, https://ec.europa.eu/commission/presscorner/detail/en/ip_25_1058.

62 Government of the United Kingdom, "UK and US Resolve Steel and Aluminium Tariffs Issue," March 22, 2022, https://www.gov.uk/government/news/uk-and-us-resolve-steel-and-aluminium-tariffs-issue.

In September 2023, India removed retaliatory tariffs on U.S. almonds, apples, chickpeas, lentils, and walnuts following a June 2023 resolution between the United States and India that terminated six nonagricultural WTO disputes.[63]

Were U.S. Agricultural Exports Affected by Retaliatory Tariffs?

The retaliatory tariffs were one of many factors that influenced agricultural exports. **Table 3** displays U.S. agricultural exports to retaliating and non-retaliating trading partners from 2017 to 2020 in nominal values. Although China, Canada, Mexico, the EU, and Turkey imposed retaliatory tariffs in the spring and summer of 2018, total U.S. agricultural exports from 2017 compared to 2018 increased by 1%. While exports to China declined by 53%, other U.S. agricultural export markets (e.g., the EU, Vietnam, South Korea, Egypt) saw an increase of exports that offset the decline in exports to China. The total value of U.S. agricultural exports declined in 2019 and 2020 relative to 2018 levels and remained similar to 2017 levels. Although foreign tariffs impact the competitiveness of U.S. agricultural exports in relation to other foreign suppliers, other factors may contribute to U.S. trade flows because of unique dynamics of specific commodities. This section provides a snapshot of select major U.S. agricultural exports between 2017 and 2020 that were impacted by retaliatory tariffs, to illustrate the role of tariffs and nontariff factors on agricultural trade flows.

Table 3. U.S.Agricultural Exports to Retaliating and Non-Retaliating Trading Partners, 2017 to 2020

In Billions of Dollars (nominal)

Trading Partner	2017	2018	2019	2020
U.S. exports to retaliating trading partners				
China	19.6	9.2	13.9	26.4
Canada	21.7	22.0	21.9	22.3
Mexico	18.8	19.3	19.4	18.3
EU-28	12.4	14.5	12.6	12.1
India	1.9	1.8	2.1	1.7
Turkey	1.8	1.5	1.3	1.2
U.S. exports to non-retaliating trading partners	66.7	76.4	69.9	67.6
Total U.S. agricultural exports	**142.9**	**144.7**	**141.1**	**149.7**

Source: CRS from USDA, GATS data (BICO-10).

Notes: Data are not just adjusted for inflation. Values may not sum to totals shown because of rounding. EU-28 = the European Union customs union and its 28 member countries, which included the United Kingdom until it left in January 2021.

Soybeans

Table 4 presents annual total U.S. soybean exports from 2017 to 2020, broken down by major markets (i.e., China, the EU, Mexico, and Egypt) and the rest of the world combined. China imposed retaliatory tariffs on U.S. soybeans starting in 2018, which is reflected in a 74% decline

[63] USDA, FAS, *Success Story – India Cuts Retaliatory Tariffs on US Almonds-Apples-Walnuts-Chickpeas-Lentils*, GAIN Report IN2023-0066, September 12, 2023 and USTR, "United States Announces Major Resolution on Key Trade Issues with India," June 22, 2023.

in exports by value in 2018 compared to 2017. Between 2009 and 2017, nearly 60% of U.S. soybean exports by value on average were destined for China. Other U.S. trading partners such as the EU, Mexico, and Egypt increased imports of U.S. soybeans but not at levels to replace the shortfall from the decline of China's imports. USDA attributed the increased imports of U.S. soybeans from trading partners other than China to factors such as more competitive prices of U.S. soybeans following China's retaliatory tariffs, Brazil-sourced soybeans commanding a price premium, and tighter supplies from Argentina because of drought.[64] Another factor that may have affected China's imports for soybeans from the United States and other suppliers was dampened demand for animal feed because of the spread of African swine fever in China beginning in the summer of 2018 and the culling of 750,000 to 1.1 million swine.[65]

Table 4. U.S. Soybean Exports, 2017 to 2020

In Millions of Dollars (nominal)

Trading Partner	2017	2018	2019	2020
China	12,224.4	3,119.2	8,004.9	14,065.7
EU-28	1,636.7	3,077.5	1,953.2	1,970.8
Mexico	1,574.2	1,818.0	1,878.1	1,879.8
Egypt	364.5	1,163.5	994.7	1,486.2
Rest of world	5,656.5	7,879.8	5,862.8	6,113.7
Total U.S. soybean exports	**21,456.3**	**17,058.1**	**18,693.6**	**25,516.2**

Source: CRS from USDA, GATS data (BICO-10).

Notes: Data are not adjusted for inflation. Values may not sum to totals shown because of rounding. EU-28 = the European Union customs union and its 28 member countries, which included the United Kingdom until it left in January 2021.

Corn

Annual total U.S. corn exports from 2017 to 2020 are displayed in **Table 5**, broken down by select markets and the rest of the world. China and the EU imposed tariffs on U.S. corn in 2018. In 2018, EU imports initially surged prior to the imposition of June 2018 retaliatory tariffs and dwindled afterward, which resulted in a total of about $320 million of U.S. corn exported to the EU in 2018, which dropped to about $510,000 in 2019. U.S. corn exports to China also saw declines in 2018 and 2019 compared to 2017. Historically, U.S. corn exports to China varied from year to year even before the implementation of retaliatory tariffs. The United States has cited past issues affecting U.S. corn market access into China, including China's biotechnology policy, policy in liquidating domestic corn stocks, and lack of transparency in how China administers its tariff-rate quota for corn (as well as rice and wheat).[66] According to USDA, multiple factors

---

[64] USDA, FAS, *EU-28: Oilseeds and Products Update – Lowest Rapeseed Crop in Over a Decade*, GAIN Report AU1907, September 12, 2019; USDA, FAS, *Mexico: Oil Seeds and Products Annual: Lack of Supports to Slow Oilseed Production, While Meal and Oil Remain Stable*, GAIN Report MX9014, April 1, 2019; and USDA, FAS, *Egypt: Oilseeds and Products Annual 2019: U.S. Soybean Exports to Egypt Skyrocket, Volume Likely to Continue Through 2020*, GAIN Report EG19004, March 31, 2019.

[65] Stephen Morgan et al., *The Economic Impacts of Retaliatory Tariffs on U.S. Agriculture*, USDA, ERS, January 2022, p. 25; and Fred Gale et al., *How China's African Swine Fever Outbreaks Affected Global Pork Markets*, USDA, ERS, November 2023, p. 12.

[66] USTR, *2019 Report to Congress on China's WTO Compliance*, March 2020, p. A-69; and USTR, *2022 Report to Congress on China's WTO Compliance*, February 2023, pp. 31-32. Tariff-rate quotas (TRQs) are two-tiered (continued...)

contributed to the decline in U.S. corn exports in 2019, including higher U.S. prices due to reduced production and strong domestic use for feed and ethanol, and export competition from Argentina, Brazil, and Ukraine.[67] In 2020, U.S. corn exports to China increased 2,136% from the previous year following the U.S.-China Phase One Agreement and China's exclusions for Section 301 retaliatory tariffs on agricultural products.[68]

Table 5. U.S. Corn Exports, 2017 to 2020

In Millions of Dollars (nominal)

Trading Partner	2017	2018	2019	2020
Mexico	2,645.5	3,060.8	2,735.9	2,685.2
Japan	2,163.4	2,813.0	2,011.2	1,855.5
China	142.0	50.2	55.5	1,240.5
Colombia	784.7	927.3	682.5	879.2
South Korea	705.4	1,355.7	358.7	548.1
EU-28	113.2	319.8	0.5	0.4
Rest of world	2,576.4	3,945.5	1,826.4	2,037.1
Total U.S. corn exports	**9,130.6**	**12,472.4**	**7,670.6**	**9,245.9**

Source: CRS from USDA, GATS data (BICO-10).

Notes: Data are not just adjusted for inflation. Values may not sum to totals shown because of rounding. EU-28 = the European Union customs union and its 28 member countries, which included the United Kingdom until it left in January 2021.

Tree Nuts

Table 6 displays U.S. tree nut exports, broken down by top export markets in addition to Turkey and the rest of the world. Starting in mid-2018, China and Turkey imposed retaliatory tariffs on U.S. tree nuts (e.g., almonds, cashews, pistachios, walnuts). In June 2019, India imposed retaliatory tariffs on U.S. almonds and walnuts. Generally, from 2017 to 2020, U.S. exports of tree nuts by value increased yearly despite the imposition of retaliatory tariffs. USDA attributed strong domestic demand in China and India for tree nuts as driving U.S. export growth.[69] Other factors that favored U.S. tree nut export growth were the United States' share in world production and trade, particularly for almonds and walnuts, as well as a steep drop-off in Iranian pistachio production and exports because of a weather shock in marketing year 2018/2019.[70] Despite Turkey's retaliatory tariffs, the United States was still a major source of almond and walnut imports for Turkey but with decreasing market share after 2018.[71]

applications of tariffs for an imported product. A specified quantity of imports (in-quota) enters the importing country at a reduced tariff rate. Imports that exceed the quantity (out-of-quota or over-quota) typically face higher tariffs.

[67] USDA, FAS, *2019 United States Agricultural Export Yearbook*, July 22, 2020, pp. 5-6.

[68] USDA, FAS, *2020 United States Agricultural Export Yearbook*, April 5, 2021, p. 6; and USDA, FAS, *China: Grain and Feed Annual*, GAIN Report CH2020-0048, April 6, 2020.

[69] USDA, FAS, *2019 United States Agricultural Export Yearbook*, pp. 27-28; and USDA, FAS, *2020 United States Agricultural Export Yearbook*, pp. 29-30.

[70] USDA, FAS, *2019 United States Agricultural Export Yearbook*, p. 28; and USDA, FAS, *2020 United States Agricultural Export Yearbook*, p. 30; and USDA, FAS, *Tree Nuts: World Markets and Trade*, February 2019.

[71] USDA, FAS, *Turkey: Tree Nuts Annual*, GAIN Report TU2020-0031, September 23, 2020.

Table 6. U.S.Tree Nut Exports, 2017 to 2020

In Millions of Dollars (nominal)

Trading Partner	2017	2018	2019	2020
EU-28	2,707.2	2,768.5	3,114.9	2,877.8
India	738.0	662.5	823.2	913.6
China	242.9	328.3	605.4	747.2
Canada	642.7	695.8	697.4	738.2
Turkey	308.4	278.9	340.4	249.8
Rest of world	3,840.0	3,781.3	3,493.2	2,873.0
Total U.S. tree nut exports	**8,479.4**	**8,515.5**	**9,074.5**	**8,399.6**

Source: CRS from USDA, GATS data (BICO-10).

Notes: Data are not just adjusted for inflation. Values may not sum to totals shown because of rounding. EU-28 = the European Union customs union and its 28 member countries, which included the United Kingdom until it left in January 2021.

Pork

Table 7 displays U.S. pork and pork product exports, broken down by the top five export markets and the rest of the world. China and Mexico imposed tariffs on U.S. pork and pork product exports in mid-2018, with Mexico lifting tariffs in mid-2019. U.S. pork exports to China dropped 14% by value between 2017 and 2018. In 2019, U.S. pork exports to China rebounded despite the retaliatory tariffs, which USDA attributes to decreased domestic pork production in China caused by African swine fever outbreaks.[72] U.S. pork exports to Mexico declined 13% by value from 2017 to 2018, while Canada gained market share in 2018.[73] Despite Mexico lifting its tariffs, U.S. pork exports declined from 2018 to 2020, which USDA attributes to strong domestic production, a weak Mexican economy, and depreciation of the peso.[74]

[72] USDA, FAS, *China: Livestock and Products Annual*, GAIN Report CH2019-0205, August 7, 2020; Fred Gale et al., *How China's African Swine Fever Outbreaks Affected Global Pork Markets*, pp. 20-21; and Frank Kyekyeku Nti et al., "Impact of Retaliatory Tariffs on the U.S. Pork Sector," *Choices* (Quarter 4, 2019).

[73] USDA, FAS, *Mexico: Livestock and Products Annual: Higher Pork Consumption Drives Production as Mexico Increases Exports of Pork and Beef*, GAIN Report MX9027, August 15, 2019; and Frank Kyekyeku Nti et al., "Impact of Retaliatory Tariffs on the U.S. Pork Sector."

[74] USDA, FAS, *2019 United States Agricultural Export Yearbook*, p. 17; and USDA, FAS, *2020 United States Agricultural Export Yearbook*, p. 17.

Table 7. U.S. Pork and Pork Product Exports, 2017 to 2020

In Millions of Dollars (nominal)

Trading Partner	2017	2018	2019	2020
China	662.3	570.9	1,300.2	2,279.8
Japan	1,625.9	1,630.5	1,523.4	1,622.9
Mexico	1,514.1	1,310.7	1,278.4	1,162.3
Canada	792.8	764.8	801.8	854.0
South Korea	475.1	670.3	592.9	452.6
Rest of world	1,415.0	1,455.4	1,454.8	1,347.8
Total U.S. pork and pork products	**6,485.1**	**6,402.8**	**6,951.5**	**7,719.6**

Source: CRS from USDA, GATS data (BICO-10).

Notes: Data are not just adjusted for inflation. Values may not sum to totals shown because of rounding.

Were U.S. Farm Sector Sales Affected by Retaliatory Tariffs?

The retaliatory tariffs were one of many factors that influenced U.S. farm sector sales. The farm sector earns revenue from the sales of crops, livestock, and animal products. The total value of these commodities was approximately $370 billion in 2017, $372 billion in 2018, $369 billion in 2019, and $368 billion in 2020 (**Table 8**). Compared to 2017 levels, the total value of crops, livestock, and animal products sold was approximately $1.6 billion higher in 2018, $1.1 billion lower in 2019, and $2.9 billion lower in 2020.

Table 8. Value of Crops, Livestock, and Animal Products Sold, 2017 to 2020

In Billions of Dollars (nominal)

Commodity Type	2017	2018	2019	2020
Crops				
Cotton	$7.57	$7.48	$6.82	$6.81
Feed crops	$53.92	$57.29	$58.42	$57.52
Food grains	$11.20	$12.13	$11.51	$11.78
Fruits and nuts	$30.59	$29.35	$29.19	$27.83
Oil crops	$41.09	$39.47	$36.22	$43.84
Tobacco	$1.38	$1.22	$0.96	$0.82
Vegetables and melons	$20.50	$18.70	$19.11	$21.06
All other crops	$28.62	$30.35	$31.53	$32.83
Livestock and animal products				
Dairy products	$37.94	$35.24	$40.55	$40.36
Cattle and calves	$66.94	$67.18	$66.19	$63.32
Hogs	$21.04	$20.77	$21.76	$19.16
Miscellaneous livestock	$6.86	$6.94	$7.06	$7.00
Poultry and eggs	$42.79	$45.96	$40.00	$35.17
Total	**$370.44**	**$372.07**	**$369.32**	**$367.50**

Source: CRS calculations using USDA, Economic Research Service, "Farm Income and Wealth Statistics—Value Added by the U.S. Agricultural Sector, 2016-2025F," updated February 2025, https://data.ers.usda.gov/reports.aspx?ID=4047.

Notes: Feed crops include barley, corn, hay, oats, and grain sorghum. Food grains include rice, rye, and wheat. Dairy products includes milk.

While the total value of crops, livestock, and animal products sold remained relatively level from 2017 to 2020, sales were variable for all categories of commodities over this period. In 2018, the value of feed grains, food grains, cattle and calves, poultry and eggs, and all other crops increased relative to 2017 levels; the total value of other agricultural commodities sold declined in 2018 relative to 2017 levels (**Table 8**). In 2019, the value of feed grains, food grains, all other crops, dairy, hogs, and miscellaneous livestock increased relative to 2017 levels, while the total value for other agricultural commodities declined relative to 2017 levels.

Changes in market prices between 2017 and 2020 contributed to the changes in the values of commodities sold each year. For example, retaliatory tariffs imposed in 2018 targeted specific agricultural commodities, including almonds, fresh sweet cherries, corn, cotton, hogs, milk, sorghum, soybeans, and wheat. Compared to 2017, 2018 marketing year average prices were higher for corn, upland cotton, sorghum, and wheat and lower for the other targeted commodities (**Table 9**). Compared to 2017, 2019 marketing year average prices were higher for corn, milk, and sorghum and lower for the other targeted commodities. Compared to 2017, 2020 marketing year average prices were higher for fresh sweet cherries, corn, milk, sorghum, soybeans, and wheat and lower for the other targeted commodities.

Table 9. Marketing Year Average Prices for Selected Agricultural Commodities, 2017 to 2020

In Dollars per Unit (Nominal)

Commodity	Unit	2017	2018	2019	2020
Almonds	Pound	$2.53	$2.50	$2.45	$1.71
Cherries (fresh sweet)	Ton	$2.06	$1.83	$1.93	$2.92
Corn	Bushel	$3.36	$3.61	$3.56	$4.53
Cotton (extra long staple)	Pound	$1.39	$1.15	$1.06	$1.19
Cotton (upland)	Pound	$0.69	$0.70	$0.60	$0.66
Hogs	Hundredweight	$53.10	$50.20	$51.40	$46.90
Milk	Hundredweight	$17.69	$16.28	$18.65	$18.16
Sorghum	Hundredweight	$5.75	$5.82	$5.96	$9.00
Soybeans	Bushel	$9.33	$8.48	$8.57	$10.80
Wheat	Bushel	$4.72	$5.16	$4.58	$5.05

Source: CRS using USDA, National Agricultural Statistics Service, "Quick Stats," accessed March 14, 2025.

What Were the Economic Losses to the U.S. Agricultural Sector from Retaliatory Tariffs in 2018 and 2019?

Various studies have estimated losses to the U.S. agricultural sector associated with retaliatory tariffs; these studies employ different methodologies and provide differing estimates of losses attributable to retaliatory tariffs.[75] Estimates of economic losses made by USDA's Office of the Chief Economist (OCE) in 2018 and 2019 had extra significance for policymakers as they were used to inform USDA's responses to retaliatory tariffs in 2018 and 2019 (see "USDA's Response to Retaliatory Tariffs").[76]

USDA OCE estimated that the 2018 economic losses were between $11 billion and $12 billion.[77] According to USDA figures reported by the Government Accountability Office (GAO), $10.2 billion of the estimated $11 billion to $12 billion were for losses to almonds, fresh sweet cherries, corn, cotton, dairy, hogs, sorghum, soybeans, and wheat.[78] According to USDA figures reported by GAO, USDA OCE estimated that the 2019 economic losses for agricultural and related commodities were approximately $16.9 billion.[79]

In January 2022, USDA ERS published updated estimates of trade losses. ERS reported estimates of approximately $27 billion in trade losses between July 2018 and December 2019.[80] ERS reported that China's retaliatory tariffs reduced the value of U.S. agricultural trade by approximately $25.7 billion, and retaliatory tariffs imposed by other countries reduced the value of U.S. agricultural trade by approximately $1.5 billion. ERS reported estimated annualized losses for some commodities, including $9.35 billion for soybeans, $854 million for sorghum, $646 million for pork, $618 million for fruits, $391 million for dairy, $366 million for cotton, $309 million for wheat, $219 million for tree nuts, $198 million for corn, and $46 million for rice.

USDA OCE estimated economic losses in 2018 and 2019 by projecting hypothetical scenarios of world trade that could have occurred had retaliatory tariffs not been imposed on U.S. agricultural products. USDA OCE made those projections before data on actual exports were available for the year as part of USDA's efforts to "craft a short-term relief strategy to protect agricultural producers" in accordance with Presidential directives.[81] Updating such projections with subsequently available data suggests that USDA OCE may have overestimated trade losses in 2018 and 2019. Actual agricultural exports were approximately $145 billion in 2018 and approximately $141 billion in 2019 (**Table 3**). These values compare to agricultural exports in 2015, 2016, and 2017 of $137 billion, $139 billion, and $143 billion, respectively. USDA's

[75] See, for example, USDA, ERS, *The Economic Impacts of Retaliatory Tariffs on U.S. Agriculture*, ERR-304, January 2022.

[76] USDA, *Cost Benefit Analysis: Market Facilitation Program*, July 24, 2018; USDA, "USDA Announces Support for Farmers Impacted by Unjustified Retaliation and Trade Disruption," press release, May 23, 2019; USDA Office of the Chief Economist (OCE), *Trade Damage Estimation for the Market Facilitation Program and Food Purchase and Distribution Program*, September 13, 2018; and USDA OCE, *Trade Damage Estimation for the 2019 Market Facilitation Program and Food Purchase and Distribution Program*, August 22, 2019.

[77] USDA, "USDA Assists Farmers Impacted by Unjustified Retaliation," press release, July 24, 2018, https://www.usda.gov/about-usda/news/press-releases/2018/07/24/usda-assists-farmers-impacted-unjustified-retaliation. In the press release, USDA stated that they were authorizing "up to $12 billion in programs, which is in line with the estimated $11 billion impact of the unjustified retaliatory tariffs on U.S. agricultural goods."

[78] CRS calculations using data in GAO, "Appendix III: 2018 MFP and 2019 MFP Trade Damage Estimate and Payment Methodologies," in *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*, GAO-22-468, November 2021, https://www.gao.gov/assets/gao-22-468.pdf.

[79] CRS calculations using data in GAO, "Appendix III: 2018 MFP and 2019 MFP Trade Damage Estimate and Payment Methodologies," in *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*. Related commodities included distiller's dried grains with solubles, ethanol, peanut butter, infant formula, ice cream, casein, and lactose.

[80] USDA, ERS, *The Economic Impacts of Retaliatory Tariffs on U.S. Agriculture*, ERR-304, January 2022.

[81] USDA, "USDA Assists Farmers Impacted by Unjustified Retaliation," press release, July 24, 2018.

estimated economic losses imply that USDA effectively projected agricultural exports in 2018 and 2019 to be approximately $157 billion in the absence of retaliatory tariffs.[82]

USDA ERS reported estimated trade losses for 2018 and 2019 at levels similar to USDA OCE's estimates. To calculate these estimated trade losses, USDA ERS used estimates published in an academic study with a different methodology than had been used by USDA OCE in 2018 and 2019.[83] This methodology is one of many that are commonly used in the academic literature to estimate economic losses from retaliatory tariffs. Other commonly used methodologies may estimate different losses. For example, a different academic study found that total 2018 and 2019 economic losses for soybeans were $3.2 billion;[84] USDA OCE estimated soybean losses at $3.6 billion for 2018 alone.[85] That study found that USDA overcompensated the agricultural sector by $5.4 billion for soybean losses in 2018 and 2019.[86]

Methods used to estimate trade losses from retaliatory tariffs can produce different estimates depending on the data used. USDA OCE produced estimates in 2018 after spring planting was complete but before 2018 commodities were harvested. In 2019, USDA OCE produced estimates before farmers had finished spring planting. USDA OCE acted at those times in support of the Administration's goal of providing expedited assistance to farmers who experienced trade disruptions with major export markets. Some policymakers may agree with the Administration's decision to provide expedited assistance to farmers in 2018 and 2019. Other policymakers may question the need for expedited assistance in 2018 and 2019 given the availability of other farm support programs.[87]

In addition, methods used to estimate trade losses can produce different estimates depending on the assumptions applied. In their 2021 analysis of the Market Facilitation Program (MFP), GAO found that USDA OCE's 2018 estimates of economic losses "used a justifiable baseline" to model what trade would have been in the absence of retaliatory tariffs.[88] GAO also found that USDA OCE's 2019 estimates of economic losses "used baselines that did not best represent what trade would be absent the retaliatory tariffs, and that increased trade damage estimates." In their response to GAO's 2021 analysis, USDA OCE stated that

> [t]he draft report's finding that the 2019 baseline is not representative and increased trade damage estimates does not take into account that the decision on what is the appropriate baseline depends on the policy goals and that there is not one single most representative baseline. OCE provided alternatives that reflected different options based on the direction of senior USDA decision makers under the previous administration and selection of the baseline was part of the program design and not made by OCE.[89]

---

[82] CRS calculations. Actual 2018 trade of $145 billion plus $12 billion in estimated trade losses is $157 billion. Actual 2019 trade of $141 billion plus $16 billion in estimated trade losses is $157 billion.

[83] USDA ERS used estimated product-specific changes in the value of exports as published in Jason H. Grant et al., "Agricultural Exports and Retaliatory Trade Actions: An Empirical Assessment of the 2018/2019 Trade Conflict," *Applied Economic Perspectives and Policy*, vol. 43, no. 2 (June 2021).

[84] Michael Adjemian et al., "Estimating the Market Effect of a Trade War: The Case of Soybean Tariffs," *Food Policy*, vol. 105 (December 2021).

[85] USDA, *Cost Benefit Analysis: Market Facilitation Program*, July 24, 2018.

[86] Michael Adjemian et al., "Estimating the Market Effect of a Trade War: The Case of Soybean Tariffs."

[87] For background on other farm support programs, see CRS In Focus IF12218, *Farm Bill Primer: Farm Safety Net Programs*.

[88] GAO, *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*.

[89] GAO, "Appendix VIII: Comments from the Department of Agriculture," in *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*, p. 86.

USDA OCE also noted that their 2018 and 2019 economic analyses adhered to departmental and Office of Management and Budget requirements for economic analyses. Some policymakers may support USDA's senior decisionmakers' reliance on USDA OCE to estimate economic losses in order to be timely and responsive to decisionmakers' requirements. Other policymakers may support the use of independent feedback on USDA OCE's economic analyses used to inform USDA policymaking.

What Were the U.S.-China Phase One Agreement Provisions for Agriculture?

In January 2020, President Trump and China's Vice Premier Liu He signed the "Economic and Trade Agreement Between the Government of the United States of America and the Government of the People's Republic of China" (U.S.-China Phase One Agreement) to reduce U.S.-China trade tensions that escalated in 2018 when the United States imposed several rounds of tariffs on imports from China under Section 232 of the Trade Expansion Act of 1962 and Section 301 of the Trade Act of 1974 authorities.[90] The Phase One Agreement included purchase commitments of U.S. imports by China of no less than $12.5 billion and $19.5 billion above a 2017 baseline in agricultural and seafood products total for 2020 and 2021, respectively.[91] Other provisions in the agreement included China abiding by its WTO obligations by improving its tariff-rate quota administration for wheat, corn, and rice and greater transparency of its domestic support programs.[92] China also agreed to implement a "transparent, predictable, efficient, science- and risk-based regulatory process" for evaluating and authorizing agricultural biotechnology products. The agreement contains SPS-measures-related provisions to facilitate trade for agricultural and food products. Additionally, in March 2020, China implemented a new Section 301 retaliatory tariff exclusion process for imported U.S. agricultural products, although this was not directly associated with the Phase One Agreement.[93] Prior to the March 2020 exclusion process, only certain enumerated products were considered for tariff exclusions.

U.S. export and China's import data show that China did not meet its purchase commitments of U.S. agricultural and seafood products listed in the Phase One Agreement for the years 2020 and 2021, falling short by an estimated total of $13.1 billion (based on U.S. trade data) or $18.1 billion (based on China's trade data) over the two years.[94] Subsequent reports from the Office of

[90] For background, see CRS In Focus IF12125, *Section 301 and China: The U.S.-China Phase One Trade Deal*; and CRS In Focus IF11412, *U.S.-China Phase I Deal: Agriculture*. For the agreement text and agriculture-related fact sheets of the U.S.-China Phase One Agreement, see USDA, FAS, "China Phase One Agreement," https://www.fas.usda.gov/topics/china-phase-one-agreement.

[91] The U.S.-China Phase One Agreement does not explicitly state the 2017 baseline amount. The agreement specifies that both U.S. and Chinese trade data will be used to determine whether the purchase commitment provisions have been implemented. The 2017 baseline amount of approximately $20.9 billion is based on CRS calculations from Trade Data Monitor and U.S. Census Bureau data of U.S. agricultural and seafood product exports to China identified in Annex 6.1 of the U.S.-China Phase One Agreement. The 2017 baseline amount would be approximately $24.1 billion based on CRS calculations from Trade Data Monitor and China Customs Statistics' import data of U.S. agricultural and seafood products. For background on differences in U.S. and China's trade data, see CRS Report RS22640, *What's the Difference?—Comparing U.S. and Chinese Trade Data*.

[92] Separate from and prior to the Phase One Agreement, the United States initiated and won two WTO disputes against China's administration of its TRQs for wheat, corn, and rice and agricultural domestic support policies for rice and wheat. TRQs are two-tiered applications of tariffs for an imported product. A specified quantity of imports (in-quota) enters into the importing country at a reduced tariff rate. Imports that exceed the quantity (out-of-quota or over-quota) typically face higher tariffs.

[93] USDA, FAS, *China Announces a New Round of Tariff Exclusions*, GAIN Report CH2020-0017, February 26, 2020.

[94] CRS calculations from Trade Data Monitor, U.S. Census Bureau, and China Customs Statistics data.

the U.S. Trade Representative assert that China did not fully implement its obligations under the Phase One Agreement, including provisions related to agricultural trade.[95]

USDA's Response to Retaliatory Tariffs

How Did USDA Respond to Retaliatory Tariffs in 2018 and 2019?

In response to foreign trade retaliation targeting U.S. agricultural products in 2018 and 2019, the Secretary of Agriculture used the authorities and funds of the Commodity Credit Corporation (CCC) to provide additional assistance to the farm sector.[96] USDA made available up to $12.0 billion in CCC funding in 2018 and up to $16.0 billion in CCC funding in 2019. USDA determined how much funding to make available each year on the basis of its modeling of economic losses resulting from foreign countries imposing retaliatory tariffs (see "What Were the Economic Losses to the U.S. Agricultural Sector from Retaliatory Tariffs in 2018 and 2019?").

The funds made available in 2018 and 2019 were distributed through three ad hoc programs: the Market Facilitation Program (MFP), the Food Purchase and Distribution Program (FPDP), and the Agricultural Trade Promotion Program (ATP). These programs provided direct income support payments to farmers, purchased agricultural commodities, and supported trade promotion activities, respectively. Support from MFP, FPDP, and ATP supplemented direct income support, commodity purchases, and trade promotion activities authorized by the farm bill and other legislation.[97]

The bulk of the CCC funds were distributed through MFP (**Table 10**). MFP made direct payments to producers of eligible crops, dairy, and hogs. USDA made significant changes to MFP between the first and second rounds of funding, including expanding the commodities eligible for support, increasing payment limits for producers, and shifting from commodity-specific payments to county-specific payments, among other changes.[98]

---

[95] See USTR, *2024 National Trade Estimate Report on Foreign Trade Barriers*, March 2024, pp. 51-60; and USTR, *2024 Report to Congress on China's WTO Compliance*, January 2025.

[96] For background on the authorities and funds of the Commodity Credit Corporation, see CRS Report R44606, *The Commodity Credit Corporation (CCC)*.

[97] For additional background on income support authorized through the farm bill, see CRS In Focus IF12218, *Farm Bill Primer: Farm Safety Net Programs*. For additional background on USDA's commodity purchasing authorities, see CRS In Focus IF12193, *Farm and Food Support Under USDA's Section 32 Account*. For additional background on trade promotion authorized through the farm bill, see CRS In Focus IF12155, *Farm Bill Primer: Trade and Export Promotion Programs*.

[98] For background on the implementation of MFP in 2018 and 2019, see CRS Report R45310, *Farm Policy: USDA's 2018 Trade Aid Package*; CRS Report R45865, *Farm Policy: USDA's 2019 Trade Aid Package*; and CRS In Focus IF11289, *Farm Policy: Comparison of 2018 and 2019 Market Facilitation Programs*.

Table 10. Funds Available and Program Outlays for USDA Programs Responding to Retaliatory Tariffs

In Millions of Dollars

Program	Funds Available	Program Outlays
USDA trade assistance announced in 2018		
Market Facilitation Program	$10,600	$8,617
Food Purchase and Distribution Program	$1,200	$1,100
Agricultural Trade Promotion Program	$200	$200
2018 subtotal	**$12,000**	**$9,917**
USDA trade assistance announced in 2019		
Market Facilitation Program	$14,500	$14,368
Food Purchase and Distribution Program	$1,400	$1,264
Agricultural Trade Promotion Program	$100	$100
2019 subtotal	**$16,000**	**$15,732**
Grand total	**$28,000**	**$25,650**

Sources: Compiled by CRS using USDA, "USDA Assists Farmers Impacted by Unjustified Retaliation," press release, July 24, 2018, https://www.usda.gov/about-usda/news/press-releases/2018/07/24/usda-assists-farmers-impacted-unjustified-retaliation; USDA, "USDA Announces Details of Assistance for Farmers Impacted by Unjustified Retaliation," press release, August 27, 2018; USDA, "USDA Launches Second Round of Trade Mitigation Payments," press release, December 17, 2018; USDA, "USDA Announces Details of Support Package for Farmers," press release, July 25, 2019; USDA, *USDA Explanatory Notes – Agricultural Marketing Service*, 2022; USDA, Agriculture Marketing Service, "Food Purchase and Distribution Program," https://www.ams.usda.gov/selling-food-to-usda/trade-mitigation-programs; USDA, Office of Inspector General, *Oversight of the Agricultural Trade Promotion Program*, Audit Report 07601-0001-24, August 2022; and Government Accountability Office (GAO), *USDA Market Facilitation Program: Oversight of Further Supplemental Assistance for Farmers Could Be Improved*, GAO-22-104259, February 2022.

Note: Values in the "program outlays" column do not sum to total shown because of rounding applied by CRS.

How Were Market Facilitation Program Funds Distributed?

USDA allocated $25.1 billion for the Market Facilitation Program (MFP) and outlaid approximately $23.0 billion in MFP payments. According to GAO, USDA distributed 2018 MFP payments to 582,596 farms (excluding farms in Puerto Rico) and 2019 MFP payments to 643,965 farms (including farms in Puerto Rico).[99] The average 2018 MFP payment per farm was $14,791 in 2018 and the average 2019 MFP payment per farm was $22,312. In each year, payments varied across farms depending on the commodities produced on the farm, the way 2018 and 2019 MFP payments were structured, and other factors.

MFP payments were available to producers of certain crops and livestock commodities. Eligible livestock commodities for 2018 and 2019 MFP payments included dairy and hogs. Eligible crops varied for 2018 and 2019 MFP, with more commodities of each type eligible for 2019 MFP payments compared to those eligible for 2018 MFP payments. In each year, more than 90% of

[99] GAO, *USDA Market Facilitation Program: Oversight of Further Supplemental Assistance for Farmers Could Be Improved*, GAO-22-104259, January 2022. GAO's report does not discuss 2018 payments to farmers in the U.S. territories in 2018 or 2019 payments to farmers in the U.S. territories excluding Puerto Rico.

MFP payments were distributed to producers of non-specialty crops (**Table 11**).[100] Livestock commodities received about 4% of total MFP payments each year, and specialty crops received about 1% of 2018 MFP payments and 2% of 2019 MFP payments.

Table 11. Distribution of Market Facilitation Program Payments, by Commodity Type

In Millions of Dollars

Commodity Type	2018 MFP Payments	2019 MFP Payments	Total
Non-specialty crops	$8,194	$13,529	$21,723
Livestock commodities	$351	$566	$917
Specialty crops	$72	$274	$346
Total	**$8,617**	**$14,368**	**$22,986**

Source: CRS calculations using GAO, *USDA Market Facilitation Program: Oversight of Further Supplemental Assistance for Farmers Could Be Improved*, GAO-22-104259, January 2022.

Notes: MFP = Market Facilitation Program. Non-specialty crops eligible for 2018 MFP payments were corn, cotton, sorghum, soybeans, and wheat. Non-specialty crops eligible for 2019 MFP payments were alfalfa hay, barley, canola, chickpeas (large and small), corn, cotton (extra long staple and upland), crambe, dried beans, dry peas, flaxseed, lentils, millet, mustard seed, oats, peanuts, rapeseed, rice (long grain, medium grain, and temperate japonica), rye, safflower, sesame seed, sorghum, soybeans, sunflower seed, triticale, and wheat. Livestock commodities eligible for 2018 and 2019 MFP payments were hogs and dairy. Specialty crops eligible for 2018 MFP payments were shelled almonds and fresh sweet cherries. Specialty crops eligible for 2019 MFP payments were almonds, cranberries, cultivated ginseng, fresh grapes, fresh sweet cherries, hazelnuts, macadamia nuts, pecans, pistachios, and walnuts.

In 2018, MFP made payments separately for each commodity.[101] According USDA, about 82% of 2018 MFP payments were for soybeans, 6% for cotton, and 3% each for sorghum and wheat (**Table 12**). Corn, dairy, and hogs each received about 2% of total payments. Fresh sweet cherries and shelled almonds each received less than 1% of total payments.

Table 12. Distribution of 2018 Market Facilitation Program Payments

Commodity	Payment (in $ million)	Share of Total
Corn	$133.52	2%
Cotton	$484.08	6%
Dairy	$182.35	2%
Fresh sweet cherries	$42.69	< 1%
Hogs	$155.59	2%
Shelled almonds	$21.92	< 1%

[100] Statute defines specialty crops as fruits and vegetables, tree nuts, dried fruits, and horticulture and nursery crops (including floriculture) (7 U.S.C. §1621 note). For additional background on specialty crops, see CRS In Focus IF11317, *2018 Farm Bill Primer: Specialty Crops and Organic Agriculture*; and CRS In Focus IF12017, *Farm Bill Primer: Horticulture Title and Related Provisions*.

[101] In 2018, the Market Facilitation Program (MFP) had payment limits of $125,000 for non-specialty crops, $125,000 for specialty crops, and $125,000 for animal products (dairy and hogs). The maximum possible payment for a producer of all three types of commodities was $375,000. Eligibility for 2018 MFP was restricted to (1) applicants whose average adjusted gross income (AGI) was less than $900,000 and (2) applicants whose AGI exceeded $900,000 and at least 75% of the AGI was derived from farming, ranching, or forestry-related activities.

Commodity	Payment (in $ million)	Share of Total
Sorghum	$244.56	3%
Soybeans	$7,069.34	82%
Wheat	$241.62	3%
Total	$8,575.65	**100%**

Source: CRS calculations using USDA *Report to House and Senate Committees on Appropriations and Agriculture*, October 31, 2019.

Notes: USDA reported outlays for 2018 Market Facilitation Program (MFP) payments of approximately $8.576 billion as of October 31, 2019. As of January 2022, program outlays were $8.617 billion. Equivalent data by commodity for the 2019 MFP are not available.

For 2019 MFP for non-specialty crops, USDA made payments separately by county. All non-specialty crops within a county received a common payment rate that varied across counties from $15 per acre to $150 per acre. Payments for non-specialty crops were capped at $250,000.[102]

According to GAO, USDA chose to change its payment calculations to avoid distorting farmers' planting decisions in 2019.[103] County-specific payment rates meant that compensation for the same commodity varied by county. For example, GAO found that corn producers in the Midwest received $61 per acre on average, while corn producers in the South received $69 per acre on average. GAO concluded that USDA's use of the new methodology resulted in 2019 MFP payments that exceeded USDA's estimated trade damages for corn and were less than USDA's estimated trade damages for soybeans, sorghum, and cotton.[104]

For specialty crops, dairy, and livestock, USDA calculated 2019 MFP payments by commodity, similar to its 2018 method. Maximum payments were capped at $250,000 total for all specialty crops and $250,000 total for dairy and hogs. GAO concluded that USDA's use of a single payment rate for tree nuts resulted in 2019 MFP payments that exceeded USDA's estimated trade damages for almonds and pecans and were less than USDA's estimated trade damages for hazelnuts, macadamia nuts, pistachios, and walnuts.[105]

How Were Food Purchase and Distribution Program Funds Distributed?

USDA allocated $2.6 billion for the Food Purchase and Distribution Program (FPDP) and outlaid more than $2.3 billion on purchased commodities. Approximately 136 vendors were awarded

[102] In 2019, MFP had payment limits of $250,000 for non-specialty crops, $250,000 for specialty crops, and $250,000 for animal products (dairy and hogs). The maximum possible payment for a producer of all three types of commodities was $750,000. Eligibility for 2019 MFP was restricted to (1) applicants whose average AGI was less than $900,000 and (2) applicants whose AGI exceeded $900,000 and at least 75% of the AGI was derived from farming, ranching, or forestry-related activities.

[103] GAO, *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*.

[104] GAO, *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*.

[105] GAO, *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*.

contracts under 2018 FPDP.[106] USDA has not released the number of vendors awarded contracts for 2019 FPDP.

Most of the commodities purchased were distributed to states for further distribution to food banks and food pantries that participate in The Emergency Food Assistance Program.[107] Other recipients eligible to receive FPDP commodities included states, for use in the Commodity Supplemental Foods Program; tribes that operate the Food Distribution Program on Indian reservations; and the National School Lunch Program.[108] Additionally, if domestic feeding programs were unable to use commodities purchased through FPDP, USDA had the option to distribute surplus commodities to approved nonprofit entities for distribution to low-income individuals.[109]

Data on actual FPDP purchases in 2018 or 2019 are not available. USDA announced targets for FPDP purchases in 2018 and 2019 (**Table 13**). The selection of targeted commodities varied in 2018 and 2019. In some instances, USDA targeted FPDP purchases of commodities that were also eligible for MFP payments. For example, FPDP targeted $919.70 million worth of dairy products and pork in 2018 and 2019. Producers of milk and hogs also received $917 million in 2018 MFP and 2019 MFP payments (**Table 11**). USDA ceased targeting FPDP purchases for some commodities that were also made eligible for MFP payments in 2019. USDA targeted 12 commodities—cranberries, grapes, hazelnuts, kidney beans, lentils, macadamia nuts, navy beans, peas, pecans, pistachios, rice, and walnuts—for 2018 FPDP purchases but not for 2019 FPDP purchases; these commodities were ineligible for 2018 MFP payments and eligible for 2019 MFP payments. USDA has not provided data that would allow for comparison of the amount of support provided from FPDP and MFP separately for each these commodities. Total FPDP targeted purchases for specialty crops were $390.42 million in 2018 and $282.60 million in 2019 ($673.02 million total). Total 2018 MFP and 2019 MFP payments for specialty crops were $346 million (**Table 11**).

Table 13. Food Purchase and Distribution Program Targeted Commodities, 2018 and 2019

In Millions of Dollars

Commodity	2018 Targeted Purchases	2019 Targeted Purchases	Total
Apples	$93.40	$88.00	$181.40
Apricots	$0.20	$0.10	$0.30
Beef	$14.80	$151.00	$165.80
Blueberries	$1.70	$5.00	$6.70
Citrus	$83.70	$104.00	$187.70
Cranberries	$32.80	$0.00	$32.80
Dairy products	$84.90	$68.00	$152.90

[106] USDA, "Report to House and Senate Committees on Appropriations and Agriculture," October 31, 2019.

[107] USDA, Agricultural Marketing Service, "Food Purchase and Distribution Program," https://www.ams.usda.gov/selling-food-to-usda/trade-mitigation-programs.

[108] USDA, "USDA Announces Details of Support Packaged for Farmers," press release, July 25, 2019.

[109] On July 29, 2019, USDA published a final rule creating the Expanded Domestic Commodity Donation Program, which allowed for disposal of surplus commodities acquired as part of USDA's trade mitigation response to outlets not currently used in existing USDA Food and Nutrition Service programs.

Commodity	2018 Targeted Purchases	2019 Targeted Purchases	Total
Figs	$0.02	$0.10	$0.12
Grapes	$48.20	$0.00	$48.20
Hazelnuts	$2.10	$0.00	$2.10
Kidney beans	$14.20	$0.00	$14.20
Lamb	$0.00	$17.00	$17.00
Lentils	$1.80	$0.00	$1.80
Macadamia nuts	$7.70	$0.00	$7.70
Navy beans	$18.00	$0.00	$18.00
Onions	$0.00	$0.40	$0.40
Peanut butter	$12.30	$0.00	$12.30
Pears	$1.40	$4.00	$5.40
Peas	$11.80	$0.00	$11.80
Pecans	$16.00	$0.00	$16.00
Pistachios	$85.20	$0.00	$85.20
Plums/prunes	$18.70	$22.00	$40.70
Pork	$558.80	$208.00	$766.80
Potatoes	$44.50	$22.00	$66.50
Poultry	$0.00	$432.00	$432.00
Processed foods	$0.00	$200.00	$200.00
Raisins	$0.00	$24.00	$24.00
Rice	$48.10	$0.00	$48.10
Strawberries	$1.50	$2.00	$3.50
Sweet corn	$2.40	$11.00	$13.40
Walnuts	$34.60	$0.00	$34.60
Total	**$1,238.82**	**$1,358.60**	**$2,597.42**

Source: CRS calculations using USDA, "USDA Announces Details of Assistance for Farmers Impacted by Unjustified Retaliation," press release, August 27, 2018; and USDA, "USDA Announces Details of Support Packaged for Farmers," press release, July 25, 2019.

Notes: Citrus includes grapefruit, lemons, limes, oranges, and orange juice. Processed foods include canned tomatoes, pasta, prepared cereals, soups and broths, tomato sauces, and other products. Cranberries, grapes, hazelnuts, kidney beans, lentils, macadamia nuts, navy beans, peas, pecans, pistachios, rice, and walnuts were purchased in 2018 but were not eligible in 2019.

USDA administered FPDP under the rules of USDA's Commodity Procurement Program and required commodities supplied to be sourced from American producers on American farms. For FPDP, the USDA Office of Inspector General (OIG) found no reportable issues related to the type and quantify of commodities purchased but did find reportable issues related to verifying the domestic origin of purchased commodities and other aspects of contract management.[110] In

[110] USDA, Office of Inspector General, *Food Purchase and Distribution Program*, Audit Report 01601-0003-41, August 2023.

response to a congressional directive, USDA noted that six vendors awarded contracts under 2018 FPDP had substantial foreign ownership but that the products purchased for the 2018 FPDP were "100 percent domestically produced and processed."[111] In 2018, the six foreign-owned vendors supplied approximately $459 million in pork, $107 million in potatoes, $1.8 million in blueberries, and $1.4 million in strawberries.

How Were Agricultural Trade Promotion Program Funds Distributed?

USDA allocated $300 million for the Agricultural Trade Promotion Program (ATP) and spent $300 million on trade promotion activities. ATP provided cost-share funds to 59 organizations that support activities to develop new markets for U.S. agricultural and agriculture-related products (e.g., forestry and seafood products).[112] ATP-eligible activities included consumer advertising, public relations, point-of-sale demonstrations, participation in trade fairs and exhibits, market research, and technical assistance. ATP participants were required to contribute 10% for generic promotion activities and 50% for branded promotion activities.[113]

ATP was similar to the Market Access Program (MAP) authorized through the farm bill, which receives annual appropriations of $200 million.[114] Using results from prior analyses of MAP, an academic study estimated that these additional ATP funds could expand U.S. agricultural exports by $8.5 billion and U.S. farm sector cash receipts by $4.8 billion.[115]

USDA OIG audited ATP in 2022. USDA OIG found that USDA awarded funding to applicants "who may not have been the most meritorious based on the announced criteria and program regulations."[116] USDA OIG said they were "unable to attest to the merits of the 59 ATP grants awarded [by USDA Foreign Agricultural Service] in fiscal year (FY) 2019, totaling $300 million."

How Have Agricultural Stakeholders and Oversight Agencies Assessed USDA's Response to Retaliatory Tariffs Imposed in 2018 and 2019?

USDA's ad hoc programs in response to retaliatory tariffs on U.S. agricultural products provided support to the agricultural sector with the goals of increasing farm incomes, increasing domestic

[111] USDA, "Report to House and Senate Committees on Appropriations and Agriculture," October 31, 2019, p. 15. Section 119 of the Continuing Appropriations Act, 2020, and Health Extenders Act of 2019 (P.L. 116-59) required the Secretary of Agriculture to provide an accounting of commodity purchases from substantially foreign-owned companies or their subsidiaries, among other provisions.

[112] For a list of Agricultural Trade Promotion Program (ATP) awardees, see USDA, FAS, "ATP Funding Allocations," https://www.fas.usda.gov/programs/agricultural-trade-promotion-program-atp/atp-funding-allocations.

[113] USDA, Commodity Credit Corporation, "Agricultural Trade Promotion Program," 83 *Federal Register* 4417, August 30, 2018.

[114] For additional background on farm-bill-funded trade promotion programs, see CRS In Focus IF12155, *Farm Bill Primer: Trade and Export Promotion Programs*.

[115] Gary Williams, "The Overlooked Agricultural Trade Promotion Program of the USDA Trade Aid Packages," *Choices* (Quarter 4, 2019).

[116] USDA Office of Inspector General, *Oversight of the Agricultural Trade Promotion Program*, Audit Report 07601-0001-24, August 2022, https://usdaoig.oversight.gov/sites/default/files/reports/2024-11/07601000124FRredactedpublic.pdf.

prices through purchases of agricultural commodities, and diversifying export markets. Farmers reported that MFP helped them manage cash flow on their operations.[117]

In response to congressional requests, GAO published analyses of MFP in 2020, 2021, and 2022.[118] In their 2021 analysis, GAO found that USDA OCE's 2018 estimates of economic losses "used a justifiable baseline" to model what trade would have been in the absence of retaliatory tariffs. GAO also found that USDA OCE's 2019 estimates of economic losses "used baselines that did not best represent what trade would be absent the retaliatory tariffs, and that increased trade damage estimates."[119] GAO also found that USDA's methodology for calculating 2019 MFP payments "addressed some limitations of its 2018 methodology but resulted in (1) producers of the same nonspecialty crop (such as corn and soybeans) being paid differently in different counties, and (2) total payments for a nonspecialty crop different from USDA's estimate of trade damage to the crop."

In their response to GAO's 2021 analysis, USDA OCE stated that

> [t]he draft report's finding that the 2019 baseline is not representative and increased trade damage estimates does not take into account that the decision on what is the appropriate baseline depends on the policy goals and that there is not one single most representative baseline. OCE provided alternatives that reflected different options based on the direction of senior USDA decision makers under the previous administration and selection of the baseline was part of the program design and not made by OCE.[120]

USDA OCE also noted that their 2018 and 2019 economic analyses adhered to departmental and Office of Management and Budget requirements for economic analyses.

In their 2022 analysis, GAO found that USDA's compliance methodology for MFP was not designed to identify high-risk payments for auditing.[121] GAO noted that USDA conducted multiple compliance reviews for MFP eligibility requirements and that the reviews identified significant improper payments in 2018 and 2019. GAO found that the review of 2018 MFP payments was "limited in its usefulness for several reasons" and that USDA discontinued its review of 2019 MFP payments because of competing agency priorities.

USDA OIG audited FPDP in 2023. USDA OIG found no reportable issues related to the type and quantity of commodities purchased but did find reportable issues related to verifying the domestic origin of purchased commodities and other aspects of contract management.[122]

USDA OIG audited ATP in 2022. USDA OIG found that USDA awarded funding to applicants "who may not have been the most meritorious based on the announced criteria and program

---

[117] See, for example, witness testimony provided to the House Committee on Agriculture Subcommittee on Livestock and Foreign Agriculture during the hearing "U.S. Agricultural Trade: Stakeholder Perspectives" on March 10, 2020, https://democrats-agriculture.house.gov/uploadedfiles/116-33_-_42601.pdf.

[118] GAO, *USDA Market Facilitation Program: Information on Payments for 2019*, GAO-20-700R, August 2020; GAO, *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*; and GAO, GAO-22-104259, *USDA Market Facilitation Program: Oversight of Further Supplemental Assistance for Farmers Could Be Improved*, January 2022.

[119] GAO, *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*.

[120] GAO, "Appendix VIII: Comments from the Department of Agriculture," *USDA Market Facilitation Program: Stronger Adherence to Quality Guidelines Would Improve Future Economic Analyses*, p. 86.

[121] GAO, GAO-22-104259, *USDA Market Facilitation Program: Oversight of Further Supplemental Assistance for Farmers Could Be Improved*, January 2022.

[122] USDA, Office of Inspector General, *Food Purchase and Distribution Program*, Audit Report 01601-0003-41, August 2023.

regulations."[123] USDA OIG said they were "unable to attest to the merits of the 59 ATP grants awarded by [USDA Foreign Agricultural Service] in fiscal year (FY) 2019, totaling $300 million."

For More Information

Congressional staff seeking additional information on any of the key terms, concepts, and answers to the FAQs in this report may contact the authors and/or refer to CRS reports on trade authorities, agricultural trade, and farm support in general, which have been identified in the relevant sections above.

Author Information

Benjamin Tsui
Analyst in Agricultural Policy

Stephanie Rosch
Analyst in Agricultural Policy

Disclaimer

[123] USDA, Office of Inspector General, *Oversight of the Agricultural Trade Promotion Program*, Audit Report 07601-0001-24, August, 2022.

THE CONVERSATION

Academic rigor, journalistic flair

One of the most visible ways that Canada responded to President Donald Trump's tariffs was by sharply restricting U.S. alcohol sales. AP Photo/Jill Colvin

Canada is kicking its US booze habit as trade tensions persist

Published: May 7, 2026 8:20am EDT

https://theconversation.com/canada-is-kicking-its-us-booze-habit-as-trade-tensions-persist-279918

Almost a year and a half after President Donald Trump began slapping tariffs on nearly all U.S. trading partners, Canada's pushback has reordered the economic relationship between Ottawa and Washington.

Canadians are pulling back on U.S. travel, boycotting U.S. goods and protesting in droves - further galvanized by Trump's call for Canada to become the 51st U.S. state.

But the example of one sector in particular, U.S. alcohol, shows how quickly access to an important market can disappear - and how difficult it can be to regain.

From 2022 through 2024, Canada accounted for roughly 35% of U.S. wine exports, more than 15% of U.S. beer exports and as much as 13% of U.S. distilled spirits exports. Within just one year of Trump returning to office, Canada's imports of U.S. alcohol cumulatively have plunged over 70%, thanks to a mix of both tariff and nontariff retaliatory measures.

It's a sharp reversal from Canada's traditional role as a top foreign destination for American beer, wine and spirits. That relationship reflected both long-standing consumer preferences as well as geographic proximity and largely tariff-free access through agreements like the North American Free Trade Agreement and its successor, the United States-Mexico-Canada Agreement.

As an agricultural economist working on trade issues related to alcohol, I see Canada's alcohol sector as a textbook example of how market access for politically exposed goods can quickly unravel. And for American beer, wine and spirits producers - and for the farmers who grow the barley, grapes and corn that go into these products - the recent experience highlights how trade disputes often hit food products hardest. If a trade ban becomes entrenched, it opens a way for consumers to develop a taste for domestic as well as other foreign alternatives.

President Donald Trump's tariffs and talk of Canada as the 51st U.S. state have sparked a sustained backlash by Canadians. These protesters gathered near the Peace Bridge border crossing in Buffalo, N.Y., on April 2, 2025. AP Photo/Adrian Kraus

The Trump tariff shock

Before Trump's tariffs and talk of Canada as the 51st U.S. state, U.S. alcohol occupied substantial shelf space in major alcohol-consuming provinces such as Ontario, British Columbia and Quebec. In 2024, these exports to Canada constituted more than 20% of Canada's alcohol imports, totaling US$744 million. For most U.S. producers, Canada served not only as a key export destination but as a stable and relatively low-risk entry point into international markets.

That changed in February 2025, when Trump, citing a national security emergency, imposed 25% tariffs on Canada and Mexico. Those tariffs - which were overturned by the Supreme Court in February 2026 - marked the first time that law was used to authorize broad tariffs.

Canada responded by slapping retaliatory tariffs of 25% on roughly $30 billion of U.S. goods and signaling it would significantly expand countermeasures if tensions persisted. It also enacted nontariff countermeasures, most notably by letting provincial liquor authorities remove U.S. beer, wine and �girits from store shelves. These tools, which fall within Canada's system of shared federal and provincial powers, sharply restricted market access for American producers.

Immediately after Trump's announcement, eight of Canada's 10 provinces imposed partial or full bans on U.S. alcohol imports by instructing their liquor boards to stop importing and selling U.S. alcohol altogether. In many cases, American products were physically removed from store shelves and online platforms - sometimes with instructions to target imports from U.S. "red" states that had supported Trump.

U.S. wine exports were hit hardest, plunging from $460 million to just $103 million, while distilled spirits fell from $238 million to $89 million and beer exports from $47 million to $17 million. Collectively, these declines slashed total U.S. alcohol exports to Canada from $744 million to $208 million, wiping out $536 million in trade.

US alcohol exports to Canada dropped in Trump's 2nd term

Shortly after Donald Trump took office in 2025, he announced sweeping tariffs on Canadian products. Canadians responded by shunning beer, wine and liquor from the U.S.

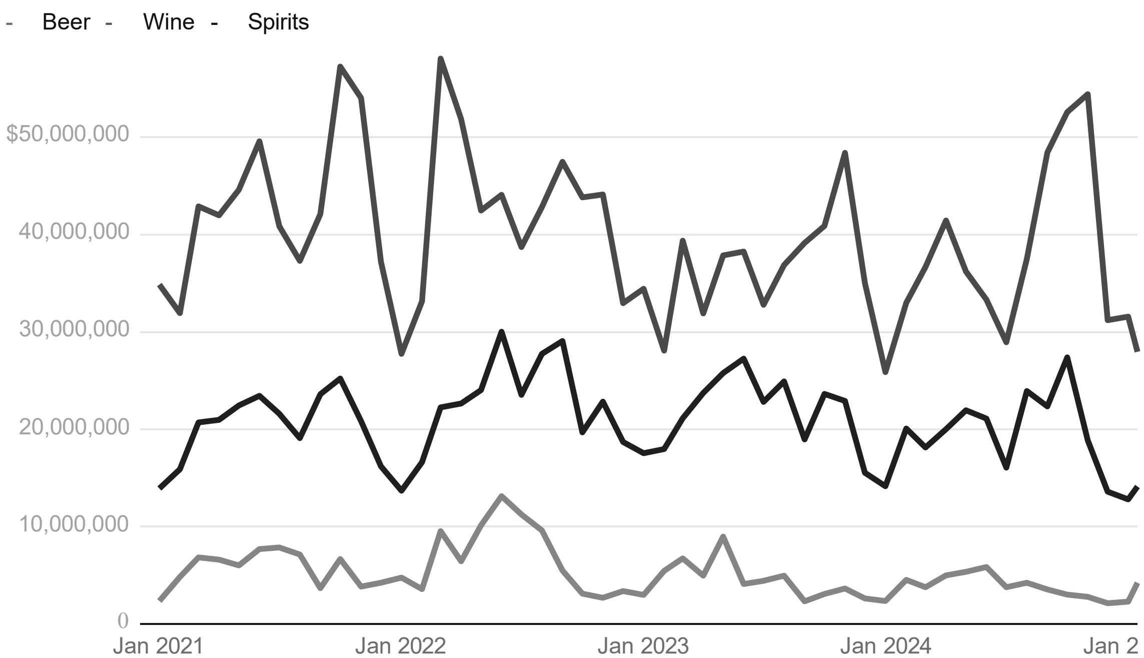


Chart: The Conversation, CC-BY-ND • Source: USDA Foreign Agricultural Service, Global Agricultural Trade System • Get the data • Embed • Download image • Created with Datawrapper

The spat quickly became testy. The alcohol boycott is one of the reasons Trump and White House officials have called Canada "mean and nasty to deal with," in the words of U.S. Ambassador to Canada Pete Hoekstra.

The trade war's latest turn

Those provincial restrictions remained in place even after the two countries reached a partial deal exempting about half of USMCA-compliant goods from ongoing tariffs in summer 2025, leading Canada to scale back some retaliatory levies. However, the de facto trade bans on U.S. alcohol remain in place.

Alcohol resurfaced again recently as a flash point, when the top U.S. trade official, Jamieson Greer, said in April 2026 that existing U.S. levies on Canadian industrial goods would stay in place and might even be toughened until Canada walked back its alcohol restrictions. That threat drew a sharp retort from Canadian Prime Minister Mark Carney.

Meanwhile, the trade dispute hasn't prompted Canadians to drink less alcohol overall. Instead, their consumption has largely shifted to other countries, especially for wine. United Nations trade data shows that in 2024, American wine accounted for 21% of all imported wine in Canada before dropping to only 5% in 2025. That year, imports from major wine exporting countries not only increased but roughly offset the decline in imports from the U.S. For distilled spirits, the U.S. slipped from 24% in 2024 to only 10% in 2025, while beer has dropped from 13% to 5%. At the same time, Canadian imports of beer, wine, and spirits from other countries increased by 9%, 15%, and 7%, respectively.

Canadians bought less US alcohol, and more from elsewhere

In 2025, as Canadian purchases of alcohol from the U.S. plummeted, the country's consumers bought more wine, beer and spirits from other parts of the world.

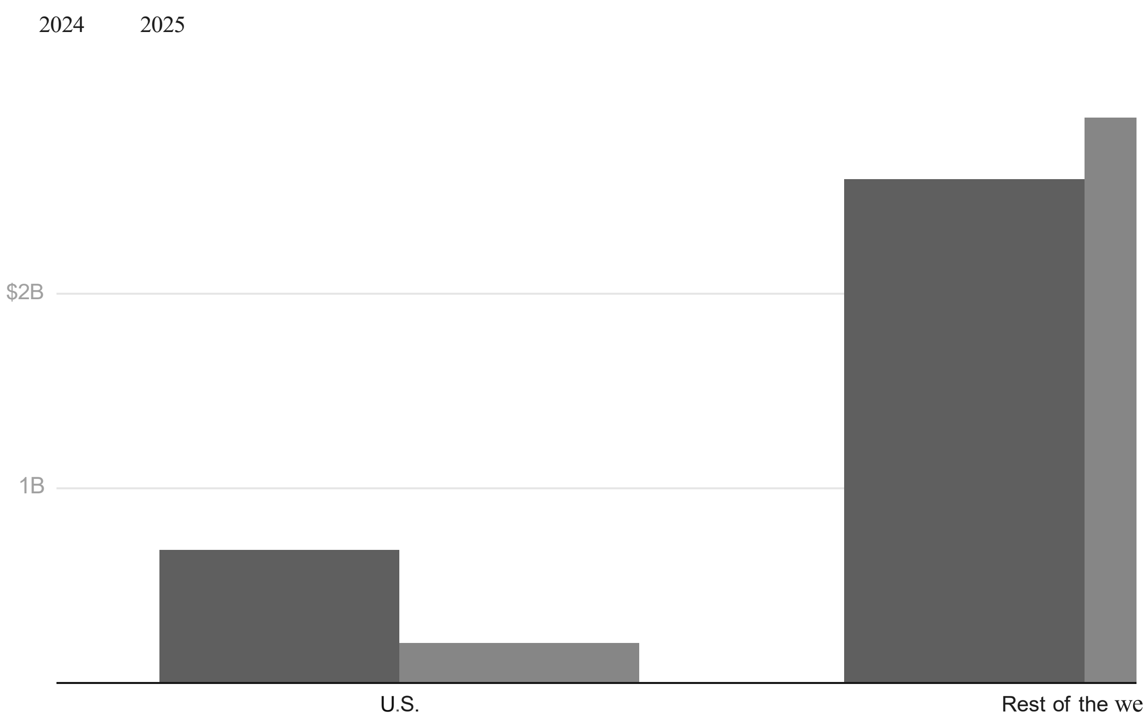


Chart: The Conversation, CC-BY-ND • Source: UN Comtrade • Get the data • Embed • Download image • Created with

"What's different this time is that people aren't just swapping one bottle, they're rethinking the whole bar," said Craig Peters, CEO of Canada's Barnburner Whiskey, in an interview with the online magazine VinePair. "Traditionally, those rail spots were locked up by big U.S. brands for decades. Now, we're seeing bars, especially independents, completely reset and go Canadian across the board."

Andrew Muhammad
Professor of Agricultural and Resource Economics, University of Tennessee

DOI

https://doi.org/10.64628/AAI.kmrrgrx9q

THE CONVERSATION

Academic rigor, journalistic flair

The Trans-Pacific Partnership agreement covers a broad range of goods and services, including food safety standards.

What American farmers could gain by rejoining the Asia-Pacific trade deal that Trump spurned

Published: May 12, 2021 8:48am EDT

https://theconversation.com/what-american-farmers-could-gain-by-rejoining-the-asia-pacific-trade-deal-that-trump-spurned-152148

The Eiden administration has an opportunity to recalibrate American global trade by rejoining the influential Trans-Pacific Partnership trade agreement. Signing on to this partnership has the potential to deliver powerful diplomatic and economic gains yet politically, the odds appear slim that there will be political consensus to agree to this partnership.

The U.S. began Trans-Pacific Partnership negotiations **in** 2008 during the Bush administration, efforts that were intensified during Barack Obama's presidency. Hammered out between the U.S. and 11 Pacific Rim countries, the intention of joining the partnership was to set trade policy and greatly expand U.S. trade and investment **in** the Asia-Pacific region. President Obama signed the agreement in 2016 and less than a year later, immediately after Donald Trump's inauguration, the U.S. withdrew from the agreement.

Rejoining the partnership, renamed the Comprehensive and Progressive Agreement for Trans-Pacific Partnership in 2018, could signal to the world that the U.S. is back in the global engagement arena. It would also strike a stark contrast to the previous adminstration's bilateral and nationalistic approach, which has resulted in tensions with major U.S. trading partners. Aside from improved trade relations, rejoining the this agreement would counter China's economic and geopolitical influence in the Asia-Pacific region.

Both of us have worked extensively with the U.S. Department of Agriculture on trade policy issues. As economists specializing in international agricultural trade, our research demonstrates that the U.S. would benefit from rejoining the trade accord and, in particular, American agriculture.

Pathway to a Southeast Asia trade agreement

International trade agreements can reduce uncertainty for trading partners in the marketplace. Marco Pregnolato/Unsplash

Regional trade agreements like the Trans-Pacific Partnership can go far beyond tariffs to tackle deeper trade and domestic issues such as investment, labor, migration, competition, intellectual property and, in some cases, key regulatory issues governing food safety standards.

Although agriculture comprises only about 10% of total U.S. exp orts, the agricultural sector in the U.S. and other countries account for a large share of trade policy considerations. Rejoining the accord has the potential to establish economic ties with emerging economies like Vietnam and Malaysia and embrace the need for improved trade relations in Southeast Asia overall.

Shipping cranes at the Port of Seattle. Andy Li/Unsplash

The Comprehensive and Progressive Agreement for Trans-Pacific Partnership could be the easiest path forward if the U.S. wanted to improve trade relations with Southeast Asia. Joining this partnership could be especially beneficial based on the volume of agricultural trade and expected growth in these markets. At an approximate US$14.3 billion annually, Southeast Asia accounts for a significant amount of U.S. agricultural exports, making it the fourth-leading destination behind China, Canada and Mexico.

US agricultural and related exports to Southeast Asia

Country	2019 trade	RCEP member	CPTPP member
Vietnam	$4.0 billion	Yes	Yes
Philippines	$3.0 billion	Yes	**No**
Indonesia	$2.9 billion	Yes	**No**
Thailand	$1.9 billion	Yes	**No**
Malaysia	$1.2 billion	Yes	Yes
Singapore	$1.0 billion	Yes	**No**

Burma, Cambodia, Brunei, Laos *and Timor-Leste are not listed. Together, these countries account for approximately $250 million in U.S. agricultural and related product exports. RCEP* is *the Regional Comprehensive Economic Partnership. CPTPP* is *the Comprehensive and Progressive Agreement for Trans-Pacific Partnership.*

Table: The Conversation, • Source: U.S. Department of Agriculture • Get the data

A return to global engagement

The Trans-Pacific Partnership was seen as an opportunity for the U.S. to shape regional and global trade rules, potentially influencing economic policies and practices in China. However, there are concerns that need to be addressed if the U.S. were to join the Comprehensive and Progressive Agreement for Trans-Pacific Partnership.

Colorful Japanese wine barrels in Tokyo. Manuel Velasquez/Unsplash

There are important differences between the agreement signed under Obama in 2016 and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership. Provisions important to the U.S. were changed in the subsequent agreement, such as the investment and intellectual property P-rovisions that offered improved standards on intellectual property relative to past trade agreements. The provisions fall short of the more stringent requirements in the earlier Trans-Pacific Partnership.

What are the odds?

Like all trade agreements, joining the partnership would require congressional approval. Historically, Republicans have been more supportive of trade agreements. But President Trump's rhetoric, that past trade agreements have been "disastrous" for the U.S. economy, may have lessened Republican support for an agreement like the Comprehensive and Progressive Agreement for Trans-Pacific Partnership.

President Joe Eiden quickly rejoined the Paris Climate Agreement and reversed President Trump's decision to withdraw from the World Health Organization,showing that the U.S. is back in the global engagement area.

Mega-regional trade agreements offer more than a forum for negotiating trade barriers. They establish procedures that reduce uncertainty in international transactions, make rules that are clear to members and provide an institutional framework to remedy trade concerns or disputes. If the Biden administration wants to signal to the world that the U.S. is pivoting to a more expansive global engagement, joining the Comprehensive and Progressive Agreement for Trans-Pacific Partnership could be an initial step.

[You're smart and curious about the world. So are The Conversation's authors and editors. You can get our highlights each weekend.]

Andrew Muhammad
Professor of Agriculture and Resource Economics, University of Tennessee

Jason Grant
Associate Professor of Agricultural and Applied Economics, Virginia Tech

DOI

https://doi.org/10.64628/AAI.j3sfpqps6

THE CONVERSATION

Academic rigor, journalistic flair

Trump's tariffs on Canada and Mexico could spell trouble for distilled spirits

Published: March 26, 2025 8:40am EDT

Bottles of tequila are displayed at a California Safeway store on March 3, 2025.
Justin Sullivan/Getty Images

https://theconversation.com/trumps-tariffs-on-canada-and-mexico-could-spell-trouble-for-distilled-spirits-251583

If all the tariff drama in the news lately has you reaching for a stiff drink, you're not alone. Unfortunately, those same tariffs might make it harder to get your hands on your favorite brand of tequila.

In early March 2025, U.S. President Donald Trump levied import tariffs of 25% on goods from Canada and Mexico, following through on a promise he made back in November 2024. While he later partially reversed course, suspending tariffs on some goods, tensions remain high. Mexico is largely holding off on retaliation, but Canada quickly fired back with counter-tariffs on billions of dollars' worth of U.S. products.

These trade tensions spell trouble for numerous industries, including the booming spirits market. Canada and Mexico - two of the top U.S. trading partners - accounted for nearly half of the US$ g billion in distilled spirits the U.S. imported in 2024.

As an agricultural economist, I've analyzed how a 25% tariff could affect tequila, whiskey and other distilled spirits - and the results weren't pretty. I found that these tariffs would cost distilled spirit importers over $1 billion in lost trade, with tequila alone taking a more than $800 million hit.

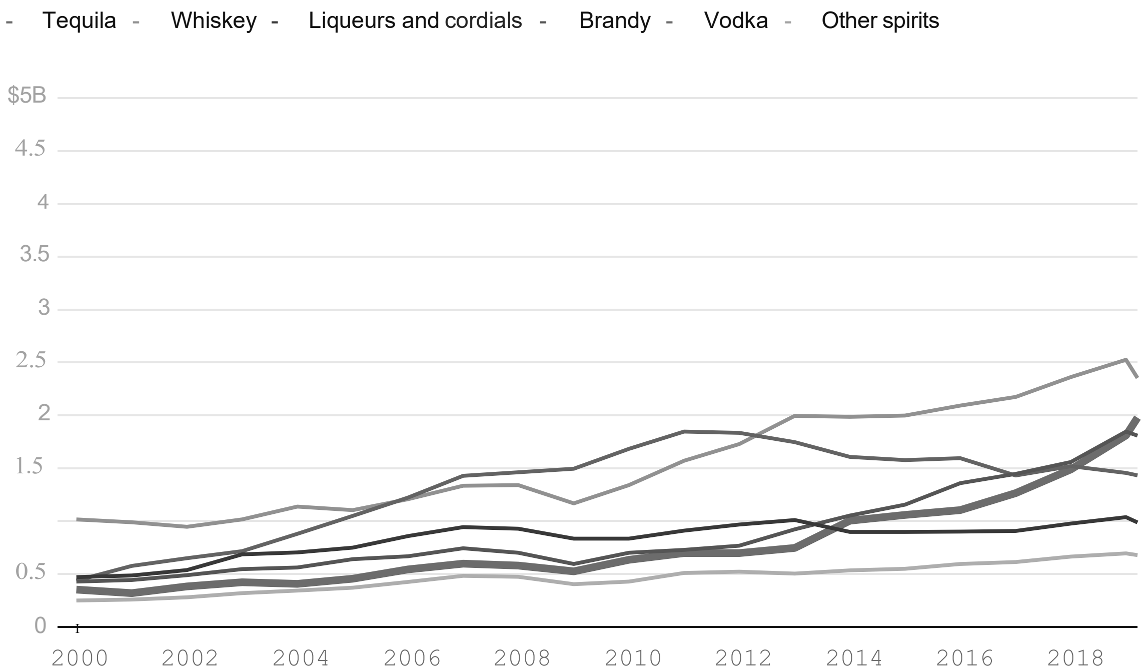
Americans' thirst for imported liquor

The U.S. imports far more distilled spirits than it exports - five times as much by value, as of 2024.

Since 2000, U.S. imports of distilled spirits have surged by more than 300%, driven largely by the explosive rise in tequila consumption. Between 2000 and 2024, tequila imports rose by 1,400%, skyrocketing from $350 million to $5.4 billion.

Americans increasingly love imported liquor

A comprehensive look at U.S. distilled spirits imports by category suggests the U.S. has developed a taste for tequila since the Obama years.



Note: Tequila includes mescal, *brandy* is *from grapes only, and "other* sprits" *includes gin, rum and distilled spirits not specified elsewhere. All figures in billions of dollars.*

Chart The Conversation, CC-BY-ND • Source: Muhammad, 2025. • Get the data • Embed • Download image· Created with

While imports of whiskey, liqueurs, vodka and brandy also grew, none matched tequila's explosive rise. Tequila now represents 45% of all spirits imported into the U.S., up from 12% in 2000.

Not surprisingly, 99% of tequila and mezcal is imported from Mexico making it the leading foreign supplier of distilled spirits to the United States. Meanwhile, Canada has supplied between 4% and 6% of U.S. spirits imports over the past two decades, primarily whiskey and liqueurs.

Since distilled spirits are classified as agricultural products, their rising imports have significantly contributed to the U.S. agricultural trade deficit. However, this isn't necessarily a problem. Imports help meet demand from U.S. consumers, generate value-added opportunities for U.S. companies, and support economic activity in bars, liquor stores, restaurants and beyond.

A 25% tariff on Mexican goods is a 25% tax on tequila

In my study, published in February in the peer-reviewed journal Agribusiness and in a follow-up policy brief, I found that 25% tariffs on Mexico and Canada could reduce imports of distilled spirits by $1.2 billion. This loss exceeds the total amount of tax revenue those tariffs can expected to bring in.

How 25% tariffs on Mexico and Canada could change the spirits industry

The Trump administration's plan could deal a big hit to the tequila market.

Product	2024 imports by value	2024 share of imports	Projected imports after tariffs	Projected change in imports after tariffs	Projected tariff revenue
Tequila	$5.358	45%	$4.548	-$810M	$910M
Whiskey	$1.838	15%	$1.738	-$1QOM	$70M
Vodka	$1.21B	10%	$1.088	-$130M	$0
Liqueurs and cordials	$1.418	12%	$1.238	-$1B0M	$70M
Brandy	$1.298	11%	$1.288	-$10M	0
Other imported spirits	$810M	7%	$BOOM	-$10M	$20M
Total	$11.908	100%	$10.68 billion	-$1.238	$1.068

[illegible]

Unsurprisingly, tequila imports would be the hardest hit, falling by $810 million. I found that the tariff revenue from tequila - $910 million - could actually exceed the corresponding fall in imports. That's because demand for tequila, like most alcoholic beverages, is what economists call "inelastic," meaning that when prices rise, consumers are unlikely to change their purchasing decisions by very much.

However, it would be a mistake to consider tequila in isolation. When I factored in other notable decreases, such as a $100 million drop in whiskey imports, I found that the value of total trade losses, in the form of decreased imports, would outweigh the total tariff revenue. I also found that no product category would come out ahead.

In fact, even products like vodka, which are mostly exempt from these tariffs, would be indirectly affected. This is because tariffs can increase the overall cost of importing,leading businesses to reduce all imports, tariffed or otherwise. My research suggests that this "trade destruction" effect, to use an economics term, will be quite significant.

A new era of tariffs

The Trump administration has argued that tariffs will generate a lot of money for the federal government. But my research suggests those gains may not outweigh the economic costs to businesses and consumers.

Contrary to common belief, trade losses don't just affect exporting countries. Domestic consumers also face higher prices and fewer choices - hurting their overall economic welfare. Reducing imports also affects U.S. businesses involved in marketing, distribution and sales.

Trade is more complex than a simple formula of"exports good, imports bad." Research makes it clear that tariffs have negative consequences, including higher consumer prices, reduced product availability and downstream economic disruption. Policymakers would be wise to take those effects seriously. Otherwise, they might find themselves with a serious economic hangover.

Andrew Muhammad

Professor of Agriculture and Resource Economics, University of Tennessee

DOI

https://doi.org/10.64628/MI.gkxvt3gfm

THE CONVERSATION

Academic rigor, journalistic flair

Canadian lumber waits for shipment in a sawmill's yard. Andrej Ivanov/Getty Images

Why higher tariffs on Canadian lumber may not be enough to stimulate long-term investments in US forestry

Published: October 15, 2025 8:52am EDT

https://theconversation.com/why-higher-tariffs-on-canadian-lumber-may-not-be-enough-to-stimulate-long-term-investments-in-us-forestry-265713

Lumber, especially softwood lumber like pine and spruce, is critical to U.S. home construction. Its availability and price directly affect housing costs and broader economic activity in the building sector. The U.S. imports about 40% of the softwood lumber the nation uses each year, more than 80% of that from Canada.

President Donald Trump says that the U.S. has the capacity to meet 95% of softwood lumber demand and directed federal officials to update policies and regulatory guidelines to expand domestic timber harvesting and curb the arrival of foreign lumber.

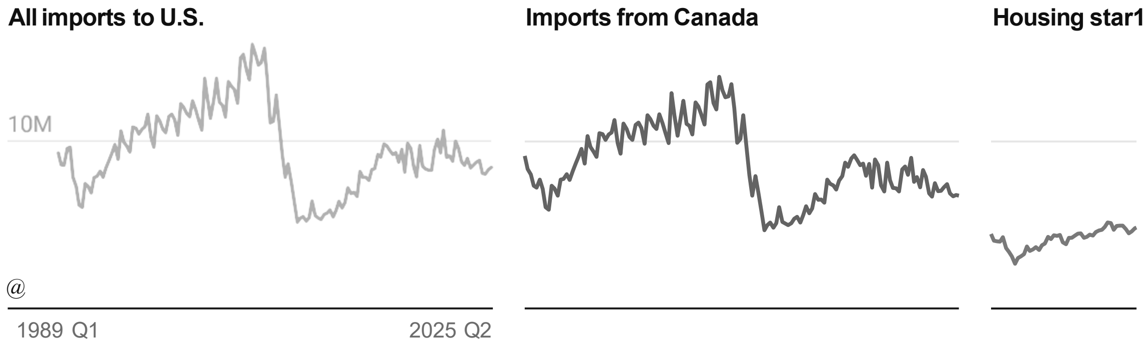
On Sept. 29, 2025, he announced new tariffs on imported timber and wood products, including an additional 10% tariff on Canadian lumber. Those were added to 35% tariffs imposed on Canadian lumber in August. It was the latest phase in a long-standing dispute over the supply of lumber to builders in the U.S., which dates back to the 1980s, when U.S. producers began arguing that Canadian companies were benefiting from unfair subsidies from their government. Starting on Oct. 15, Canadian softwood lumber imports could face tariffs exceeding 45%.

As researchers studying the forestry sector and international trade, we recognize that the U.S. has ample forest resources. But replacing imports with domestic lumber isn't as simple as it sounds.

There are differences in tree species and quality, and U.S. lumber often comes at a higher cost, even with tariffs on imports. Challenges like limited labor and manufacturing capacity require long-term investments, which temporary tariffs and uncertain trade policies often fail to encourage. In addition, the amount of lumber imported tends to mirror the boom-and-bust cycles of housing construction, a dynamic that tariffs alone are unlikely to change.

US lumber imports and housing starts rise and fall together

Since 1989, federal data shows that trends in lumber imports - the vast majority of which are from Canada - track closely with construction of new housing.



Lumber imports data in cubic meters, using Harmonized System classification 4407.

Chart: The Conversation, CC-BY-ND • Source: Lumber imports: U.S. Department of Agriculture, Global Agricultural Trade System; Housing starts: Federal Reserve Bank of St. Louis • Get the data • Embed • Download image· Created with

Trump's moves

To boost U.S. logging, in March, Trump issued an executive order telling the departments of Interior and Agriculture to ease what he called "heavy-handed" regulations on timber harvesting. The executive order and a follow-up memo from Agriculture Secretary Brooke Rollins do not spell out specifics, but officials say more details are in the works that will simplify the timber harvesting process, with the goal of boosting domestic timber production by 25%.

That same month, Trump ordered the Commerce Department to assess how imports of timber, lumber and related wood products affect U.S. national security.

While that assessment was underway, in July, the Commerce Department published findings from a trade review of 2023 Canadian lumber imports. That inquiry alleged that Canadian companies were selling lumber to the U.S. at unfairly low prices, potentially leaving U.S. producers with lower sales or depressed prices. That finding was cited as the basis for the 35% August tariff announcement.

In its national security investigation initiated in March, the Commerce Department concluded that an overreliance on imported wood products means "the United States may be unable to meet demands for wood products that are crucial to the national defense and critical infrastructure." The September tariff announcement is based on those findings.


Canadian timber harvesting continues, despite uncertainty about trade with the U.S. Artur Widak/NurPhoto via Getty Images

Canadian lumber in the US market

In 1991, the U.S. imported 11.5 billion board feet (27 million cubic meters) of Canadian lumber. Those imports rose to a high of 22 billion board feet (52 million cubic meters) by 2005.

But as housing construction declined - especially during the Great Recession from 2007 to 2009 - imports dropped sharply, to less than 8-4 billion board feet (20 million cubic meters) in 2009. The current volume has not recovered to prerecession levels, rising only to 12 billion board feet (28 million cubic meters) in 2024.

The value of Canadian lumber has also fluctuated. Historically, prices for Canadian lumber have averaged about US$330 per thousand board feet ($140 per cubic meter). During and after the COVID-19 pandemic, import prices soared to almost $800 per thousand board feet ($340 per cubic meter). But since peaking in 2021 and 2022, prices have dropped significantly to $436 per thousand board feet ($185 per cubic meter) by 2024.

In total, in 2024, the U.S. imported more than $11 billion in forest and wood products from Canada. Softwood lumber accounted for almost half of that.

Lumber and housing

As personal income rises and populations grow, people seek to build new homes. As new home construction - called "housing starts" in economic data - increases, so does demand for softwood lumber to build those homes. And when housing starts slow, so does lumber demand.

For instance, housing starts fell during the Great Recession. They declined from a January 2006 peak of 2.3 million to less than 500,000 in January 2009 - a decrease of nearly 80%. In that same period, imports of Canadian lumber fell by more than 60%. Domestic softwood lumber production fell by more than 40%.

Both domestic and imported lumber prices can directly influence the overall cost of building homes, which in turn affects housing affordability. That said, lumber used for framing usually accounts for less than 10% of the total cost to build a new home. The effects of tariffs on new home construction may be significantly less than other factors, such as rising labor costs.

There are different kinds of wood commonly used in building lumber.

A matter of choice

The U.S. has a lot of potential lumber available. Especially in the South, the inventory ofharvestable lumber has grown significantly over many years.

However, the types of wood available in the U.S. are not always the same as what's available from Canadian imports. For framing, contractors may prefer spruce, northern pines and fir, naturally abundant in Canada, because they are lighter and less likely to warp than southern yellow pine, which is abundant in the southern U.S. Southern yellow pine is more commonly used to make utility poles and preservative-treated lumber for outdoor construction projects, such as decks.

Lumber from Idaho, eastern Oregon and eastern Washington, however, does share characteristics with Canadian species and could take the place of at least some Canadian lumber.

As the Trump administration seeks to boost domestic lumber, buyers will be looking not only at where their lumber came from, but what it costs and what type oflumber is best for what they need to accomplish.

Andrew Muhammad

Professor of Agriculture and Resource Economics, University of Tennessee

Adam Taylor
Professor of Natural Resources, University of Tennessee

DOI

https://doi.org/10.64628/MI.wyv5tguh7

CHOICES
The magazine of food, farm, and resource issues
A publication of AAEA Agricultural & Applied Economics Association
VOLUME 41 QUARTER 1

The US Beef Industry in a Time of Trade Tensions

Andrew Muhammad, Charles Martinez, and Parker Wyatt

JEL Classifications:
Keywords: Beef, Brazil, China, Tariffs, Trade war, United States
DOI: 10.22004/ag.econ.371493

Since his inauguration in January 2025, President Trump has systematically raised tariffs on imports from nearly all major trading partners. These measures have been enacted under authorities such as the International Emergency Economic Powers Act and Section 232 of the Trade Expansion Act (Burkhart and Hammond, 2025). Tariffs can reduce trade, investment, and output by increasing costs and disrupting supply chains, often leading to long-term inefficiencies. Trade policy uncertainty further amplifies these effects by discouraging business investment and slowing economic decision-making—even in the absence of new tariffs (Luckstead and Devadoss, 2025). For the US beef sector, already grappling with supply constraints and global competition, these trade actions have added pressure to an already strained industry.

The beef sector remains a cornerstone of American agriculture, having undergone notable transformations over the past decade. Both imports and exports play a crucial role in shaping the US beef industry and agricultural trade overall. Although imports account for only 17% of US beef consumption and exports represent 10% of domestic production (USDA-FAS, 2025a), beef consistently ranks among the top 10 agricultural imports and top 5 agricultural exports in the United States (USDA-FAS, 2025b).

Figure 1 shows US beef consumption and trade from 2010 to 2024. Consumption has remained relatively stable, with modest growth, from around 26 billion pounds in 2010–2012 to almost 29 billion pounds in 2024. During this period, imports have grown significantly, rising from about 2.3 billion pounds to 4.6 billion pounds, with the fastest growth occurring in the last few years. Exports also increased overall but at a slower pace, peaking around 2018 before slightly declining. The widening gap between imports and exports in recent years suggests increasing reliance on foreign countries for US demand. It is important to note, however, that most beef imports are different from exports. The US usually imports leaner and lower-cost cuts used for ground beef production, while exports are mostly high-value, grain-fed cuts like steaks and ribs that appeal to premium markets abroad (Brower, 2022).

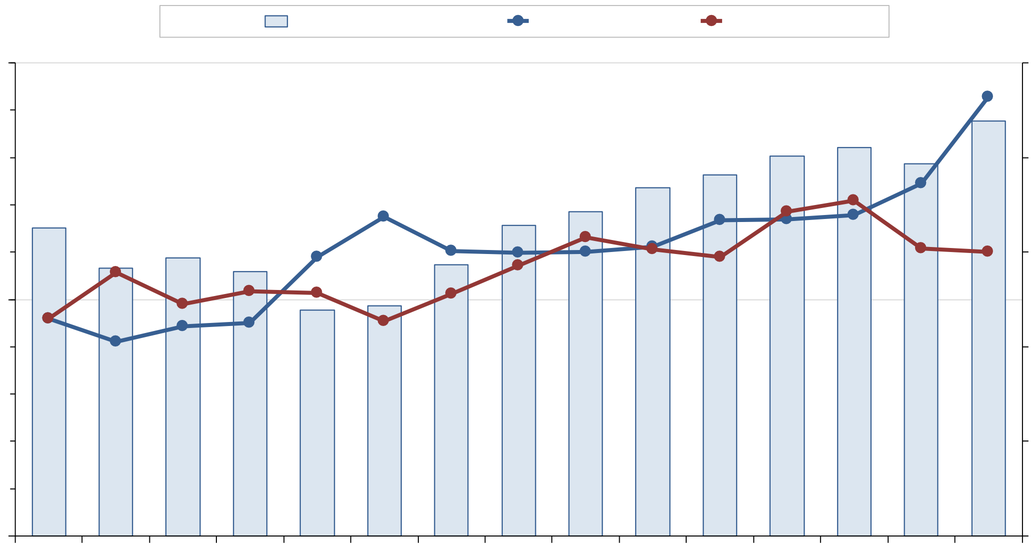
In this article, we examine recent trends in US beef production and trade, highlighting how the sector has adapted to shifting global consumption patterns and domestic supply constraints. We also assess the impact of recent tariffs and trade tensions on US beef imports from key suppliers such as Canada, Mexico, and Brazil. While these policies are often framed as protective measures for American producers, they may inadvertently raise costs for processors and consumers. On the export side, we explore the effects of current trade tensions and how major beef-producing countries like Brazil have expanded their global market share, outcompeting US beef in key international markets.

This article provides a comprehensive overview of how trade tensions, international competition, and shifting supply and demand have collectively influenced the structure and performance of the US beef industry in recent years. Understanding these shifts is essential not only for policymakers and industry stakeholders but also for consumers, whose choices and costs are increasingly shaped by international trade.

Shrinking Herds and Rising Prices

Understanding the current state of US cattle inventory and beef production is essential to evaluating trade dynamics, as domestic supply levels directly influence imports, exports, and prices. The US cattle herd has continued to shrink, marking sixth straight years of decline. According to the USDA January 2025 cattle report (USDA-NASS, 2025), the total number of cattle and calves dropped by about 1% from the previous year, bringing the herd inventory to its lowest level since 1952. This ongoing reduction is part of a broader cattle cycle that began in 2014 and has now lasted 11 years, resulting in the third-longest decline in US history.

Figure 1. US Beef Consumption and Trade, 2010–2024

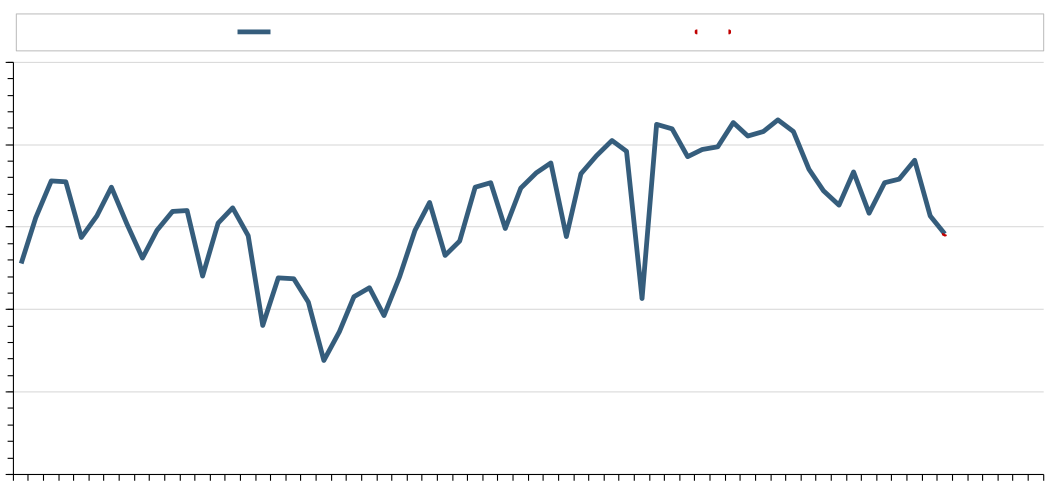


Source: USDA-FAS (2025a).

As expected, lower cattle inventories translate directly into reduced beef production. Figure 2 shows quarterly US beef production from the first quarter of 2010 through the second quarter of 2025, with forecasts extending through the third quarter of 2026 (LMIC, 2025; USDA-AMS, 2025). Production peaked in the third quarter of 2022 at 7.1 billion pounds and has since trended downward. Over the past 15 years, the average quarterly production has been approximately 6.5 billion pounds. The most recent data from the second quarter of 2025 show production at less than 6.4 billion pounds, slightly below the long-term average.

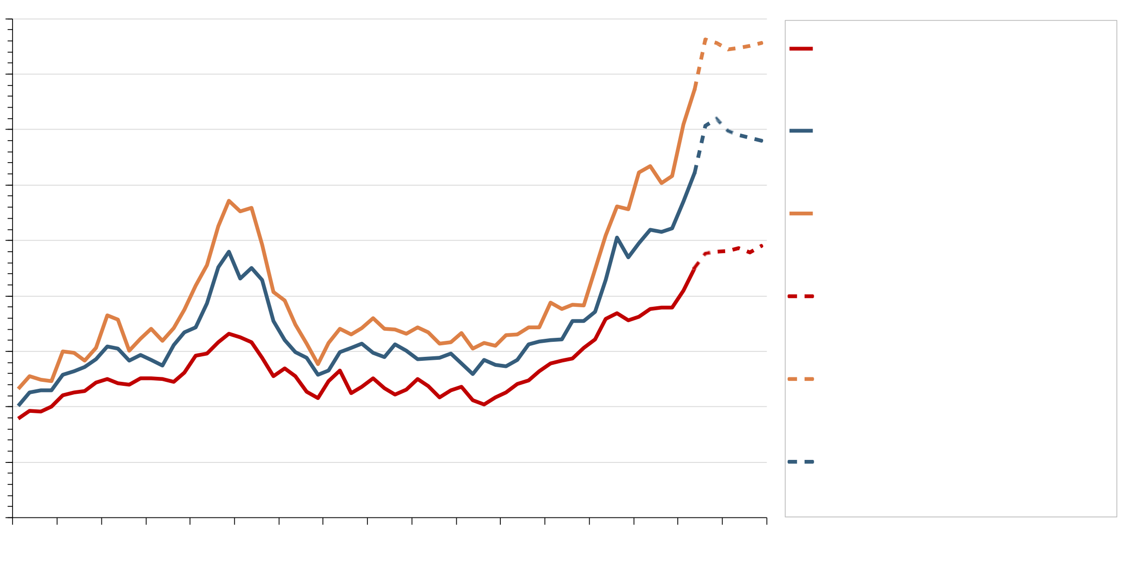
Forecasts for 2025 and 2026 suggest continued declines in production due to two key factors: heifer retention and overall herd reduction. Both contribute to fewer cattle available for slaughter, reinforcing the downward trend in beef supply. These production levels are not surprising given the persistent liquidation of the cattle herd and the structural constraints facing producers (Figure 2).

Figure 2. US Beef Production and Forecasts, 2010:Q1–2026:Q3



Source: USDA-AMS (2025), LMIC (2025).

Figure 3. US Feeder and Slaughter Steer Prices and Forecasts, 2010:Q1–2025:Q3



Source: USDA-AMS (2025), LMIC (2025).

Reduced production has led to noticeable price increases at the retail level. During the first half of 2025, the average price for all fresh beef rose from $8.15 per pound in January to $8.90 per pound in July (USDA-ERS, 2025). Ground beef, a highly consumed product, increased from $5.50 to $6.25 per pound over the same period. These price movements reflect tightening supply and signal broader inflationary pressures within the beef supply chain.

Historically, the US beef industry has relied on the live cattle trade to supplement domestic supply. Imports of feeder calves from Mexico and Canada help offset tight cattle inventories but have faced recent disruptions. In November 2024, the Animal and Plant Health Inspection Service announced restrictions on livestock imports from Mexico due to an outbreak of New World screwworm (NWS) in Mexico's southern region. Feeder cattle typically enter the United States in the spring and fall and account for roughly 5% of total placements annually (Anderson, Maples, and Martinez, 2024). In southern states, that figure rises to approximately 18% (Anderson, 2025).

The November ban resulted in the loss of one month of feeder cattle imports in 2024 and two months in early 2025. Although the border reopened briefly in March, imports were suspended again in May due to rising NWS cases. As of this writing, the ban remains in effect, effectively nullifying a key source of supply for the US beef industry. Live cattle imports from Canada also declined, albeit slightly, in 2025 (USDA, 2025; USDA-FAS, 2025b).

The shortage of domestic and imported feeder cattle has driven prices to record highs. Figure 3 shows quarterly prices for feeder and slaughter steers from the first quarter of 2010 through the second quarter of 2025, with projections through the third quarter of 2026. Steer prices (500–600 lb) rose from around $116 per hundredweight in the first quarter of 2010 to almost $286 in 2014, driven by drought and tight supply. That year also marked the beginning of the current cattle cycle.

Improved prices during the early years of the cycle led to herd expansion, followed by a correction and price declines from 2017 to 2020. Since then, prices have rebounded sharply. In the second quarter of 2025, 500–600 lb steers reached a record $386.73 per hundredweight—a 179% increase over 9 years. Similar trends are observed for 700–800 lb steers and slaughter cattle (Figure 3).

With record-high beef prices and higher costs for replacement cattle, producers are likely to continue liquidating herds rather than rebuilding. This trend is expected to sustain high cattle prices in the near term. Ultimately, factors such as weather conditions, feed costs, and consumer willingness to pay for beef will determine when herd expansion resumes.

Trade Tensions and US Beef Imports

Next, we examine US beef import trends to determine whether recent trade tensions have influenced imports. In 2024, the United States was the second-largest beef-importing country in the world (United Nations, 2025). Beef imports supplement the domestic supply, especially during periods of low cattle inventory or shortages,

Table 1. US Fresh and Chilled and Frozen Beef Imports: 2024 and 2025 Year-to-Date (January–July) Comparison

Source	Fresh and Chilled Jan.–July 2024	Fresh and Chilled Jan.–July 2025	%Δ	Source	Frozen Jan.–July 2024	Frozen Jan.–July 2025	%Δ
	Value ($ billions)				Value ($ billions)		
World (total)	3.21	3.62	12.6	World (total)	2.45	4.05	65.5
Canada	1.36	1.41	3.9	Australia	0.74	1.20	62.6
Mexico	0.96	1.07	11.0	Brazil	0.42	0.89	112.3
Australia	0.56	0.74	31.1	New Zealand	0.69	0.82	18.4
	Quantity (000 MT)				Quantity (000 MT)		
World (total)	387.56	405.14	4.5	World (total)	439.18	655.11	49.2
Canada	183.54	174.34	-5.0	Australia	126.32	178.51	41.3
Mexico	114.60	124.60	8.7	Brazil	86.51	177.50	105.2
Australia	50.08	61.56	22.9	New Zealand	121.61	123.09	1.2
	Unit Value/Price ($/kg)				Unit Value/Price ($/kg)		
World (total)	8.29	8.93	7.7	World (total)	5.58	6.19	10.9
Canada	7.41	8.10	9.4	Australia	5.83	6.71	15.1
Mexico	8.38	8.55	2.1	Brazil	4.84	5.00	3.4
Australia	11.25	12.00	6.6	New Zealand	5.71	6.67	17.0

Note: Fresh and chilled beef is defined according to HS 0201: meat of bovine animals, fresh or chilled; frozen beef is defined according to HS 0202: meat of bovine animals, frozen.
Source: USDA-FAS (2025b).

ensuring consistent availability for consumers (Calil, 2024). Imports of lean beef trimmings are essential for producing ground beef, while feeder cattle from Mexico and Canada support feedlot operations (Brower, 2022; USDA-FAS, 2025b). Imports also help stabilize prices and buffer market disruptions such as droughts and disease outbreaks. While almost all live cattle imports are from Canada and Mexico, beef imports are more diversified (USDA-FAS, 2025b).

Table 1 presents a year-to-date comparison of US imports of fresh and chilled and frozen beef from January to July in 2024 and 2025, detailing changes in import value, quantity, and unit value (price) across major trading partners. Despite recent trade tensions, US beef imports experienced significant growth in 2025, with both fresh and chilled and frozen beef increasing in value and volume. Fresh and chilled beef imports rose by 12.6% in value and 4.5% in quantity, driven by moderate gains from Mexico and Australia. Canada remained the largest supplier in this category, though its volume slightly declined. In contrast, frozen beef imports surged by 65.5% in value and 49.2% in volume, with Brazil and Australia showing the most significant increases. Brazil's frozen beef exports to the US more than doubled in both value and volume, reflecting its growing competitiveness in the global market.

Prices—as measured by unit values—also increased for most sources, suggesting rising demand and possible supply constraints. For example, frozen beef from New Zealand saw a 17% increase in price, while fresh and chilled beef from Canada rose by 9.4%.

The sharp rise in frozen beef imports from countries like Brazil reflects both a response to domestic supply challenges and a shift toward more competitive international suppliers. However, recent trade tensions may begin to dampen this trend. Earlier in 2025, Mexico and Canada faced tariffs of 25% and 35%, respectively, largely due to concerns over border security and drug trafficking. Australia, New Zealand, and Brazil were impacted by the "Liberation Day" tariffs, which began at approximately 10%, while Brazil was hit with an additional 40% tariff due to the prosecution of former President Bolsonaro. Imports from Canada and Mexico may be exempt under USMCA origin provisions, and tariffs on Australia, New Zealand, and Brazil had not yet been implemented at the time of this article (Burkhart and Hammond, 2025). However, we are starting to see the impact of these policies take effect. For instance, frozen beef imports from Brazil and New Zealand in July 2025 were down 25% and 14%, respectively, compared to July 2024 (USDA-FAS, 2025b). This decline suggests that tariffs and resulting trade tensions are starting to impact beef imports.

Recent Trends in US Beef Exports

The United States is one of the largest beef-exporting countries in the world, ranked third in value behind Brazil and Australia in 2024 (United Nations, 2025). While

Table 2. US Fresh and Chilled and Frozen Beef Exports: 2024 and 2025 Year-to-Date (January–July) Comparison

	Fresh and Chilled				Frozen		
Destination	Jan.–July 2024	Jan.–July 2025	%Δ	Destination	Jan.–July 2024	Jan.–July 2025	%Δ
	Value ($ billions)				Value ($ billions)		
World (total)	2.61	2.37	-9.1	World (total)	2.70	2.55	-5.4
South Korea	0.54	0.53	-1.5	South Korea	0.68	0.82	20.6
Mexico	0.52	0.52	-1.1	Japan	0.32	0.40	24.8
Japan	0.54	0.43	-20.1	China	0.70	0.38	-46.0
Canada	0.40	0.36	-9.6				
	Quantity (000 MT)				Quantity (000 MT)		
World (total)	231.00	199.59	-13.6	World (total)	331.67	316.81	-4.5
South Korea	39.88	40.32	1.1	South Korea	87.36	101.12	15.8
Mexico	53.80	47.13	-12.4	Japan	62.17	74.11	19.2
Japan	60.39	47.07	-22.1	China	79.12	43.94	-44.5
Canada	36.35	31.66	-12.9				
	Unit Value/Price ($/kg)				Unit Value/Price ($/kg)		
World (total)	11.29	11.88	5.2	World (total)	8.13	8.05	-0.9
South Korea	13.56	13.22	-2.5	South Korea	7.83	8.16	4.2
Mexico	9.74	11.00	12.9	Japan	5.20	5.44	4.7
Japan	8.89	9.12	2.5	China	8.82	8.58	-2.7
Canada	10.90	11.32	3.8				

Note: Fresh and chilled beef is defined according to HS 0201: meat of bovine animals, fresh or chilled; frozen beef is defined according to HS 0202: meat of bovine animals, frozen
Source: USDA-FAS (2025b).

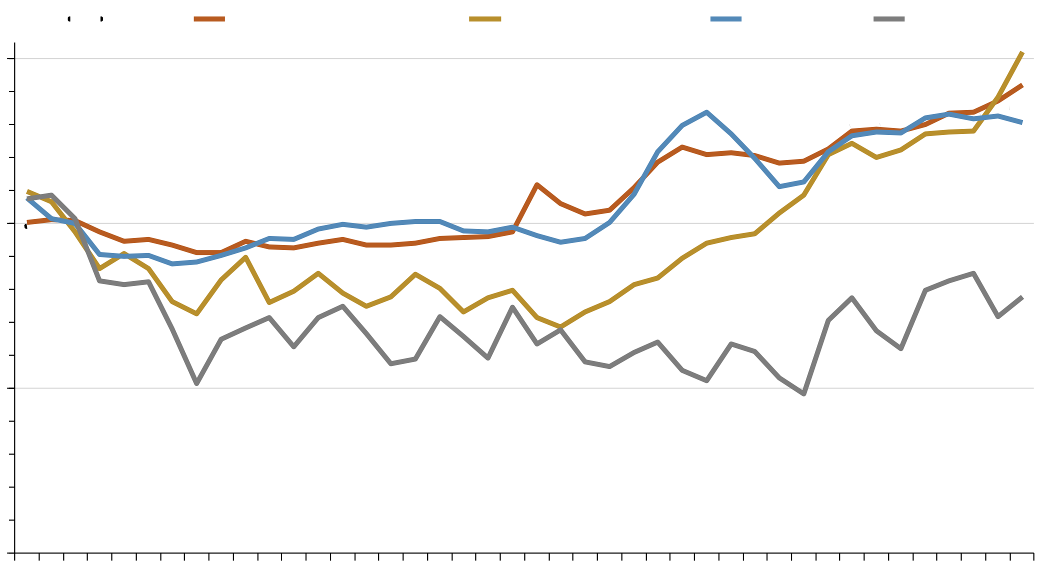
export values are comparable across the three countries—$9.1 billion in fresh, chilled, and frozen beef exports for the United States versus $11.7 billion for Brazil and $9.3 billion for Australia—both Brazil and Australia export significantly more than the United States in terms of quantity. This was due to US beef prices ($9.48/kg) being significantly higher than Brazil ($4.58/kg) and Australia ($6.52/kg) (United Nations, 2025). US beef is grain-finished and is considered higher value in global markets, whereas beef from countries such as Australia, New Zealand, and Brazil is mostly grass-finished, which can reduce quality and consumer appeal (Melton et al., 1982).

Unlike US beef imports, export trends have been more negative in 2025, particularly for fresh and chilled beef and frozen beef exports to China. This may be the result of rising global competition and shifting consumer preferences, but it could also be due to US trade policies, which have introduced uncertainty and increased costs for foreign buyers of American beef.

Table 2 presents a year-to-date comparison of US exports of fresh and chilled, and frozen beef from January to July in 2024 and 2025, detailing changes in import value, quantity, and unit value (price) across major destination countries. US beef exports declined in early 2025, with both fresh and chilled and frozen categories showing year-to-date decreases in value and volume compared to the same period in 2024. Fresh and chilled beef exports fell by 9.1% in value and 13.6% in volume, with notable declines to Japan (–20.1% in value; –22.1% in volume) and Canada (–9.6% in value; –12.9% in volume). Frozen beef exports dropped 5.4% in value, driven largely by a sharp 46% decline in exports to China. However, some markets showed growth in value in 2025: South Korea increased its frozen beef imports by 20.6%, and Japan by 24.8%. Export prices, on the other hand, have been relatively stable compared to import prices.

The significant decline in frozen beef exports to China warrants further discussion. In response to US tariffs, China imposed retaliatory tariffs exceeding 100% earlier this year. Although those tariffs have since been reduced to around 33% (Bown, 2025), the ongoing trade tensions appear to have negatively impact US beef in the Chinese market. In addition, in March 2025, the Chinese government allowed export registrations for nearly 400 beef processing facilities to expire, effectively revoking market access for about 60% of all US facilities authorized to export to China (Marianetti, 2025). According to China customs data, total beef imports from January to July rose by 5.1% compared to the same period last year. Notably, imports from Brazil increased by 19.1%, while imports from the United States declined over the same period (Trade Data Monitor, 2025).

Figure 4. Selected Beef and Cattle Price Indexes and CPI, 2015:Q1–2025:Q2



Source: CPI, both all goods and beef and veal, Bureau of Labor Statistics; Slaughter Steer, USDA Agricultural Marketing Service; Exports and Imports, USDA, Foreign Agricultural Service.

Price Comparisons and Inflation

In this final section, we compare import and export prices, domestic beef prices, and cattle prices to overall inflation. This is important for understanding how trade dynamics and broader economic pressures are influencing costs throughout the beef supply chain. Price indexes from 2015–2025 are reported in Figure 4. Early in the period, retail beef prices (beef and veal CPI) and export prices closely tracked overall inflation (CPI), while slaughter steer prices fell below the inflation rate. Import price indexes also dipped during these years. By 2018–2019, retail beef prices stabilized near CPI, but export prices lagged slightly. The pandemic years (2020–2021) brought sharp disruptions: Retail beef prices climbed above CPI, and export prices rose even faster, driven by strong foreign demand and supply chain constraints. Notably, the most significant increase was observed in steer prices post-pandemic. In contrast, import prices remained relatively flat. From 2022 onward, consumer, export, and steer prices all outpaced CPI, reflecting persistent inflationary pressures and tightening supply in the industry.

Closing Remarks

In this article, we examined the evolving dynamics of the US beef trade, focusing on how domestic production trends, global competition, and trade policy have collectively shaped market outcomes. Recent shifts reflect broader changes in global supply and demand, the emergence of competing exporters, and trade policies dating back to President Trump’s first term. The US beef industry continues to face significant challenges, including declining cattle inventories, rising production costs, and shifting trade relationships. Imports have played a vital role in stabilizing domestic supply amid record-high prices and supply chain disruptions. However, recent trade tensions and disease-related restrictions have complicated access to key sources of imported beef, raising concerns about long-term resilience. Retaliatory tariffs and evolving trade partnerships have redirected global beef flows, with countries like China seeking alternative markets to the United States.

For More Information

Anderson, D. 2025, May 13. “Screwworms, Part II.” *Southern Ag Today* 5(20.2). Available online: https://southernagtoday.org/2025/05/13/screwworms-part-ii/

Anderson, D, D Maples, and C Martinez. 2024, November 26. “An Old Menace.” *Southern Ag Today* 4(48.2). Available online: https://southernagtoday.org/2024/11/26/an-old-menace/

Bown, C.P. 2025. *US-China Trade War Tariffs: An Up-to-Date Chart*. Peterson Institute for International Economics. Available online: https://www.piie.com/research/piie-charts/2019/us-china-trade-war-tariffs-date-chart

Brower, J. 2022. *Reviewing the Tariff-Rate Quotas for U.S. Beef Imports*. International Agricultural Trade Report. US Department of Agriculture, Foreign Agricultural Service. Available online: https://www.fas.usda.gov/data/reviewing-tariff-rate-quotas-us-beef-imports

Burkhart, W.F., and K.E. Hammond. 2025. *Presidential 2025 Tariff Actions: Timeline and Status*. CRS Report R48549. Congressional Research Service.

Calil, Y. 2024, August 27. “U.S. Beef Imports: A Quick Look at Recent Trends.” *Southern Ag Today* 4(35.2). Available online: https://southernagtoday.org/2024/08/27/u-s-beef-imports-a-quick-look-at-recent-trends/

Livestock Marketing Information Center (LMIC). 2025. *U.S. Beef Production and Forecasts Report*. Available online: https://www.lmic.info/

Luckstead, J., and S. Devadoss. 2025. “Consequences of Trump’s Bilateral Trade Policies for Agriculture.” *Choices* 40(4). https://doi.org/10.22004/ag.econ.370424

Marianetti, J. 2025. *USA Dairy, Pork, and Poultry Registrations Renewed while Beef Remains Overdue*. Report CH2025-0056. USDA Foreign Agricultural Service. Available online: https://www.fas.usda.gov/data/china-usa-dairy-pork-and-poultry-registrations-renewed-while-beef-remains-overdue

Melton, S.L., M. Amiri, G.W. Davis, and W.R. Backus. 1982. “Flavor and Chemical Characteristics of Ground Beef from Grass-, Forage-Grain- and Grain-Finished Steers.” *Journal of Animal Science* 55:77–87. https://doi.org/10.2527/jas1982.55177x

Trade Data Monitor. 2025. Available online: https://tradedatamonitor.com/

United Nations. 2025. *UN Comtrade Database*. Available online: https://comtradeplus.un.org/

US Department of Agriculture (USDA). 2025, May 11. “Secretary Rollins Suspends Live Animal Imports Through Ports of Entry Along Southern Border, Effective Immediately.” Press Release. Available online: https://www.usda.gov/about-usda/news/press-releases/2025/05/11/secretary-rollins-suspends-live-animal-imports-through-ports-entry-along-southern-border-effective

US Department of Agriculture Agricultural Marketing Service (USDA-AMS). 2025. *U.S. Livestock, Poultry, and Grain Market News*. Available online: https://www.ams.usda.gov/market-news/livestock-poultry-grain

US Department of Agriculture Economic Research Service (USDA-ERS). 2025. *Meat Price Spreads*. Available online: https://www.ers.usda.gov/data-products/meat-price-spreads/

US Department of Agriculture Foreign Agricultural Service (USDA-FAS). 2025a. *Production, Supply, and Distribution Online*. Available online: https://apps.fas.usda.gov/psdonline/app/index.html#/app/home

———. 2025b. *Global Agricultural Trade System*. Available online: https://apps.fas.usda.gov/gats/default.aspx

US Department of Agriculture National Agricultural Statistics Service (USDA-NASS). 2025. *January Cattle Report*. Available online: https://usda.library.cornell.edu/concern/publications/h702q636h

About the Authors: Andrew Muhammad is a Professor and Blasingame Chair of Excellence with the Department of Agricultural and Resource Economics at the University of Tennessee Institute of Agriculture. Charles Martinez is an Assistant Professor with the Department of Agricultural and Resource Economics at the University of Tennessee Institute of Agriculture. Parker Wyatt is a Graduate Student with the Department of Agricultural and Resource Economics at the University of Tennessee Institute of Agriculture.

Acknowledgements: We thank the editor Zhengfei Guan, guest editor Stephen Devadoss, and an anonymous reviewer for their comments and insightful suggestions, which greatly improved the quality and clarity of this paper.

ANNUAL REVIEWS

Annual Review of Resource Economics

Global Food Demand: Overcoming Challenges to Healthy and Sustainable Diets

Andrew Muhammad,[1] Emiliano Lopez Barrera,2
and Norbert L.W. Wilson[3]

[1] Department of Agricultural and Resource Economics, University of Tennessee Institute of Agriculnire, Knoxville, Tennessee, USA; email: amuhammad@utk.edu

[2]Department of Agricultural Economics, Texas A&.M University, College Station, Texas, USA; email: elopezba@tamu.edu

'Duke Divinity School, Wcxld Food Policy Center, and Sanford School of Public Policy, Duke University, Durham, North Carolina, USA; email: norhert.wilsnn@duke.edu

An.nu. Rev. Resour. Econ. 2025. 17:41-64

First published as a Review in Advance on
June 10, 2025

The *Annual Revil·w of Resource Economics* is online at resource.annualreviews.org

https://doi.org/10.l146/annurev-resnurce-112923-040421

JEL codes: F0l, I15, Ql8, Q28, Q58

Keywords

economic models, food security, global food demand, least-cost diet, sustainability

Abstract

We review the research on global food demand and examine modeling efforts to address the complexities of dietary transitions. We also highlight challenges affecting the economic feasibility of dietary targets aimed at promoting both human health and environmental sustainability (e.g., EAT-*Lancet).* The relationships among income, prices, and food demand play an important role in understanding how economic growth impacts nutrition and sustainability. As colmtries become more affluent, and food accow1ts for a smaller share of income, dietary transitions often lead to increased consumption of both resource-intensive and energy-dense foods. Modeling strategies must account for these dynamics to accurately project future resource needs and nutritional outcomes. Research should also consider the cost of healthy diets within the context of both food and nonfood expenditures. When both are considered, considerably fewer people can afford proposed sustainable diets. Economic, environmental, and health perspectives should all be integrated when developing strategies to promote healthy and sustainable diets.

1. INTRODUCTION

Transforming food systems to address public health and environmental challenges calls for a comprehensive understanding of the factors driving global food demand. While the consumption of healthy foods has improved globally, there has also been an increase in the consumption of unhealthy foods, as well as animal-based proteins and vegetable oils, which are only considered healthy at lower intake levels (Costlow et al. 2025, Imamura et al. 2015). This trend has contributed to global health issues, including the simultaneous rise of undernutrition and obesity. Micronutrient deficiencies affect more than 5 billion people (Passarelli et al. 2024), contributing to child stunting and wasting (WHO 2023). Simultaneously, the prevalence of overweight and obesity among children has surged, primarily due to increased intake of highly processed, energy-dense foods (Lopez Barrera & Shively 2022, WHO 2023). Dietary patterns are also fueling a rise in adult obesity, particularly in middle- and low-income countries (NCD-Risk Factor Collab. 2016), contributing to the increased risk of noncommunicable diseases such as cardiovascular disease and diabetes (Afshin et al. 2019, Murray et al. 2020). Addressing tl1ese challenges requires that individuals choose healthier diets. However, healthy food choices depend on both access and affordability (Headey & Alderman 2019, Wallingford et al. 2024).

As health and nutrition issues have intensified, global patterns have increasingly impacted the environment. The intensification of agricultural production to meet growing demand places pressure on natural resources, w1dermining global environmental resilience (Campbell et al. 2017, Cordell & White 2014, Rockstrom et al. 2009). The global food system also relies heavily on freshwater resources, and nutrient runoff from farming activities further compounds environmental challenges (Foley et al. 2005, Hoekstra & Wiedmann 2014). If unchecked, production trends could threaten ecosystems and biodiversity, highlighting the need for sustainable practices and policies to mitigate environmental degradation. In this context, food loss and waste pose another challenge (30-40% of food production) (FAO 2013, Lopez Barrera & Hertel 2021). This waste accounts for about 24% of freshwater use and 23% of global cropland (Kummu et al. 2012).

When addressing the critical goal of providing a growing global population with safe and nutritious foods, it is essential to consider the economic and social factors that shape global food demand **(Figure 1).** These factors are important for promoting healthy food choices and mitigating the environmental degradation caused by food production (Fan et al. 2021). Understanding these factors is pivotal for tl1e following:

- Projecting future food needs (Bodirsky et al. 2015, Valin et al. 2014),
- Addressing global food security (Regmi & Meade 2013),
- Managing natural and agricultural resources to meet growing demand (Keating et al. 2014, Sands et al. 2023),
- Assessing the environmental consequences of increased demand (Tilman et al. 2011),
- Evaluating how economic instability and prices impact vulnerable populations (Kallruhl et al. 2016), and
- Structuring incentives and policies aimed at promoting healthier diets and improving associated public healtl1 and environmental outcomes (Bodirsky et al. 2015).

Without a clear w1derstanding of what people eat and why, along with the economic and cultural influences affecting food choices globally, we cannot effectively address food-related challenges such as malnutrition and food insecurity. This knowledge is also essential for developing sustainable diet solutions.

In this article, we review the research on global food demand and dietary transitions and examine past and current modeling efforts to address the complexities of these transitions. In this

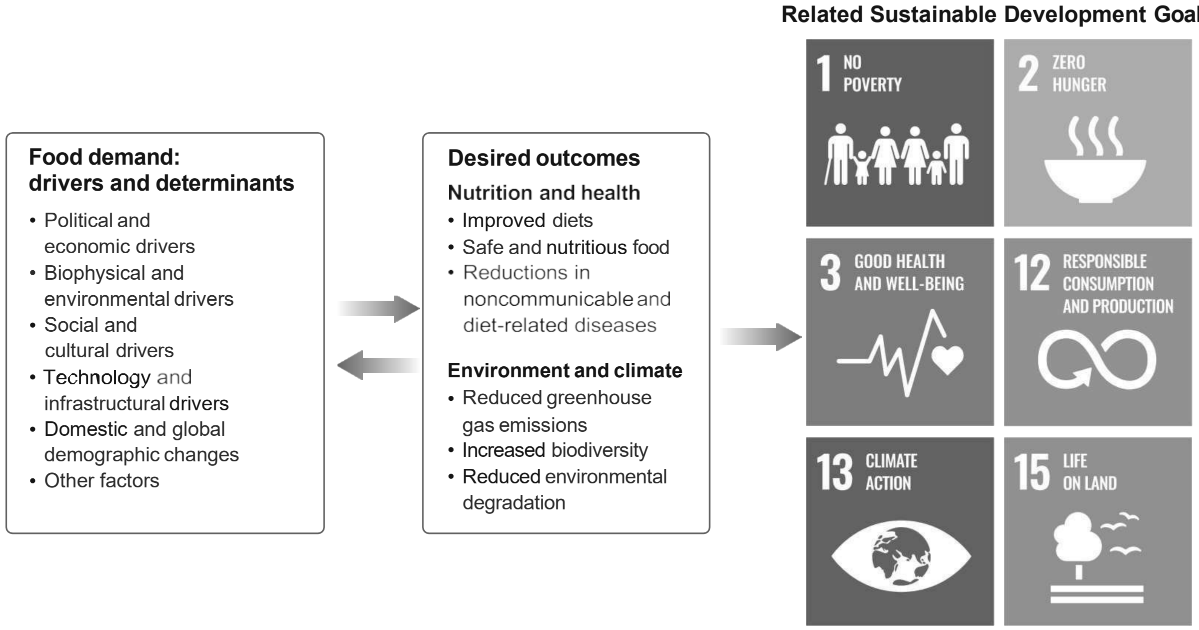


Figure 1

Overview of food demand drivers, desired outcomes, and related United Nations Sustainable Development Goals. Information is based on the various studies reviewed in the article. Related Sustainable Development Goals reproduced from the United Nations Department of Economic and Social Affairs, Sustainable Development **(https://sdgs.un.org/goals).**

context, we also review research on challenges impacting the economic feasibility of dietary targets designed to promote both human health and environmental sustainability (e.g., *EAT-Lancet).* Economic and cultural factors shaping food demand globally can work against sustainable diet solutions. Regarding this issue, we discuss the economic factors that determine dietary choices around the world, considering the primary drivers of affordability and access: income and prices. Here we consider how income or national affluence and prices have shaped food spending and consumption across the full spectrum of countries, from the least-developed to the highest-income nations.

Economic growth can lead to dietary shifts toward more resource-intensive foods, with notable implications for economic, environmental, and health dimensions. Modeling frameworks that effectively integrate these dimensions offer valuable insights for addressing these challenges. We review the traditional modeling approaches to assessing the impacts of dietary transitions and consider how modeling frameworks have been used to assess the impacts of diets on human health and environmental wellbeing.

We then discuss the economic feasibility of sustainable dietary frameworks. Drawing from the planetary boundaries framework, the *EAT-Lancet* Commission used "the latest available science to make a global assessment of the food system and set global scientific targets for healthy diets and sustainable food production" (Willett et al. 2019, p. 452). We discuss the affordability of nutritionally adequate diets with a focus on the affordability of the *EAT-Lancet* diet (henceforth the *Lancet* diet). We point out challenges as well as potential ways forward for achieving sustainable and nutritious diets globally.

We close the review with a discussion of policy interventions-such as taxes on resource-intensive foods, subsidies for sustainable alternatives, and incentives to reduce food waste-and their potential to promote healthier, more sustainable food consumption bundles. We further critique computable general equilibrium (CGE) and partial equilibrium (PE) models in this context, assessing their ability to simulate complex dietary transitions and highlighting future directions for analysis and model refinement.

2. ECONOMICS OF GLOBAL FOOD DEMAND

The factors affecting food demand within and across countries include income, prices, culture, tastes, and preferences, among others. These factors must also be considered in the context of anthropometric food requirements (i.e., dietary needs based on body dimensions) (Bodirsky et al. 2020). The literature has been consistent on issues of income and prices. Individuals in higher-income countries allocate a significantly smaller share of their total budget to food compared to those in the poorest countries (less than 10% versus more than 50%). For example, US food expenditures account for about 5% of gross domestic product (GDP), whereas in countries such as South Sudan, Nepal, and Somalia, this figure can exceed 50% (World Bank 2024). Consequently, income and prices can exert a stronger influence on food demand and diets in lower-income countries than in higher-income countries (Clements et al. 2006; Cranfield et al. 1998; Muhammad et al. 2011, 2017; Regmi & Meade 2013; Seale et al. 2003; Selvanathan & Selvanathan 2003). "Whereas in the lowest-income countries, a percentage increase in income will cause an increase in spending on starchy staples by more than half the proportional increase in income, the resulting increase in higher-income countries is usually negligible and can even be negative (Muhammad et al. 2011, Seale et al. 2003).

Identifying global consumption patterns due to tastes and preferences or noneconomic factors has proven to be more elusive (Clements et al. 2006, Gao 2012). However, studies have identified changing cultural trends such as consumers in lower-income countries adopting more westernized diets (Liang et al. 2024). For example, recent data show significant shifts in dietary patterns in countries such as China and Brazil, where rising incomes have led to increased consumption of meat and dairy products (Delgado 2003, Parlasca & Qaim 2022, Vecchia & Majem 2015). Evidence also shows that diet quality and healthy food choices increase with education in most world regions (Miller et al. 2022).

Other factors such as taste and preferences are, in part, reflected by changing demand estimates related to income and price (Gao 2012, Lusk 2017, Selvanathan & Selvanathan 2003). For instance, food demand responsiveness to income and prices has been found to vary with age, sex, and regional influences (Muhammad et al. 2017). The notion that preferences and other factors could affect demand estimates has important implications for the effectiveness of taxes and subsidies in different populations and countries and how other policies such as information campaigns and nutrition education might influence structural change in food demand responsiveness (Guthrie et al. 2015).

In this section, we review studies of global food demand and discuss the economic factors that determine dietary choices around the world. Although we primarily focus on the effects of income and national affluence, as they are considered important drivers of food demand (Fukase & Martin 2020), we also consider how prices have shaped demand. Fundamental to this discussion is how food spending and consumption vary across the full spectrum of countries, from the least-developed to tl1e highest-income nations. On this point, the literature has focused on food demand overall, i.e., the demand for food relative to other major spending categories such as health care, education, and housing (Clements et al. 2006, Selvanathan & Selvanathan 2003, Theil 1996), as well as the demand for individual food categories (Cranfield et al. 1998, Liang et al. 2024, Muhammad et al. 2011, Seale et al. 2003). By exploring these various factors, we gain a comprehensive understanding of how income and prices shape global food demand.

2.1. Country Affluence and Global Diets

Understanding the relationship between food demand and income can inform how economic growth and national affluence might contribute to (or undermine) nutrition and sustainability goals. Data suggest that income growth does not necessarily lead to greater demand for healthier and more nutritious foods, nor does it ensure a reduced intake of foods associated with negative health and environmental outcomes (Finaret & Masters 2019, Herforth & Ahmed 2015, Masters et al. 2022). In fact, when considering the factors that influence overall diet quality and sustainability, policy interventions have been argued to be necessary even in the highest-income cow1tries (Steenson & Buttriss 2021).

How does income influence food spending across countries and food categories, and what are the implications for global nutrition and sustainable diets? Evidence suggests that income growth could result in dietary changes that are not consistent with sustainability goals. For instance, sustainable diet recommendations outlined by Willett et al. (2019) suggest reduced intake of reel meat and dairy products and increased consumption of fruits and vegetables. However, rising incomes worldwide often result in food trends that contradict these recommendations.

Using recent data from the International Comparison Program (ICP) of the World Bank, a global initiative that collects detailed price and expenditure data at the country level (World Bank 2024), we estimate the predicted food shares for selected food categories for countries included in both tl1e 2017 and 2021 ICP data round. Predicted food shares are derived using a conditional demand model following Working (1943), (I:�;E;, = *ci;* + Aln(L; *Eic)),* where *E;c* is the expenditure on the ith food category in country *c.*[1] Results are reported in **Figure** 2. *As* the figure shows, the share of food expenditures allocated to meat and dairy significantly rises with national affluence, particularly at the early stages of income growth. Meat expenditure shares increase from less than 15% in the lowest-income countries to more than 20% when per capita income reaches US$10,000 [adjusted for purchasing power parity (PPP)]. Dairy expenclinire shares increase from less than **1**% to more than 10% when per capita income reaches $20,000.

According to Willett et al. (2019) and Lang & Barling (2013), even small increases in reel meat or dairy consumption could hinder sustainability goals. Unfortunately, rising incomes lead to substantial increases in spending on these products, particularly at the lower encl of the income spectrwn. Nate that 43% of the global population is in countries where annual per capita income is less than $10,000. Depending on the country, tl1is translates to only $3,000 to $5,000 on a market exchange rate basis (i.e., not adjusted for PPP) (World Bank 2024). The increase in spending on meat and dairy as countries become more affluent is most significant among these lower-income countries and tends to level off in the early stages of the global income distribution. For instance, meat expenditure increased from around 13% in the lowest-income countries (approximately $65 per person) to about 20% as per capita income reaches $5,000 (around $113 per person in lower-middle-income countries) but remains around 20% thereafter.

Although dietary recommendations include increased consumption of fruits and vegetables, fruit expenditure shares remain constant across countries regardless of income (< 10% globally), with only a modest increase at the lower encl of the income spectrwn. The share of spending on vegetables tends to decline with a country's affluence, decreasing from around 30% in the lowest-income cow1tries (armmcl $132 per person) to less tlian 15% in tl1e highest-income cow1tries (around $319 per person). Spending on vegetables decreases mainly at lower-income levels, yet the decline also continues throughout the middle-income level **(Figure 2).** The results for vegetables

[1]The above specification was estimated using a maximum likelihood procedure for equation systems. We assumed average or fixed prices for estimation.

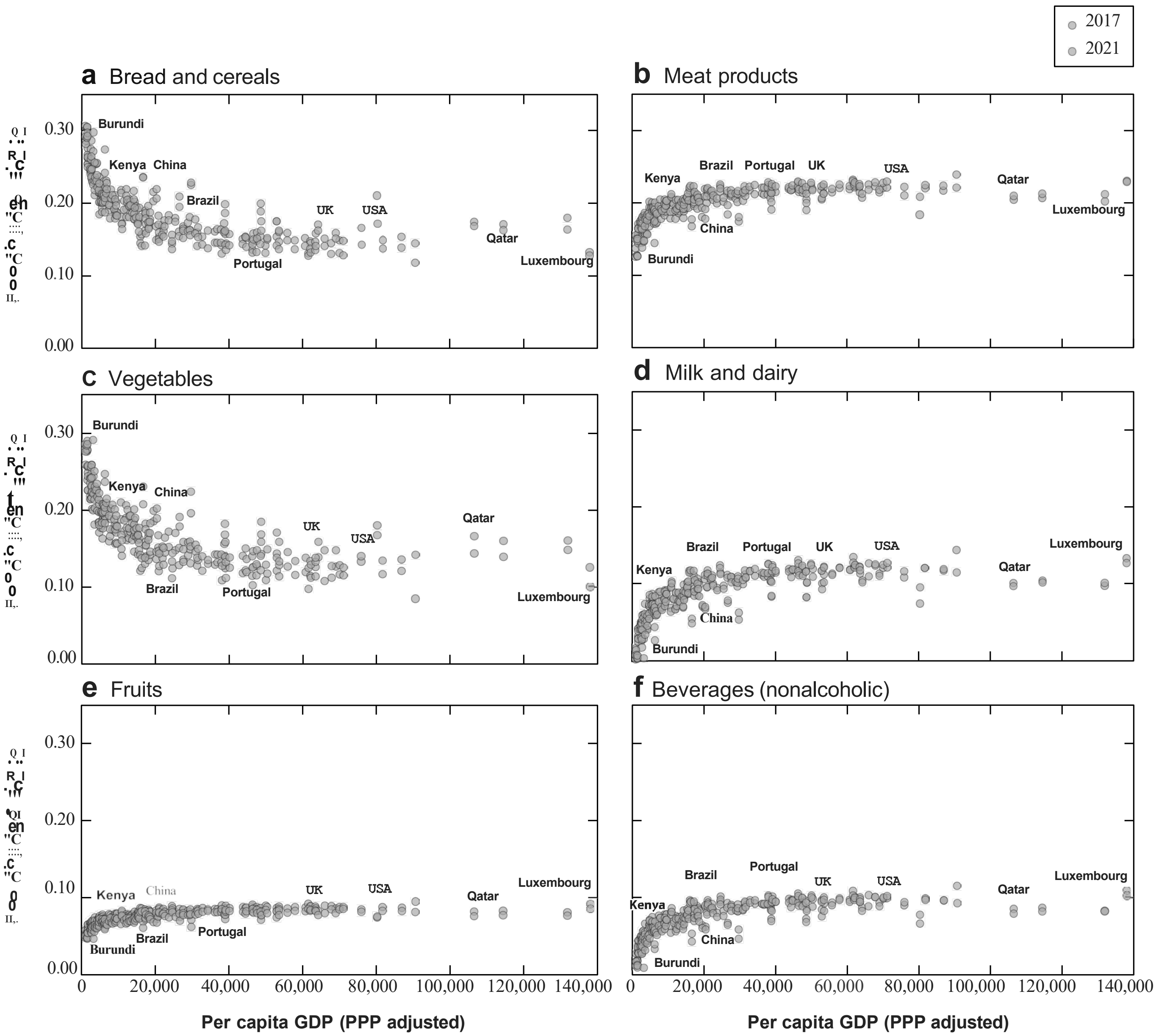


Figure 2

Predicted food budget shares for selected categories across 162 countries. Spending shares and gross domestic product (GDP) are purchasing power parity (PPP) adjusted. Predicted food shares are derived using a conditional demand model by Working (1943), $\left(\frac{E_{ic}}{\sum_i E_{ic}} = \alpha_i + \beta_i \ln(\sum_i E_{ic})\right)$, where E_{ic} is the expenditure on the ith food category and $\sum_i E_{ic}$ is total food spending **in** country c. Estimates are derived using data from the International Comparison Program (ICP), World Bank (2024) **(https://www.worldbank.org/en/programs/icp/ data).**

could be misleading because tubers and legumes are included among vegetables (World Bank 2020). Observed declines could be due, in part, to decreased spending on these categories.

Expenditures on breads and cereals, being the most staple-dominated category, decline as national affluence increases, ranging from approximately 30% in Burundi (the lowest-income country according to our data) to 13% in Luxembourg (the highest-income country), with most of this reduction happening at lower-income levels **(Figure 2).** This category includes basic staples such as rice and grains (World Bank 2020), so the overall decline is not surprising. However, this category also includes whole grains, which are considered nutritionally beneficial (Willett et al. 2019).

2.2. Income Elasticities Across Countries

Income elasticities are widely used measures of food demand responsiveness. They quantify the percentage change in the quantity demanded for a specific good or consumption category in response to a percentage change in income. Because elasticities are based on percentage changes rather than unit changes, they are comparable across spending categories and countries.

Food, as an aggregate, is both a normal good (income elasticity > 0) and a necessity ($1 >$ income elasticity > 0), as noted in studies going back more than a half century. For example, Tobin (1950) examined US urban and rural households as early as 1918 and found income elasticity estimates ranging from as low as 0.35 for farm households in 1941 to 0.68 for urban households in 1927-1928. Similarly, Houthakker (1957) reported estimates ranging from 0.71 for blue collar households in The Netherlands and in the western United States to 0.34 for middle-class households in the United Kingdom. This phenomenon, known as Engel's (1857) law, suggests that as income grows, the proportion of income spent on food decreases (Engel 1857, Houthakker 1957). This relationship has been repeatedly confirmed within and across countries (Bodirsky et al. 2015, Chai & Monera 2010, Clements et al. 2006, Cranfield et al. 1998, Fukase & Martin 2020, Goldberger & Gamaletsos 1970, Liang et al. 2024, Muhammad et al. 2011, Regmi & Meade 2013, Seale et al. 2003, Selvanathan & Selvanathan 2003, Theil 1996).

While understanding the impact of income on aggregate food demand is important, knowing the demand responsiveness of individual food categories (e.g., fruit, meat, dairy) to income changes is even more important for developing sustainable diet solutions. The demand for individual food categories is often estimated as a function of total food expenditures (conditional demand), which can result in expenditure elasticities that differ notably from corresponding income elasticities. However, we can indirectly assess how an individual food category will respond to income changes by multiplying the conditional expenditure elasticity for a category by the income elasticity for food (Seale et al. 2003). Given that the income elasticity for food tends to be less than one, income elasticities for individual food categories are usually smaller than the expenditure elasticities reported in the literature.

Income elasticity estimates throughout the literature provide further evidence that rising incomes will result in dietary changes that are inconsistent with sustainability goals. On average, income elasticities are higher for meat (0.73) and dairy products (0.72) compared to cereals and grains (0.45) (Femenia 2019). Income elasticities can also vary by national affluence. In lower-income countries, estimates are around 0.80 for meat and dairy products, but 0.50 for cereals. However, in higher-income countries, estimates are around 0.50 for meat and dairy products and near zero or even negative for cereals (Muhammad et al. 2011, Seale et al. 2003). Income elasticities for fruits and vegetables average around 0.60 but can be as low as 0.30 in higher-income countries. The most sensitive category to income changes is nonalcoholic beverages, with elasticities greater than one in poor countries, implying that nonalcoholic beverages are luxury goods in these countries (Femenia 2019, Muhammad et al. 2011, Seale et al. 2003). When food intake is considered (as opposed to food spending), income growth still has a significantly larger effect on milk, red meat, and sugar-sweetened beverages, especially in lower-income countries, but no significant effect on staples and vegetables (Muhammad et al. 2017).

Worldwide, individuals tend to diversify away from starchy staples and consume more animal products as their incomes rise (Gouel & Guimbard 2019). The difference in income elasticities for

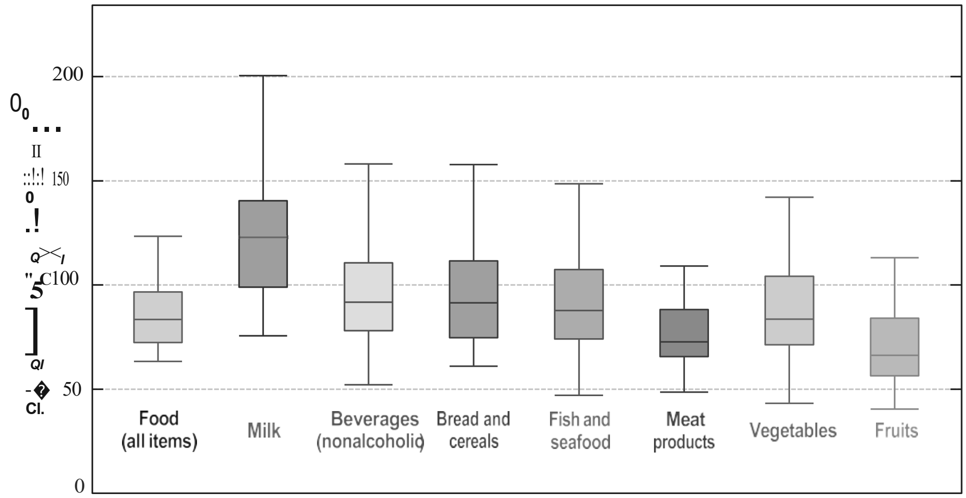


Figure 3

Price level indices by selected food categories in lower-income countries. Data are based on countries in the bottom quartile according to purchasing power parity (PPP)-adjusted per capita gross domestic product (GDP). Data from the International Comparison Program (ICP), World Bank (2017 data; **https://www.worldbank.org/en/programs/icp/data).**

meat and dairy versus cereals supports this notion and conforms Bennett's law; that is, the share of starchy staples in diets tends to decrease with income (Bennett 1941, Timmer et al. 1983).

2.3. Price Elasticities Across Countries

How do food prices vary around the world? **Figure 3** shows box and whisker plots for selected food price indices (world= 100) in the poorest countries (lowest-income quartile). While median prices for food overall and most food categories in low-income countries are below the global average (< 100), the interquartile range exceeds the global average for beverages, breads and cereals, fish and seafood, and vegetables. Interestingly, the interquartile range for meat products and fruits is less than 100, indicating that these products tend to be less expensive in lower-income countries. Milk and dairy stand out as being considerably more expensive in poor countries, with an interquartile range above 100 and extreme values, indicating that dairy products can be twice as expensive in the lowest-income countries. The values in **Figure 3** do not account for PPP differences across countries. Food prices are even higher in lower-income countries when PPP differences are considered (World Bank 2024).

Price elasticities can inform strategies to promote healthier and more sustainable diets. For instance, if the demand for an unhealthy food category is highly elastic, meaning consumers are very sensitive to price changes, then even a small price increase (e.g., through taxes) could reduce spending and consumption. Overall, the demand for food (as an aggregate) is inelastic (lelasticityl < 1) throughout the world but can vary by affluence. Income and national affluence directly affect how sensitive food demand is to price changes; elasticities range from approximately -0. 70 in lower-income countries to approximately-0.30 in countries such as the United States (Muhammad et al. 2011, Seale et al. 2003).

Price elasticities can vary notably across food categories and countries, indicating that low-income countries would be the most impacted by taxes or subsidies (Cornelsen et al. 2015). However, most studies have found the demand to be inelastic, with a few noted exceptions (e.g., beverages and food away from home in lower-income countries) (Andreyeva et al. 2010, Green et al. 2013, Muhammad et al. 2011). A meta-analysis of more than 130 studies and 160 countries, comprising more than 3,000 data points, identified differences in own-price elasticities between low-income and high-income countries (Green et al. 2013). Across studies, the own-price elasticity for cereals ranged from around -0.61 in low-income cow1tries to about -0.43 in high-income conntries; for meat, from -0.78 to -0.60; for fruits and vegetables, from -0.72 to -0.53; and for dairy, from about -0.78 to approximately -0.60 (Green et al. 2013). A recent study of consumers in selected African countries (Malawi, Niger, Nigeria, Tanzania, and Uganda) found food demand to be highly elastic for the poorest consumers (e.g., -1.38 for rice, -2.44 for poultry, and -3. 94 for dairy in Malawi). However, demand became significantly more inelastic as incomes increased from less than $2.00/day to more than $5.50/day (McCullough et al. 2024).

Price responsiveness across countries can differ when considering intake instead of expenditures. In the poorest countries, some products (e.g., processed meat, fruit, fruit juice) are highly elastic. However, as national income increases, price sensitivity mostly declines. Although milk spending can be highly elastic, actual milk intake across countries has relatively lower price sensitivity, whereas fruit juice intake is highly sensitive to price changes (elastic demand) regardless of national income or global region (Muhammad et al. 2017).

Overall, research findings highlight the importance of economic factors in determining food choice. Both income and price estimates suggest dietary transitions that are inconsistent with nutrition and sustainability goals. This must be considered when developing sustainable diet solutions.

3. ASSESSING HEALTH AND ENVIRONMENTAL IMPACTS

In the previous section, we explored how dietary shifts are driven by income and prices. This section examines key methodologies used to assess the environmental and health effects of food demand. We synthesize methodologies that connect diets, health, and environmental sustainability. These include lifecycle assessments (LCAs), which provide detailed insights into environmental impacts, and CGE and PE models, which capture broader economic and policy dynamics. Together, these approaches underscore critical dimensions of food systems, revealing the prevalence of unhealthy and unsustainable food consumption trajectories and contributing to discussions on global food system challenges.

3.1. Quantifying Environmental and Health Impacts of Diets

LCAs provide essential insights into the environmental and health impacts of food systems by quantifying emissions, resource use, and dietary health outcomes. For instance, Drewnowski & Popkin (1997) examine dietary shifts in low-income countries, identifying the rising prevalence of obesity and chronic diseases. Their findings underscore how tl1ese changes contribute to unhealthy and unsustainable diets, particularly in developing regions, and highlight tl1e need to align dietary recommendations with both environmental and health objectives. With the rise of environmental concerns, researchers began integrating health and sustainability factors into food system analyses.

Horrigan et al. (2002) expand the scope of analysis by connecting sustainable agriculture practices to both environmental and health outcomes. They emphasize how industrial farming exacerbates ecological degradation and public health challenges, underscoring the importance of transitioning to sustainable agricultural practices. Similarly, Eshel & Martin (2006) evaluate energy use and greenhouse gas (GHG) emissions linked to various diets, quantifying the environmental costs of resource-intensive dietary choices, particularly those involving animal-based products. This pioneering work laid the foundation for subsequent data-driven studies, illustrating the outsized impact of meat-heavy diets on sustainability metrics. Building on this foundation, Stehfest et al. (2009) and Friel et al. (2009) employ global climate models and health impact assessments to explore the effects of reduced meat consumption. These studies demonstrate how plant-based diets not only reduce GHG emissions but also improve public health by addressing issues such as cardiovascular diseases. This convergence of health and environmental modeling has opened new avenues for understanding global food system transitions.

LCAs have since become indispensable tools for systematically comparing the environmental impacts of various food products. Nijdam et al. (2012) conduct a meta-analysis of LCAs, emphasizing the environmental benefits of reducing animal product consumption. Their findings consistently demonstrate that plant-based diets have lower environmental footprints, particularly regarding emissions and resource use. Similarly, Scarborough et al. (2012) use epidemiological data to model the health impacts of sustainable diets, illustrating how dietary changes benefit both human health and the environment.

Westhoek et al. (2014) apply scenario modeling to examine regional effects of reducing meat and dairy consumption in Europe, identifying solutions tailored to local contexts. Their research highlights tl1e importance of targeted interventions that address region-specific environmental and health challenges. Tilman & Clark (2014) extend this analysis by projecting future dietary patterns and illustrating their potential to reduce emissions and prevent chronic diseases. These findings underscore the interconnectedness of local and global scales in addressing food system challenges. Springmann et al. (2016) build on this by using comparative risk assessment and LCA-based emissions data to quantify the health and environmental impacts of dietary shifts, highlighting tl1eir potential to reduce mortality rates and food-related GHG emissions.

Godfray et al. (2018) present a detailed analysis of the trade-offs between meat consumption, health, and environmental sustainability. Their work acknowledges the complexity of dietary transitions, balancing the benefits of plant-based diets with the cultural and economic factors influencing meat consumption. In a more comprehensive global context, Springmann et al. (2018) propose the planetary health diet (PHD), integrating healtl1 and environmental objectives to provide a practical framework for balancing human nutritional needs with planetary boundaries. LCAs and aggregate-level analyses provide robust methodologies for quantifying the environmental and health impacts of dietary choices. By consistently exposing the unsustainable and unhealthy nature of current consumption patterns, these approaches offer a critical foundation for understanding the global implications of food demand. Furthermore, this evidence-based framework highlights tl1e potential of aligning dietary recommendations witl1 sustainability and public health objectives, paving the way for actionable strategies to transform food systems.

3.2. Insights from Broader Economic Models

Although LCAs excel at capturing detailed environmental and health metrics, they often fall short of addressing broader economic and social dynamics, such as impacts on food prices, employment, or market interactions. This necessitates the use of more comprehensive frameworks. CGE and PE models address these gaps by offering complementary strengths in simulating economic and policy impacts. As Valin et al. (2014) emphasize, CGE models provide economy-wide perspectives, capturing cross-sectoral and regional interactions, while PE models deliver detailed, sector-specific analyses. This complementarity is particularly valuable for understanding variations in food demand projections influenced by income elasticities, price responses, and regional contexts. By complementing LCAs, these economic modeling techniques provide a more holistic understanding of the systemic implications of dietary transitions and their broader socioeconomic impacts.

The integration of environmental outcomes into economic models began with pioneering work such as the dynamic integrated climate-economy (DICE) and regional integrated climate-economy (RICE) models (Nordhaus 1992, Nordhaus & Yang 1996). These models represent a breakthrough in general equilibrium (GE) modeling by linking economic activity with environmental and climate dynamics. They enable policymakers to explore the long-term effects of climate change and evaluate mitigation strategies, such as carbon pricing, on a global scale (Nordhaus 2017). By incorporating environmental externalities into the broader economic framework, Nordhaus's work illustrates the potential for GE models to extend beyond traditional economic analysis, addressing pressing global challenges and providing a foundation for subsequent advancements in economic-environmental modeling.

Building on this foundation, GE models have evolved to explore critical intersections between economic systems and sustainability, including their application to the diet-health-environment trilemma. Economic modeling techniques, particularly the CGE and PE models, have proven essential in capturing complex market interactions and assessing the broad effects of dietary changes, public health policies, and environmental sustainability initiatives. CGE models simulate economy-wide impacts, considering interlinkages across sectors, making them ideal for analyzing the broader effects of policies or shocks (Hertel 1997). In contrast, PE models focus on specific sectors, holding others constant, offering more targeted and detailed insights into sector-specific changes (Hertel & Baldos 2016). Together, these models not only complement LCAs by extending their scope to broader systemic impacts but also build on earlier advances such as DICE and RICE to provide a more integrated view of how policies influence individual sectors and the wider economy.

Baldos & Hertel (2014) develop the SIMPLE (simplified international model of agricultural prices, land use, and the environment) PE model, incorporating a food security module based on the Food and Agriculture Organization of the United Nations (FAO) Prevalence of Undernourishment methodology. Their projections for global food security up to 2050 under various agricultural productivity and climate change scenarios suggest that sustained productivity growth plays a key role in reducing undernutrition. Conversely, stagnation or adverse climate impacts are associated with exacerbated food insecurity. This analysis complements the broader findings of Frank et al. (2019), showing how productivity and environmental interventions are interlinked in addressing food security. Together, these studies highlight the multifaceted nature of food system challenges.

By addressing both supply-side and demand-side dynamics, these studies emphasize the multidimensional nature of food system challenges. The integration of CGE and PE models with other methodologies, such as LCAs, strengthens the analytical framework for understanding interdependencies between dietary choices, environmental sustainability, and food security. This integrative approach also allows for policy interventions that account for systemic trade-offs and cobenefits, enabling more informed decision-making.

3.3. Integrating Insights for Policy and Practice

LCAs can highlight the health and environmental burdens of current dietary trajectories, capturing detailed metrics such as emissions, resource use, and dietary health outcomes. Broader economic models, such as CGE and PE frameworks, complement these analyses by examining systemic dynamics, including market interactions, policy trade-offs, and socioeconomic impacts. Together, these methods provide a comprehensive perspective on the challenges posed by dietary trends, emphasizing their contribution to ecological pressures and public health challenges. The insights derived from these methodologies emphasize the prevalence of unhealthy and unsustainable diets, offering valuable tools for understanding the multifaceted impacts of food demand. These tools lay a foundation for identifying key leverage points in global food systems, setting the stage for further examination of targeted solutions in subsequent sections.

4. GLOBAL FOOD DEMAND: TOWARD SUSTAINABLE AND HEALTHY DIETS

One of the key leverage points is to develop potential diets that balance sustainability concerns and human health. For example, the *EAT-Lancet* Commission developed scientific targets based on the planetary boundaries framework (Steffen et al. 2015) to recommend healthy diets from sustainable food production and consumption (Willett et al. 2019). The key takeaway from the Commission's findings is that the world should aim to reduce the consumption of unhealthy foods, such as red meat and sugar, by at least half and double the intake of healthy foods, namely fruits, vegetables, legumes, and nuts, with some regional variations.

The Commission's efforts are part of a long-standing initiative to acknowledge the interdependence of sustainable diets, climate change, and human health through the promotion of a PHD (Blackstone et al. 2018; Chaudhary & Krishna 2019; Gephart et al. 2016; Gussow & Clancy 1986; Myers et al. 2014; Scarborough et al. 2012; Springmann et al. 2016, 2018; Tilman & Clark 2014; Vermeulen et al. 2012). Overall, research suggests that climate change reduces the nutritive value of foods, red meat decreases human health and produces GHGs, and fruits and vegetables are healthy, with lower environmental harm. The studies, as mentioned in the Commission's effort (Willett et al. 2019), do not include economic or social aspects (such as culture and animal welfare) of the food system. Critically, food access is not a prominent outcome across these studies. The lack of focus on food access in PHDs raises important questions about how to interpret and assess these diets.

4.1. Food Access

The clearing of global food and agricultural markets is neither a necessary nor a sufficient condition for food security where "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 1996). The FAO et al. (2023) report that in 2022, 29.6% of the global population was moderately or severely food insecure, which was more than the share of 25.3% before the COVID-19 pandemic. The *2024 Global Report on Food Crises* notes that the outlook for food insecurity looks bleak in 2024 in countries/territories with an identified food crisis because of conflict, weather (El Nino), high food prices, and decreasing humanitarian funding (FSIN & Glob. Netw. Against Food Crises 2024). In the United States, the prevalence of food insecurity has risen since the pandemic, reaching 13.5% in 2023 (Rabbitt et al. 2024). As noted across these reports, food markets, namely prices, are critical to food security and poverty. However, this narrative is complicated depending on whether households are net producers of foods, where net producers are often the cause of, and can benefit from, high food prices (Deaton 1989, Headey & Fan 2008, Headey & Martin 2016). In addition to food prices, low income is a critical reason for food insecurity. Thus, efforts to address tl1e sustainability of food markets must consider the influence of income, especially in the most vulnerable populations.

The previous section highlighted modeling results that could inform how global agricultural and food markets could adjust to achieve various sustainability or climate goals. However, this literature does not consider how solutions address the equity or feasibility of policies for all consumers. To incorporate tl1e needs of these consumers, the burgeoning literature on affordability, and the cost of a healthy diet, could serve as a benchmark for evaluating the social implications of these sustainability efforts (Herforth et al. 2020).

4.2. Least-Cost Diet Developments

The least-cost diet is one of the ways economists have determined whether markets provide foods that meet nutritional adequacy and affordability. George Stigler, who is often cited as one of the earliest progenitors of the least-cost diet, took a production economics approach to determine the least-cost diet that is nutritionally adequate (Stigler 1945). His work appears to be a retort to the work of dieticians from the US Department of Agriculture (Carpenter & Stiebeling 1936, Rose 1938, Stiebeling & Clark 1939), who estimated a higher minimum cost for a nutritionally adequate diet. These early measurements of an affordable, nutritious diet were mostly descriptive, but they pointed to the expenditure levels necessary to provide a nutritionally adequate diet.

Stigler (1945, p. 313) argues that "dieticians take account of the palatability of foods, variety of diet, prestige of various foods, and other cultural facets of consumption." Potgieter (1947, p. 768) counters Stigler (1945), stating that he "neglected to consider certain important physiological, chemical, dietetic, geographical, seasonal, and cultural factors." While the inclusion of these factors may appear unscientific and more expensive, they made the diet nutritionally adequate and tolerable (Potgieter 1947). These early debates point to the ongoing tensions in developing least-cost diets: complex diets that reflect dietary patterns and localized market prices versus tractable, replicable models of nutrients in foods given standardized, comparable prices across regions.

Subsequent economists have worked to incorporate constraints into the least-cost dietary framework to move the optimal diet closer to what people actually eat (O'Brien-Place & Tomek 1983, Smith 1959, Wilde & Llobrera 2009). Nevertheless, the debate about the palatability and appropriateness of tl1e selected foods in a least-cost diet persists today (e.g., Allen 2017, Babb 2024, Bai et al. 2021, Davis & You 2011, Maillot et al. 2010, Rose 2007, Schneider et al. 2023, Wilde & Llobrera 2009, Zhao et al. 2025).

Underlying the least-cost diets is nutrition research leveraging household-level surveys of foods consumed, national or international guidelines of dietary needs, and national or subnational prices. The data used in international comparative studies are usually food prices from the World Bank's ICP. The nutrient content of foods is based on the US Department of Agriculture's National Nutrient Database for Standard Reference, while the dietary reference intake requirements for 20 nutrients and energy balance are from the US National Academy of Medicine (Bai et al. 2020, 2021, 2022; FAO et al. 2020; Herforth et al. 2020; Hirvonen et al. 2020). Researchers model commonly consumed baskets of foods at the lowest cost to construct the least-cost diet (Gupta et al. 2021, Headey et al. 2023, Herforth et al. 2024). However, following the agricultural economics literature more closely (O'Brien-Place & Tomek 1983, Smith 1959, Stigler 1945), researchers have used a linear programming approach to develop the lowest-cost combination of foods that meet the nutrition needs of a healthy, active person. Least-cost diet calculations serve as a benchmark to delineate unaffordability from other barriers against nutritional access (Bai et al. 2022). The medical and nutrition literature has also used a linear programming approach to determine nutritional adequacy at least cost (Briend & Darmon 2000, Briend et al. 2003, Darmon et al. 2006). The modeling of foods was not intended to represent ideal diets (Hirvonen et al. 2020, Stigler 1945), but the cost necessary for survival (Allen 2017). To this end, Allen (2017) calculates the least-cost diet to establish a more accurate poverty line, representing the minimum amount of money needed to cover essential food and nonfood items for basic living.

Many least-cost diet models use a minimization model of costs within the country (price times quantity) subject to constraints that represent upper and lower limits of nutrients and energy needs (Bai et al. 2020, 2021, 2022; Bai & Masters 2024; Hirvonen et al. 2020; Schneider 2022; Schneider et al. 2023). The authors of this literature seek to identify global or national variation in nutritional needs caused by cost5, i.e., the cost of nutrient adequacy (CoNA), to determine the least-cost diets. This CoNA provides "a cost metric of nutrient adequacy," not a recommended diet, which would require further constraints to capture variety and cultural relevance (Schneider 2022, p. 5). Nutritional adequacy is useful for survival but inadequate to reflect the complex food environments and cultural foodways. Further, researchers must make simplifying assumptions that may not fully capture the market inefficiencies such as externalities and transaction costs.

In both global and national comparisons, the overarching theme is that a nutritionally adequate diet remains unaffordable for significant portions of the population. Schneider (2022) focuses on Malawian households, documenting a least-cost diet of $2.32/person/day, which is ahove the $1.90 poverty line and available for only 60% of households. Schneider et al. (2023) highlight differences in affordability for individuals versus households and the seasonality of foods affecting the affordability of nutrients over time. Using "high-frequency, high-density price observations," Bai et al. (2020, p. 6) show that the variability of prices clue to seasonality of crops affects affordability of nutritional adequacy in Malawi, Tanzania, and Ethiopia.

The cross-country comparisons of Bai et al. (2020) point to the power of the least-cost method using the CoNAindex. By comparing the CoNA with the cost of calorie adequacy across 177 countries, Bai et al. (2021) find that the world's poorest cannot afford a nutritionally adequate diet at $1.35 per day. The cost of the diet is more than twice the cost of starchy staples at $0.57, with little variation by national income. Relatedly, using ICP data, Bai et al. (2022) find the median cost of a healthy diet in 2017 to be $2.32, witl1 variation by demographic groups across 172 countries. The median cost for low-income countries was above the international poverty line of $2.10.

Under the banner of least-cost diets is the related cost of a healthy diet (CoAHD) construct. Herforth et al. (2024, p. 2) define the CoAHD as "the minimum cost of purchasing a healthy diet in the market, defined as a diet that adheres to food-based dietary guidelines (FBDG)." The CoAHD is not derived from an optimization model; rather, it is the collection ofleast-cost foods across categories that meet dietary requirements, given market prices or indices. The country case studies, conducted with national statistical services, in Herforth et al. (2024) highlight differences in national and subnational CoAHD versus global metrics because of country-specific prices, healthy diet standards, and income/affordability data.

4.3. Least-Cost Diets and Sustainability

Prior to the release of the *Lancet* diet, researchers have used the least-cost diet method to address nutritionally adequate diets that mitigate GHG emissions. Macdiarmid et al. (2012) combine data from LCAs of foods to minimize GHG emissions subject to cost and nutrient constraints for an adult woman in the United Kingdom. They find a so-called acceptable diet, with less meat and more fruits and vegetables, that meets all nutrient requirements with a 36% reduction in GHG emissions relative to a 1990 baseline at a cost of $46 per week. This cost was 89% of UK food expenditures, excluding products such as tea, coffee, and alcohol. For New Zealand, Wilson et al. (2013) report a "more familiar meals" diet that lowers GHG emissions by nearly half and is nearly 40% of the cost of the typical New Zealand diet. Perignon et al. (2016) minimize the difference of optimized and observed cost of consumption to simulate in the least-cost framework lower GHG emissions. They find reductions of GHG emissions of 30% that produce culturally acceptable diets in France at equivalent or lower costs of the observed diet. Higher reductions in GHG emissions would require drastic changes in diets compared to current consumption at lower costs. In contrast, He et al. (2021) find a least-cost diet that lowers GHG emissions but is not affordable for lower-income households, particularly for Black and Hispanic households in the United States. These findings suggest that in developed countries, a nutritionally adequate diet with reduced GHG emissions may be affordable, but it is important to consider household diversity and income differences within these countries.

For developing countries, researchers use least-cost diets to illustrate the challenges of affording a base level of nutrients generally. Specifically, a cadre of researchers uses the least-cost diet to address the affordability of the *Lancet* diet (Willett et al. 2019). Drawing attention to the *EAT-Lancet* Commission's self-recognized omission of cost and affordability in their diet, Hirvonen et al. (2020) demonstrate that the *Lancet* diet has an estimated cost of $2.84 per day in international dollars. The *Lancet* diet costs 6.1% of high-income countries' per capita income and 89.1% of low-income countries' per capita income. The cost of the *Lancet* diet exceeds the incomes of 1.6 billion people, 80% of whom live in middle-income countries. The *Lancet* diet is 1.6 times more expensive than the minimum CoNA. Although the least-cost diet and *Lancet* diet emphasize fruits, vegetables, and legumes, the cost difference is driven by the demand for more animal source proteins in the *Lancet* diet, which are not required based on nutrient adequacy in the least-cost diet. In a related study using similar methods shaping *The State of Food Security and Nutrition in the World 2020* (FAO et al. 2020), Herforth et al. (2020) find that 3 billion people in the world cannot afford a nutritionally adequate diet, with a global median cost of $3.75 per person per clay and the *Lancet* diet costing $3.31-$3.61.

Given the cost and affordability studies (FAO et al. 2020, Herforth et al. 2020, Hirvonen et al. 2020), Gupta et al. (2021) extend the method of the cost and affordability of a healthy diet and reevaluate the *Lancet* diet specifically for rural India. The extension centers on the data used. Gupta et al. (2021) argue that the ICP data are at the national level and do not account for subnational prices that rural people actually face. Further, these studies do not address the seasonality and regionality of prices. "While these differences in data can matter, Gupta et al. (2021) find that the *Lancet* diet costs $3.30/day relative to the $0.60 to $1.00 cost oflocal diets. Fruits, vegetables, and animal proteins are substantial cost factors in the *Lancet* diet. The cost of the *Lancet* diet ranges from $2.90 to $3.70 depending on the season. Further, Herforth et al. (2024) extend this effort to country-level analysis around the world. Although several studies point to the unaffordability of PHDs, Springmann et al. (2021) find a that PHD-which incorporates different dietary patterns, food waste, and full cost accounting-is up to one-third lower in cost than current consumption in most countries. Thus, the affordability of prescribed diets such as the *Lancet* diet or other PHDs is more challenging and nuanced than indicated in previous global comparison studies.

Headey et al. (2024) further the critique of the least-cost method while reinforcing the importance of evaluating the cost of a nutritionally adequate diet. Focusing on methods developed by FAO et al. (2020), Herforth et al. (2020), Hirvonen et al. (2020), and Headey et al. (2024) point out innovations in the least-cost method that would more accurately estimate the number of people who are unable to afford a nutritionally adequate diet. The authors' innovation is to simulate demographic differences to more accurately develop the cost of the diet. This innovation lowers the number of people who cannot afford the *Lancet* diet by 143 million (a 2.1-percentage-point difference) compared to replicated values informed by Hirvonen et al. (2020), updated with the 2017 ICP data.

Across the PHD and least-cost diet literature, when the affordability of the diets is mentioned, cost and food prices are the central concern. However, prices are only part of the economics story, as consumers must have an adequate income to afford foods given market prices. Consumers in low-income households have challenges with food access beyond economic access to food such as crop failures, disasters, political and social conflict, and war. Thus, a critical literature to consider focuses on interventions to increase incomes or subsidy programs to support families from low-income households assessed through CGE and PE models.

5. ADVANCING MODELS FOR DIETARY TRANSFORMATION: POLICY INTERVENTIONS AND FUTURE DIRECTIONS

5.1. Insights from CGE and PE Modeling

Gatto et al. (2023) use the MAGNET CGE model to explore the spillover effects of transitioning to sustainable diets, such as the *Lancet* diet. They find that while such dietary shlfts reduce GHG emissions and agricultural land use, they can also lead to economic disparities, particularly for agricultural workers in low-income regions, who might experience wage declines. Their findings emphasize the importance of designing policies that simultaneously promote environmental sustainability and mitigate social inequities. Similarly, Gatto & Chepeliev (2024) employ an environmentally extended multi-regional input-output (MRIO) model to assess the public health and environmental impacts of reducing global food loss and waste. They demonstrate that reducing food loss significantly lowers air pollutants, such as sulfur dioxide (SO_2) and fine particulate matter (PM2.5), resulting in substantial public health benefits. However, they caution that rebound effects-where savings from reduced food consumption are redirected toward more environmentally harmful activities-could offset these gains, highlighting the need for integrated policy frameworks.

Recent studies increasingly explore dietary shifts using various policy tools within CGE models, including differentiated value added taxes (VATs), subsidies at the consun1er and value chain levels, and trade policies. For example, using a CGE framework, Springmann & Freund (2022) analyze the effects of increasing VAT on high-impact foods such as meat while reducing it for low-impact foods such as fruits and vegetables in the United Kingdom and Germany. Bouyssou et al. (2024) examine the potential impact of a GHG tax on food consumption through country-specific scenarios, considering cross-price effects, GE responses, and associated GHG and health outcomes. Additionally, Springmann & Freund (2022) explore the reform of agricultural subsidies to promote healthier and more environmentally sustainable food options. Their findings suggest that reallocating subsidies could lower GHG emissions, improve health outcomes globally, and enhance sustainable food systems without negatively affecting economic welfare.

Focusing on food waste, Lopez Barrera & Hertel (2021) apply the SIMPLE PE model to evaluate how reducing food waste improves food affordability and reduces environmental pressures, particularly in emerging economies. Their analysis demonstrates that cutting food waste reduces land use and GHG emissions, underscoring the environmental benefits of addressing food waste. Expanding on this, Lopez Barrera & Hertel (2023) introduce the prevalence of overacquisition in the SIMPLE PE model to better capture overconsumption and food waste. They assess the healtl1 and environmental impacts of shlfting to sustainable diets, such as healthy dietary guidelines and flexitarian diets, breaking down the effects into three components: changing diet composition, reducing food waste, and cutting excessive intake. Their findings reveal that food waste reduction has the greatest impact on lowering natural resource pressures, reinforcing its critical role in improving global health and sustainability. Moreover, these findings contribute to an evolving w1derstanding of tl1e interplay between food purchasing reductions, dietary transitions, and sustainability outcomes, offering innovative perspectives compared to prior research.

CGE and PE models offer valuable insights into the economic, social, and environmental impacts of policies such as taxes, subsidies, and food waste reduction, highlighting pathways for dietary transitions. However, key limitations in these models remain, warranting further advancements to better simulate complex, large-scale dietary transformations.

5.2. Rethinking Economic Models for Dietary Shifts and Policy Design

A key challenge faced by CGE and PE models lies in their limited ability to capture heterogeneous policy impacts across diverse populations and regions. Bourguignon & Spadaro (2006) highlight the transformative potential of microsimulation models in addressing this limitation by accounting for individual-level differences and behavioral responses to policy changes. They emphasize the importance of incorporating dynamic elements, such as life-cycle impacts and evolving preferences, to improve long-term predictions and policy assessments. As Peichl (2008) suggests, integrating microsimulation with CGE and PE models enables more detailed, disaggregated analyses. This approach provides critical insights into the distributional effects of dietary policies, particularly for vulnerable populations, while enhancing the granularity and relevance of policy evaluations.

Another significant notable of CGE and PE models is their reliance on relatively rigid assumptions about consumer preferences, which often fail to capture behavioral adaptations and evolving consumption patterns. This restricts their ability to accurately simulate large-scale dietary shifts over time. Addressing these limitations requires rethinking demand structures and incorporating advanced policy frameworks. Latka et al. (2021) highlight that although market-based instruments such as taxes and subsidies are effective, achieving significant dietary shifts necessitates substantial tax levels and more sophisticated frameworks, such as nested demand systems, to account for food group interactions and substitution effects. They emphasize the importance of coherent policy packages that integrate nutrition and sustainability goals. Complementing this perspective, Bodirsky et al. (2022) advocate for structural transformations-such as transitioning to needs-based food systems, implementing equitable income distribution, and integrating GHG pricing-as essential strategies for creating GHG-neutral food systems and improving nutritional outcomes. Together, these studies underscore the need for advancing economic models to design and evaluate policies that align health and sustainability objectives effectively.

Beaussier et al. (2019) underscore the transformative potential of coupling economic models with environmental tools, such as LCAs and material flow analysis, to enhance the granularity and comprehensiveness of policy evaluations. They emphasize the importance of incorporating feedback loops and systemic interactions to capture the multidimensional impacts of policies on socioeconomic and environmental outcomes. These advanced frameworks address a critical gap by prioritizing regional and sectoral granularity, enabling more targeted and equitable policy interventions. Building on these principles, spatially explicit biophysical-economic models integrate high-resolution geographic data, allowing localized assessments of policy impacts and systemic interactions (Haqiqi & Hertel 2025). In this context, advanced computational techniques further enhance these models' capabilities. Artificial intelligence-driven tools and deep learning methods, such as deep equilibrium nets (Azinovic et al. 2022), can improve parameter estimation and predictions under uncertainty, bridging gaps between technical advancements and practical applications to support policies aligned with health and sustainability goals.

6. SUMMARY AND CLOSING

In this article, we provide a comprehensive review addressing key aspects of global dietary issues such as how economic factors influence food demand and diets across countries, the need for modeling frameworks that adequately capture the complexities of dietary transitions, and the feasibility of dietary solutions that are both nutritionally sufficient and environmentally sustainable. If policymakers are to develop effective strategies to promote sustainable diets and mitigate the negative impacts of dietary changes on both human health and the environment, economic, environmental, and health perspectives must be considered.

The relationship between income, prices, and food demand plays an important role in understanding how economic growth impacts nutrition and sustainability. Despite the relatively high cost of foods in lower-income countries, global income growth has outpaced the rise in food prices. However, higher incomes and increased affordability do not always lead to healthier food choices. As nations grow wealthier, diets improve, but they also shift toward more resource-intensive foods. Adopting healthier and more sustainable diets is crucial for addressing global health and sustainability challenges. However, the key question is how economic trade-offs will unfold. To achieve a balance between health and environmental sustainability, interventions are needed to address the complex challenges within global food systems in a way that is economical and equitable.

Economic modeling frameworks have substantially advanced our understanding of the interactions between diets, health, and the environment. These models have highlighted how dietary shifts and policies influence economic, environmental, and health outcomes, showcasing synergies and trade-offs between health and sustainability goals. However, to better capture the complexities of the diet-health-environment trilemma, future research should enhance model flexibility by incorporating more refined representations of consumer behavior and regional heterogeneity. Expanding the use of microsimulations and integrating advanced computational techniques, such as artificial intelligence-driven tools like deep equilibrium nets, can improve parameter estimation and uncertainty reduction, strengthening the predictive capacity of CGE and PE frameworks in dietary policy analysis.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

ACKNOWLEDGMENTS

We sincerely thank the reviewers (William A. Masters and Benjamin L. Bodirsky) for their insightful comments, which significantly improved the final version of our work. We are also grateful to Thomas W Hertel *(Annual Review of Resource Economics* Editorial Board) and the journal's Production Editor, Laura Niven.

LITERATURE CITED

Afshin A, Sur PJ, Fay KA, Cornaby L, Ferrara G, et al. 2019. Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 393(10184):1958-72

Allen RC. 2017. Absolute poverty: when necessity displaces desire. *Am. Econ. Rev.* 107(12):3690-721

Andreyeva T, Long MW, Brownell KD. 2010. The impact of food prices on consumption: a systematic review of research on the price elasticity of demand for food. *Am. J. Public Health* 100(2):216-22

Azinovic M, GaegaufL, Scheidegger S. 2022. Deep equilibrium nets. *Int. Econ. Rev.* 63(4):1471-525

Babb AM. 2024. A brief genealogy of the Thrifty Food Plan. *Food Cult. Soc.* 27(1):174-201

Bai Y, Alemu R, Block SA, Headey D, Masters WA. 2021. Cost and affordability of nutritious diets at retail prices: evidence from 177 countries. *Food Policy* 99:101983

Bai Y, Herforth A, Masters WA. 2022. Global variation in the cost of a nutrient-adequate diet by population group: an observational study. *Lancet Planet. Health* 6(1):el 9-28

Bai Y, Masters WA. 2024. Complex dynamics between food prices, income and dietary quality in sub-Saharan Africa. *Nat. Food* 5(3):196-97

Bai Y, Naumova EN, Masters WA. 2020. Seasonality of diet costs reveals food system performance in East Africa. *Sci. Adv.* 6(49):eabc2162

Baldos ULC, Hertel TW 2014. Global food security in 2050: the role of agricultural productivity and climate *change.Aust.]. Agric. Resour. Econ.* 58(4):554-70

Beaussier T, Caurla S, Bellon-Maurel V, Loiseau E. 2019. Coupling economic models and environmental assessment methods to support regional policies: a critical review. *J. Cleaner Prod.* 216:408-21

Bennett MK. 1941. International contrasts in food consumption. *Geogr. Rev.* 31(3):365-76

Blackstone NT, El-Abbadi N, McCabe MS, Griffin TS, Nelson ME. 2018. Linking sustainability to the healthy eating patterns of the Dietary Guidelines for Americans: a modelling study. *Lancet Planet. Health* 2(8):e344-52

Bodirsky BL, Chen DM-C, Weindl I, Soergel B, Beier F, et al. 2022. Integrating degrowth and efficiency perspectives enables an emission-neutral food system by 2100. *Nat. Food* 3(5):341-48

Bodirsky BL, Dietrich JP, Martinelli E, Stenstad A, Pradhan P, et al. 2020. The ongoing nutrition transition thwarts long-term targets for food security, public health and environmental protection. *Sci. Rep.* 10:19778

Bodirsky BL, Rolinski S, Biewald A, Weindl I, Popp A, Lotze-Campen H.2015. Global food demand scenarios for the 21st century. *PLOS ONE* 10(1 l):e0139201

Bourguignon F, Spadaro A. 2006. Microsimulation as a tool for evaluating redistribution policies. *J. Econ. Inequal.* 4(1):77-106

Bouyssou C, Springmann M, Clora F, Jensen JD, Yu W 2024. Carbon-taxation of food consumption: a global perspective. GTAP Resour. 7195, Purdue University. **https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordlD=7195**

Briend A, Darmon N. 2000. Determining limiting nutrients by linear programming: a new approach to predict insufficient intakes from complementary foods. *Pediatrics* 106(Suppl. 4):1288-89

Briend A, Darmon N, Ferguson **E,** Erhardt]. 2003. Linear programming: a mathematical tool for analyzing and optimizing children's diets during the complementary feeding period. *J. Pediatr. Gastroenterol. Nutr.* 36(1):12-22

Campbell BM, Beare DJ, Bennett EM, Hall-Spencer JM, IngramJSI, et al. 2017. Agriculture production as a major driver of the Earth system exceeding planetary boundaries. *Ecol. Soc.* 22(4):8

Carpenter RS, Stiebeling HK. 1936. *Diets to fit tbe family income.* USDA Farm. Bull. 1757, US Department of Agriculture

Chai A, Moneta A. 2010. Retrospectives: Engel curves.]. *Econ. Perspect.* 24(1):225-40

Chaudhary A, Krishna V. 2019. Country-specific sustainable diets using optimization algorithm. *Environ. Sci. Tecbnol.* 53:7694-703

Clements KW, Wu Y, Zhang]. 2006. Comparing international consumption patterns. *Empir. Econ.* 31(1):1-30

Cordell D, White S. 2014. Life's bottleneck: sustaining the world's phosphoms for a food secure *future.Annu. Rev. Environ. Resour.* 39:161-88

Cornelsen L, Green R, Turner R, Dangour AD, Shankar B, et al. 2015. What happens to patterns of food consumption when food prices change? Evidence from a systematic review and meta-analysis of food price elasticities globally. *Health Econ.* 24(12):1548-59

Costlow L, Herforth A, Sulser TB, Cenacchi N, Masters WA. 2025. Global analysis reveals persistent shortfalls and regional differences in availability of foods needed for health. *Glob. Food Scczn"* 44:I00825

Cranfield JAL, Hertel TW, Eales JS, Preckel PV. 1998. Changes in the structure of global food demand. *Am. J. Agric. Econ.* 80(5):1042-50

Darmon N, Ferguson EL, Briend A. 2006. Impact of a cost constraint on nutritionally adequate food choices for French women: an analysis by linear programming.]. *Nutt: Educ. Bebav.* 38(2):82-90

Davis GC, You W 2011. Not enough money or not enough time to satisfy the Thrifty Food Plan? A cost difference approach for estimating a money-time threshold. *Food Policy* 36(2):101-7

Deaton A. 1989. Rice prices and income distribution in Thailand: a non-parametric analysis. *Econ.J.*99(395):1-37

Delgado CL. 2003. Rising consumption of meat and milk in developing countries has created a new food revolution.]. *Nut1"* 133(11):3907S-10S

Drewnowski A, Popkin BM. 1997. The nutrition transition: new trends in the global diet. *Nutr. Rev.* 55(2):31-43

Engel E. 1857. Die Productions- und Consumtionsverhiiltnisse des Konigreichs Sachsen. Z. *Stat. Bur. K. Sachs. Minist. Innem.* 8/9:1-54

Eshel G, Martin PA. 2006. Diet, energy, and global warming. *Earth Interact.* 10(9):1-17

Fan S, Headey D, Rue C, Thomas T. 2021. Food systems for human and planetary health: econonuc perspectives and challenges. *Annu. Rev. Resoui: Econ.* 13:131-56

FAO (Food Agric. Organ.). 1996. *Rome Declaration on World Food Security and World Food Summit Plan of Action: World Food Summit, 13-17 November 1996, Rome.* Rep., Food and Agricultural Organization

FAO (Food Agric. Organ.). 2013. *Food Wastage Footprint: Impacts on Natural Resources.* Summ. Rep., Food and Agricultural Organization

FAO, IFAD, UNICEF, WFP, WHO. 2020. *The State of Food Security and Nutrition in the World 2020. Transforming Food ::,)stems for Affordable Healthy Diets.* FAO, IFAD, UNICEF, WFP, WHO

FAO, IFAD, UNICEF, WFP, WHO. 2023. *The State of Food Security and Nutrition in the World 2023. Urbanization, Agrifood !:,)stems Transformation and Healthy Diets across the Rural-Urban Continuum.* FAO, IFAD, UNICEF, WFP, WHO

Femenia F. 2019. A meta-analysis of the price and income elasticities of food demand. Work. Pap. 19-03, SMART-LERECO

Finaret AB, Masters WA. 2019. Beyond calories: the new economics of nutrition. *Annu. Rev. Rcsour. Econ.* 11:237-59

Foley JA, DeFries R, Asner GP, Barford C, Bonan G, et al. 2005. Global consequences of land use. *Science* 309(5734):570-74

Frank S, Havlik P, Stehfest E, Van Meiji H, Witzke P, et al. 2019. Agricultural non-CO2 emission reduction potential in the context of the 1.5°C target. *Nat. Clim. Change* 9(1):66-72

Friel S, Dangour AD, Garnett T, Lock K, Chalabi Z, et al. 2009. Public health benefits of strategies to reduce greenhouse-gas emissions: food and agriculture. *Lancet* 374(9706):2016-25

FSIN (Food Secur. Inf. Netw.), Glob. Netw. Against Food Crises. 2024. *2024 global report on food crises: joint analysis for better decisions.* Rep., Food Security Information Network, Global Network Against Food Crises. **https://www.fsinplatform.org/grfc2024**

Fukase E, Martin W. 2020. Economic growth, convergence, and world food demand and supply. *World Dev.* 132:104954

Gao G. 2012. World food demand. *Am.]. Agric. Econ.* 94(1):25-51

Gatto A, Chepeliev M. 2024. Reducing global food loss and waste could improve air quality and lower the risk of premature mortality. *Environ. Res. Lett.* 19(1):014080

Gatto A, Kuiper M, Van Meijl **H.** 2023. Economic, social and environmental spillovers decrease the benefits of a global dietary shift. *Nat. Food* 4(6):496-507

Gephart JA, Davis KF, Emery KA, Leach AM, Galloway **JN,** Pace ML. 2016. The environmental cost of subsistence: optimizing diets to minimize footprints. *Sci. Total Environ.* 553:120-27

Godfray HCJ, Aveyard P, Garnett T, Hall JW, Key TT, et al. 2018. Meat consumption, health, and the environment. *Science* 361(6399):eaam5324

Goldberger AS, Gamaletsos **T.** 1970. A cross-country comparison of consumer expenditure patterns. *Eur. Econ. Rev.* 1(3):357-400

Gouel C, Guimbard H.2019. Nutrition transition and the structure of global food demand. *Am.J. Agric. Econ.* 101(2):383-403

Green **R,** Cornelsen L, Dangour AD, Turner R, Shankar **B,** et al. 2013. The effect of rising food prices on food consumption: systematic review with meta-regression. *BMJ* 346:f3703

Gupta S, Vemireddy V, Singh DK, Pingali P. 2021. Ground truthing the cost of achieving the EAT lancet recommended diets: evidence from rural India. *Glob. Food Secur.* 28:100498

Gussow JD, Clancy KL. 1986. Dietary guidelines for sustainability.*J. Nuti: Educ.* 18(1):1-5

Guthrie J, Mancino L, Lin C-TJ. 2015. Nudging consumers toward better food choices: policy approaches to changing food consumption behaviors. *Psychol. Mark.* 32(5):501-11

Haqiqi I, Hertel TW, eds. 2025. *SIMPLE-G: A Gridded Economic Approach to Sustainability Analysis of the Earth's Land and Water Resources.* Springer

He P, Feng K, Baiocchi G, Sun L, Hubacek K. 2021. Shifts towards healthy diets in the US can reduce environmental impacts but would be unaffordable for poorer minorities. *Nat. Food* 2(9):664-72

Headey D, Fan S. 2008. Anatomy of a crisis: the causes and consequences of surging food prices. *Agric. Econ.* 39(sl):375-91

Headey **D,** Hirvonen K, Alderman **H.** 2024. Estimating the cost and affordability of healthy diets: How much do methods matter? *Food Polily* 126:102654

Headey **DD,** Alderman **HH.** 2019. The relative caloric prices of healthy and unhealthy foods differ systematically across income levels and continents.]. *Nutr.* 149(11):2020-33

Headey **DD,** Ecker 0, Comstock AR, Ruel MT. 2023. Poverty, price and preference barriers to improving diets in sub-Saharan Africa. *Glob. Food Sccur.* 36:100664

Heacley **DD,** Martin \VJ. 2016. The impact of food prices on poverty and food security. *Annu. Rev. Resour. Econ.* 8:329-51

Herforth A, Ahmed S. 2015. The food environment, its effects on dietary consumption, and potential for measurement within agriculture-nutrition interventions. *Food Smir.* 7(3):505-20

Herforth A, Bai Y, Venkat A, Ebel A, Masters WA. 2020. *Cost and affordability of healthy diets across and within countries.* Backgr. Pap. for The State of Food Security and Nutrition in the World 2020. FAO Agric. Dev. Econ. Tech. Study 9, Food Agric. Organ.

Herforth AW, Gilbert R, Sokourenko K, Fatima T, Adeyemi 0, et al. 2024. Monitoring the cost and affordability of a healthy diet within countries: building systems in Ethiopia, Ghana, Malawi, Nigeria, Pakistan, Tanzania, and Viet Nam. *Curr. Dev. Nutr.* 8:104441

Hertel TW, ed. 1997. *Global Trade Analysis: Modeling and Applications.* Cambridge Univ. Press

Hertel TW, Baldos ULC. 2016. *Global Change and the Challenges of Sustainably Feeding a Growing Planet.* Springer

Hirvonen K, Bai Y, Headey D, Masters WA. 2020. Affordability of the *EAT-Lancet* reference diet: a global analysis. *Lancet Glob. Health* 8(1):e59-66

Hoekstra AY, Wiedmann TO. 2014. Humanity's unsustainable environmental footprint. *Science* 344(6188):1114-17

Horrigan L, Lawrence RS, Walker P. 2002. How sustainable agriculture can address the environmental and hunrnn health harms of industrial agriculture. *Environ. Health Perspect.* 110(5):445-56

Houthakker **HS.** 1957. An international comparison of household expenditure patterns, commemorating the centenary of Engel's law. *Econometrica* 25(4):532-51

Imamura **F,** Micha **R,** Khatibzadeh S, Fahimi S, Shi P, et al. 2015. Dietary quality among men and women in 187 countries in 1990 and 2010: a systematic assessment. *Lancet Glob. Health* 3(3):e132-42

Kalknhl M, von Braun **J,** Torero M. 2016. Volatile and extreme food prices, food security, and policy: an overview. In *Food Price Volatility and Its Implications for Food Security and Policy,* eel. M Kalkuhl,J von Braun, M Torero. Springer Open

Keating BA, Herrero M, Carberry PS, Gardner J, Cole MB. 2014. Food wedges: framing the global food demand and supply challenge towards 2050. *Glob. Food Seem:* 3(3):125-32

Kummu M, De Moel H, Porkka M, Siebert S, Varis 0, Ward PJ. 2012. Lost food, wasted resources: global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use. *Sci. Total Environ.* 438:477-89

Lang T, Barling D. 2013. Nutrition and sustainability: an emerging food policy discourse. *Proc. Nut, �Soc.* 72(1):1-12

Latka C, Kuiper M, Frank S, Heckelei T, Havlik P, et al. 2021. Paying the price for environmentallysustainable and healthy EU diets. *Glob. Food Secur.* 28:100437

Liang W, Sivashankar P, Hua Y, Li W 2024. Global food expenditure patterns diverge between low-income and high-income countries. *Nat. Food* 5(7):592-602

Lopez Barrera E, Hertel T. 2021. Global food waste across the income spectrum: Implications for food prices, production and resource use. *Food Policy* 98:101874

Lopez Barrera E, Hertel T. 2023. Solutions to the double burden of malnutrition also generate health and environmental benefits. *Nat. Food* 4(7):616-24

Lopez Barrera E, Shively G. 2022. Excess calorie availability and adult BMI: a cohort analysis of patterns and trends for 156 countries from 1890 to 2015. *Food Policy* 109:102271

LuskJL. 2017. Consumer research with big data: applications from the Food Demand Survey (FooDS). *Am. J. Agric. Econ.* 99(2):303-20

Macdiarmid], Kyle], Horgan G, Loe], Fyfe C, et al. 2012. Sustainable diets for the future: Can we contribute to reducing greenhouse gas emissions by eating a healthy diet? *Am.]. Clin. Nutt:* 96(3):632-39

Maillot M, Darmon N, Drewnowski A. 2010. Are the lowest-cost healthful food plans culturally and socially acceptable? *Public Health Nutr.* 13(8):1178-85

Masters WA, Finaret AB, Block SA. 2022. The economics of mahmtrition: dietary transition and food system transformation. In *Handbook of Agricultural Econo1nics,* Vol. 6, eel. CB Barrett, DR Just. Elsevier

McCullough EB, Lu M, Nouve Y, Arsenault], Zhen C. 2024. Nutrient adequacy for poor households in Africa would improve with higher income but not necessarily with lower food prices. *Nat. Food* 5(2):171-81

Miller V, Webb P, Cuclhea F, Shi P, Zhang J, et al. 2022. Global dietary quality in 185 countries from 1990 to 2018 show wide differences by nation, age, education, and urbanicity. *Nat. Food* 3(9):694-702

Muhammad A, D'Souza A, Meade B, Micha R, Mozaffarian D. 2017. How income and food prices influence global dietary intakes by age and sex: evidence from 164 countries. *BM] Glob. Health* 2(3):e000184

Muhammad A, Seale JL, Meade **B,** Regmi A. 2011. *International evidence on food consumption patterns: an update using 2005 international comparison program data.* USDA-ERS Tech. Bull. 1929, US Department of Agriculture, Economic Research Service

Murray CJL, Aravkin AY, Zheng P, Abbafati C, Abbas KM, et al. 2020. Global burden of 87 risk factors **in** 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 396(10258):1223-49

Myers SS, Zanobetti A, Kloog I, Huybers PJ, Leakey ADB, et al. 2014. Increasing CO_2 threatens human nutrition. *Nature* 510:139-42

NCD-Risk Factor Collab. 2016. Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19-2 million participants. *Lancet* 387(10026):1377-96

Nijclam D, Rood T, Westhoek H. 2012. The price of protein: review oflancl use and carbon footprints from life cycle assessments of animal food products and their substitutes. *Food Policy* 37(6):760-70

Nordhaus WD. 1992. An optimal transition path for controlling greenhouse gases. *Science* 258(5086):1315-19

Norclhaus WD. 2017. Revisiting the social cost of carbon. *PNAS* 114(7):1518-23

Norclhaus WD, Yang Z. 1996. Regional dynamic general-equilibrium model of alternative climate-change strategies.Am. *Econ. Rev.* 86(4):741-65

O'Brien-Place PM, Tomek WG. 1983. Inflation in food prices as measured by least-cost diets. *Am. J. Agric. Econ.* 65(4):781-84

Parlasca MC, Qaim M. 2022. Meat consumption and sustainability. *Annu. Rev. Resow: Econ.* 14:17-41

Passarelli S, Free CM, Shepon A, Beal T, Batis C, Golden CD. 2024. Global estimation of dietary micronutrient inadequacies: a modelling analysis. *Lancet Glob. Health* 12:el590-99

Peichl A. 2008. The benefits of linking CGE and microsimulation models: evidence from a flat tax analysis. FiFo-CPE Discuss. Pap. 08-6, FiFo

Perignon M, Masset G, Ferrari G, Barre T, Vieux F, et al. 2016. How low can clieta1y greenhouse gas emissions be reduced without impairing nutritional adequacy, affordability and acceptability of the diet? A modelling study to guide sustainable food choices. *Public Health Nutr.* 19(14):2662-74

Potgieter M. 1947. Comments on "The Cost of Subsistence" by GeorgeJ. Stigler. *Am.J.Agric. Econ.* 29(3):767-72

Rabbitt MP, Reed-Jones M, Hales LJ, Burke MP. 2024. *Household food security in the United States in 2023.* Rep. ERR-337, US Department of Agriculture, Economic Research Service

Regmi A, Meade B. 2013. Demand side drivers of global food security. *Glob. Food Secitr.* 2(3):166-71

RockstromJ, Steffen W, Noone K, Persson A, Chapin FS, et al. 2009. Planetary boundaries. *Ecol. Soc.* 14(2):32

Rose D. 2007. Food Stamps, the thrifty food plan, and meal preparation: the importance of the time dimension for US nutrition policy.]. *Nut,: Educ. Bchav.* 39(4):226-32

Rose MS. 1938. *The Foundations of Nutrition.* Macmillan. 3rd eel.

Sands R, Meade B, Seale JL Jr., Robinson S, Seeger R. 2023. *Scenarios of global food consumption: implications for agriculture.* Rep. ERR-323, US Department of Agriculture, Economic Research Service

Scarborough P, Allender S, Clarke D, Wickramasinghe K, Rayner M. 2012. Modelling the health impact of environmentally sustainable dietary scenarios in the UK. *Eur. J. Clin. Nutr.* 66(6):710-15

Schneider KR. 2022. Nationally representative estimates of the cost of adequate diets, nutrient level drivers, and policy options for households in rural Malawi. *Food Policy* 113:102275

Schneider KR, Christiaensen L, Webb P, Masters WA. 2023. Assessing the affordability of nutrient-adequate diets. *Am. J. Agric. Econ.* 105(2):503-24

Seale JL, Regmi A, Bernstein]. 2003. *International evidence on food consumption patterns.* USDA-ERS Tech. Bull. 1904, US Department of Agriculture, Economic Research Service

Selvanathan EA, Selvanathan S. 2003. *International Consumption Comparisons: OECD Versus LDC.* World Scientific

Smith VE. 1959. Linear programming models for the determination of palatable human diets. *J. Farm Econ.* 41(2):272-83

Springmann M, Clark MA, Rayner M, Scarborough P, Webb P. 2021. The global and regional costs of healthy and sustainable dietary patterns: a modelling study. *Lancet Planet. Health* 5(11):e797-807

Springmann M, Freund F. 2022. Options for reforming agricultural subsidies from health, climate, and economic perspectives. *Nat. Commun.* 13(1):82

Springmann M, Godfray HCJ, Rayner M, Scarborough P. 2016. Analysis and valuation of the health and climate change cobenefits of dietary change. *PNAS* 113(15):4146-51

Springmann M, Wiebe K,Mason-D'Croz D, Sulser T, Rayner M, Scarborough P.2018. Health and nutritional aspects of sustainable diet strategies and their association with environmental impacts: a global modelling analysis with country-level detail. *Lancet Planet. Health* 2(10):e451-61

Steenson S, ButtrissJL. 2021. Healthier and more sustainable diets: What changes are needed in high-income countries? *Nutr. Bull.* 46(3):279-309

Steffen W, Richardson K, RockstromJ, Cornell SE, Fetzer I, et al.2015. Planetary boundaries: guiding human development on a changing planet. *Science* 347(6223):1259855

Stehfest E, Bouwman L, van Vuuren DP, den Elzen MGJ, Eickhout B, Kabat P. 2009. Climate benefits of changing diet. *Clim. Change* 95(1-2):83-102

Stiebeling H, Clark F. 1939. Planning for good nutrition. In *Food and Life Yearbook of Agriculture 1939,* ed. PE Howe, G Hambidge. Gov. Print. Off.

Stigler GJ. 1945. The cost of subsistence.]. *Farm Econ.* 27(2):303-14

Theil H. 1996. *Studies in Global Econometrics.* Kluwer

Tilman D, Balzer C, Hill J, Befort BL. 2011. Global food demand and the sustainable intensification of agriculture. *PNAS* 108(50):20260-64

Tilman D, Clark M. 2014. Global diets link environmental sustainability and human health. *Nature* 515(7528):518-22

Timmer CP, Falcon WP, Pearson SR. 1983. *Food Policy Analysis.Johns* Hopkins Univ. Press

Tobin]. 1950. A statistical demand function for food in the U.S.A.]. *R. Stat. Soc. A* 113(2):113-49

Valin H, Sands RD, van der Mensbrugghe D, Nelson GC, Ahammad H, et al.2014. The future offood demand: understanding differences in global economic models.Agric. *Econ.* 45(1):51-67

Vecchia CL, Majem LS. 2015. Evaluating trends in global dietary patterns. *Lancet Glob. Healt/1* 3(3):ell4-15

Vermeulen SJ, Campbell BM, IngramJSI. 2012. Climate change and food *systems.Annu. Rev. Environ. Rcsour.* 37:195-222

WallingfordJK, de Pee S, Herforth AW, Kuri S, Bai Y, Masters WA. 2024. Measuring food access using least-cost diets: results for global monitoring and targeting of interventions to improve food security, nutrition and health. *Glob. Food Secur.* 41:100771

Westhoek H, LesschenJP, Rood T, Wagner S, De Marco A, et al.2014. Food choices, health and environment: effects of cutting Europe's meat and dairy intake. *Glob. Environ. Change* 26:196-205

WHO (World Health Organ.). 2023. *Levels and trends in child malnutrition: UNICEF/WHO/World Bank group joint child malnutrition estimates: key findings �f the 2023 edition.* Rep., World Health Organization

Wilde PE, Llobrera J. 2009. Using the thrifty food plan to assess the cost of a nutritious diet. *J. Consum. Aff* 43(2):274-304

Willett W, Rockstrom J, Loken B, Springmann M, Lang T, et al. 2019. Food in the Anthropocene: the *EAT-Lancet* Commission on healthy diets from sustainable food systems. *Lancet* 393(10170):447-92

Wilson N, Nghiem N, Ni Mhurchu C, Eyles H, Baker MG, Blakely T. 2013. Foods and dietary patterns that are healthy, low-cost, and environmentally sustainable: a case study of optimization modeling for New Zealand. *PLOS ONE* 8(3):e59648

Working H. 1943. Statistical laws of family expenditure.]. *Am. Stat. Assoc.* 38(221):43-56

World Bank. 2020. *Purchasing Power Parities and the Size of World Economies. Results from the 2017 International Comparison Program.* World Bank Group

World Bank. 2024. *World Bank DataBank ICP 2021*. International Comparison Program, World Bank Group, updated 2025. **https://datahank.worldhank.org/source/icp-2021**

Zhao Y, Fan L, Wilson NLW, Valderrama AV, Wilde P. 2025. Variations on the Thrifty Food Plan: model diets that satisfy cost and nutrition constraints. *Food Policy* 130:102781

CHOICES

AAEA Agricultural & Applied Economics Association

Volume 38. Quarter 2

Why Are Eggs so Expensive? Understanding the Recent Spike in Egg Prices

Andrew Muhammad, Charles Martinez, and Abdelaziz Lawani

JEL Classifications: Q02, Q11
Keywords: Avian influenza, Eggs, Energy, Feed, Prices

Throughout 2022, U.S. consumers faced persistent increases in egg prices. According to the Bureau of Labor Statistics (BLS), the average retail price of eggs (grade A, not seasonally adjusted) reached a record high of $4.25/dozen in December 2022, up 138% from December 2021 ($1.79/dozen) (BLS, 2023). Comparable increases have been observed in the egg producer price index (PPI), which is a measure of the average price paid to U.S. egg producers (see Figure 1). Soaring egg prices have garnered attention from policy makers and researchers and have been the subject of recent news reports including the *Wall Street Journal, New York Times*, and *The Economist*. Further indication of increased interest is the intensity of Internet searches: Over the last year, the number of searches on egg-price-related terms increased by more than 5,000% (Google Trends, 2023).

Noted causes of the recent surge in egg prices include supply-chain disruptions due to the COVID-19 pandemic, increased egg demand during the holiday season, and overall inflation (Malone, Schaefer, and Lusk, 2021; Oh and Vukina, 2022). However, most articles have cited recent outbreaks of highly pathogenic avian influenza (HPAI) (i.e., bird flu) as the primary cause (Lusk, 2023). Overall, the price of eggs has increased significantly more than food prices (USDA, 2023b), which raises the question: Why are eggs currently so expensive? Egg prices have been so high, in fact, that policy makers and advocacy groups have called on the Federal Trade Commission to investigate whether producers have improperly manipulated prices (e.g., Funk and the Associated Press, 2023). Although one could never rule out nefarious actions or collusion on the part of suppliers, we do not have to resort to conspiracy theories to explain the recent surge in egg prices. In this article, we show that economic factors—particularly on the production side—adequately explain the current situation, even beyond the oft-cited cause: unprecedented bird losses due to avian influenza.

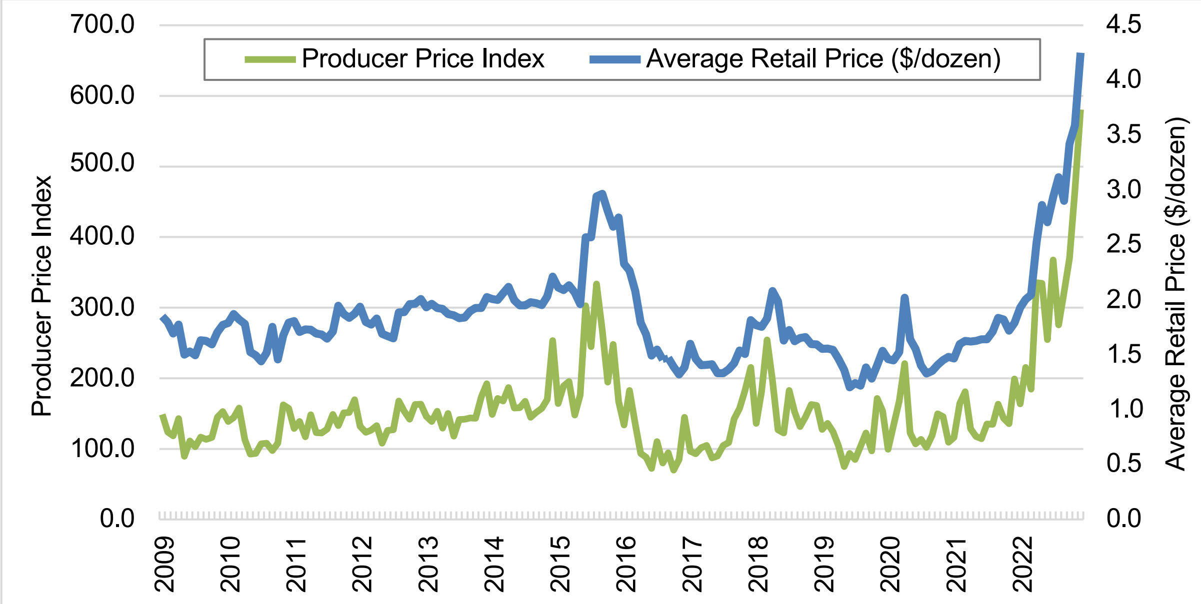
HPAI Outbreaks and Bird Loss

Since current reports have cited bird loss due to avian influenza as the primary cause of rising egg prices, it is important to provide some background on recent outbreaks and their consequences. As part of its safeguarding mission, the USDA manages the national response to major animal disease events like HPAI outbreaks to reduce disease spread and to limit negative economic impacts on the poultry sector. Since HPAI is highly contagious and can affect humans, the USDA euthanizes both infected birds and affected flocks to prevent spread. Thus, avian influenza outbreaks have significant impacts on commercial bird populations in affected areas.

Specific to the U.S. commercial table egg layer flock, the first reported HPAI case was on February 22, 2022, in New Castle County, Delaware, affecting over a million birds. Since late February, more than 44 million commercial layers have been lost due to the disease and related depopulation protocols, accounting for about 77% of all depopulated birds for commercial use in 2022 (e.g., layers, broilers, meat birds, turkeys) (USDA, 2023a).

Figure 2 shows the monthly bird loss (actual and five-period average) and the U.S. table egg layer flock from January 2009–December 2022. The monthly bird loss data from USDA-NASS include all commercial layers (table eggs and otherwise). Thus, the bird loss numbers in Figure 2 are somewhat higher than reported losses for table egg layers only. Bird loss is a natural occurrence and simply a cost of doing business. Since January 2009, average bird loss was about 9.5 million layers per month. Prior to the last major outbreak in 2015, averaged monthly losses were about 7.8 million layers. Thereafter (2016–2021), monthly losses averaged 10.7 million layers. However, this increase in the latter period was in proportion to increases in overall flock size.

Figure 1. Producer Price Index (PPI) and Average Retail Prices for Eggs in the United States: January 2009–December 2022



Note: PPI for eggs for fresh use, not seasonally adjusted (1984:12 = 100). The average retail price ($/dozen) is the U.S. city average price for large grade A eggs per dozen, not seasonally adjusted.

Source: Producer Price Index and Average Price Data databases from the U.S. Bureau of Labor Statistics (2023).

Periods of major disease outbreaks and resulting bird loss (e.g., 32 million birds lost in May 2015 and 27 million birds lost in March 2022) have had significant impacts on overall flock size (Figure 2). Figure 2 also shows that replacing lost birds is not a fast process and takes time. Following the 2015 HPAI outbreak, the table egg laying flock shrunk to 276 million birds by June 2015. Flock sizes then increased to 342 million birds in March 2019, which was the largest monthly average during this period. As a result of HPAI outbreaks in 2022, the table egg laying flock shrunk to 299 million birds. Disease response protocols reduced the size of the U.S. egg laying flock in 2022 by about 5% compared to the previous year.

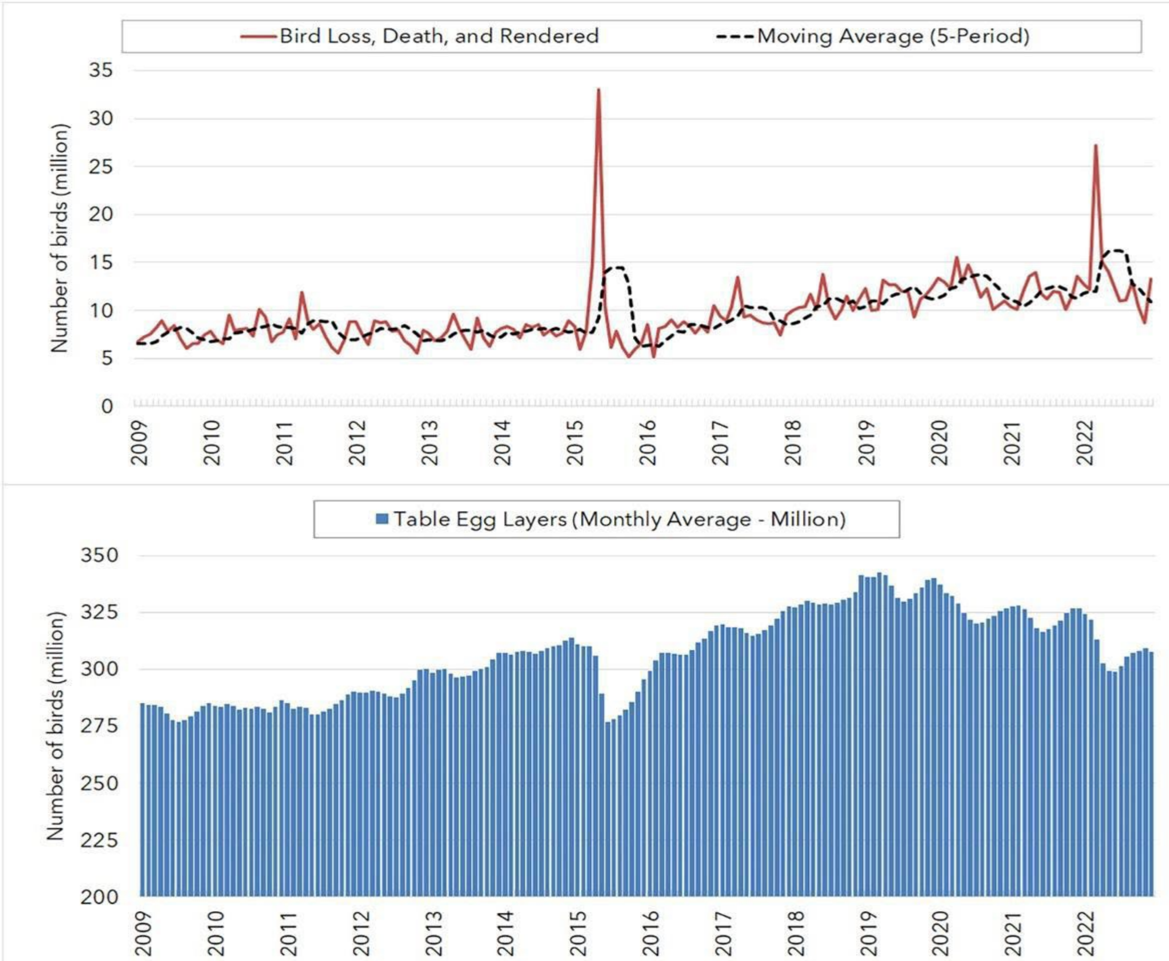
Month-to-month fluctuations in flock size are due to various market dynamics. Historically, the U.S. egg laying flock expands in the winter and early spring due to increased demand around Christmas and Easter, then contracts when demand declines during the summer months. More recently, the downward trend in flock size was due to the COVID-19 pandemic and supply chain issues that altered grocery store demand. Although grocery demand rose during the pandemic, the egg supply chain was not initially set up to shift large volumes into the retail space. Compounding the pandemic challenges was an increase in the egg PPI, which was due to higher input costs (Malone, Schaefer, and Lusk, 2021).

Data and Analysis

Using data from January 2009–December 2022, we estimated a basic vector autoregression (VAR) model of egg prices at both the producer and retail level. While the details of the VAR model and resulting estimates are beyond the scope of this article, there are a few issues that we considered for the analysis, requiring a brief discussion for clarity. First, the prices paid to U.S. egg producers (as measured by the egg PPI) and average retail prices (measured in cents per dozen for the VAR procedure) were determined by the model, while the commercial bird feed cost index, natural gas price index, and relative bird loss were treated as predetermined. Depending on the U.S. region and season, natural gas is the primary energy input in egg production, although electricity is also used (Matthews and Sumner, 2015). Since natural gas and electricity prices are highly correlated, we did not include electricity prices in the model. Since bird loss is a routine monthly occurrence, we used a five-period moving average of relative bird loss for the analysis (i.e., bird loss relative to the size of the egg laying flock). This allowed for smoothing out routine month-to-month changes and negated changes in bird loss due to changes in overall flock size and allowed for significant bird losses to still have an impact, even beyond the month of occurrence.

Table 1 reports the VAR estimates. Based on the Schwartz BIC, we assumed two-period lags for the producer price index (PPI) and average retail price (ARP). The lag estimates indicate that producer prices have a positive and significant effect on average retail prices, which is to be expected. However, the effect of average retail prices on producer prices is insignificant when both lag periods are considered (note that the sum of ARP(t–1) and ARP(t–2) is not significant in the PPI equation). The effects of the predetermined (exogenous) variables on producer and retail prices are all positive, which is to be expected, and highly significant. Since these variables directly affect production, the estimates are relatively larger in the PPI equation. Note that Bird Loss has the largest estimated impact on producer

Figure 2. Bird Loss and Table Egg Layer Inventories in the United States: January 2009–December 2022



Source: USDA (2023c) and LMIC (2023).

prices (18.79) and average retail prices (4.28), significantly higher than the estimates for the natural gas price index and feed cost index. Although our analysis was limited to just three exogenous variables (feed cost index, natural gas price index, and relative bird loss), these variables—along with two-period lagged dependent variables—adequately explained 74% and 94% of the variation in producer price index and average retail prices, respectively.

Responsiveness of Egg Prices to Input Prices and Bird Loss

Table 2 reports elasticity estimates (percentage responsiveness of egg prices to a percentage change in natural gas prices, feed cost, or relative bird loss). For the long-run elasticities, we set *y(t) = y(t-1) = y(t-2)* (y is either PPI or ARP). Consequently, the long-run estimates account for the total effects of the predetermined variables on egg prices. For instance, the long-run elasticity for average retail prices with respect to changes in relative bird loss includes

Table 1. VAR Model Estimates for Producer and Retail Egg Prices

	Constant	*PPI*(*t*-1)	*PPI*(*t*-2)	*ARP*(*t*-1)	*ARP*(*t*-2)	P_{NG}	P_{FEED}	*Bird Loss*
PPI	-110.64	0.74	0.12	-0.74	0.79	0.12	0.25	18.79
	(27.2)***	(0.11)***	(0.11)	(0.31)**	(0.23)***	(0.05)**	(0.10)**	(4.98)***
ARP	-20.96	0.31	-0.06	0.23	0.46	0.05	0.10	4.28
	(8.84)**	(0.04)***	(0.04)	(0.10)**	(0.08)***	(0.02)***	(0.03)***	(1.62)***

Note: Single, double, and triple asterisks (*, **, ***) denote significance at the 10%, 5%, and 1% level, respectively. Standard errors are in parentheses. Schwarz BIC = 1,474.43. The R^2 for the *PPI* and *ARP* are 0.74 and 0.94, respectively. *PPI* is the producer price index, *ARP* is the average retail price (measured in cents per dozen), P_{NG} is the natural gas price index, P_{FEED} is the feed cost index, and *Bird Loss* is the five-period moving average of relative bird loss.

Table 2. Percentage Responsiveness of Egg Prices to a 1% Change in Natural Gas Price, Feed Cost, and Relative Bird Loss

	Producer Price Index	Average Retail Prices
Short Run		
Natural Gas Index	0.08**	0.03***
Feed Cost Index	0.30**	0.12***
Bird Loss Share	0.40***	0.09***
Long Run		
Natural Gas Price Index	0.30*	0.32**
Feed Cost Index	1.15*	1.27**
Bird Loss Share	1.51**	1.46***

Note: Estimates can be interpreted as the percentage responsiveness of producer or retail prices to a percentage change in the exogenous variables. Single, double, and triple asterisks (*, **, ***) denote significance at the 10%, 5%, and 1%, respectively.

the effect through producer prices in addition to any direct effect. Like the VAR estimates, relative bird loss is the most important determinant of producer and retail egg prices, particularly in the long run. Note that a 1% increase in bird loss (relative to flock inventories) results in a 1.5% increase in both producer and retail egg prices. The responsiveness of producer and retail prices to feed costs is also relatively large (1.2% and 1.3%, respectively), albeit smaller than the bird loss estimates. Although statistically significant, natural gas prices had the smallest effect on egg prices (0.3% at both the producer and retail level).

To break down the impact of natural gas prices, feed costs, and bird loss on the recent surge in egg prices, we first compare all variables in 2022 to their 3-year averages (2019–2021) (See Table 3). Then we apportion the increase in retail egg prices based on the observed percentage changes in the exogenous variables. The benefit of doing an annual comparison (versus a monthly comparison) is that we can ignore month-to-month changes due to seasonal factors affecting supply and demand. In comparing 2022 to the previous period (2019–2021), the egg producer price index rose from 131 to 323, which is a 146.6% increase, and retail prices increased to $2.86/dozen in 2022, up 87.3% compared to the previous period average ($1.53/dozen). Note that during the same period, the natural gas price index increased by 143.3% and feed cost by 37.4%, and relative bird loss increased by 19.4%. Taking a much longer view on commercial bird feed and natural gas prices, we see that both reach record levels in 2022 (see Figure 3). Interestingly, both natural gas prices and feed cost were significantly lower in 2015, when the last major HPAI outbreak occurred. This could explain why egg prices did not increase as much in 2015 despite significant bird loss that year.

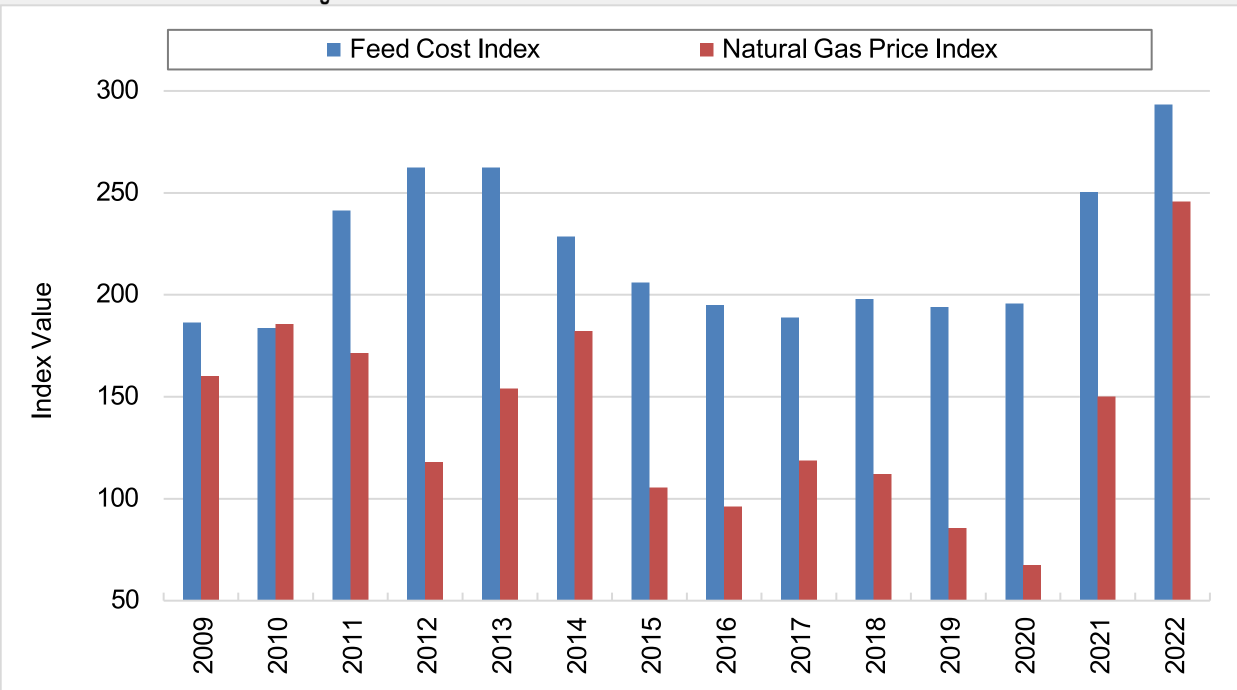
We break down the change in retail egg prices for each exogenous variable (natural gas prices, feed cost, and bird loss) (see Figure 4). Using the long-run elasticity estimates for average retail prices (Table 2) and the corresponding percentage changes in the determining variables, we find that 38.0% of the total price increase is due to the increase in natural gas prices, 38.8% is due to the increase in feed cost, and 23.1% in due to relative bird loss. Applying these percentages to the increase in average retail egg prices in 2022 relative to the 3-year average (2019–2021) ($1.33 = $2.86 - $1.53) we can apportion this increase by determining factor. Based on our estimates, $0.31 of the overall price increase was due to relative bird loss, $0.51 was due to natural gas prices, and $0.52 was due to the increase in feed cost (all three increases combined is slighter higher by $0.01 due to rounding error). While bird loss was the most important determinant based on the estimated impact, it was not most important in explaining the annual increase in prices. Of the three exogenous variables, the change in bird loss was smaller overall, 19.4% versus 37.4% and 143.3% for feed cost and natural gas prices, respectively.

Table 3. 2022 and 2019–2021 (3-Year Average) Comparison and Percentage Change

Variable	3-Year Average (2019–2021)	2022	Percentage Change
Egg Producer Price Index (1991 = 100)	131.03	322.56	146.2
Average Retail Price ($/dozen)	1.53	2.86	87.3
Natural Gas Price Index (1982 = 100)	100.99	245.74	143.3
Feed Cost Index (1986 = 100)	213.42	293.29	37.4
Bird Loss Share (loss ÷ inventory × 100)	3.65	4.36	19.4

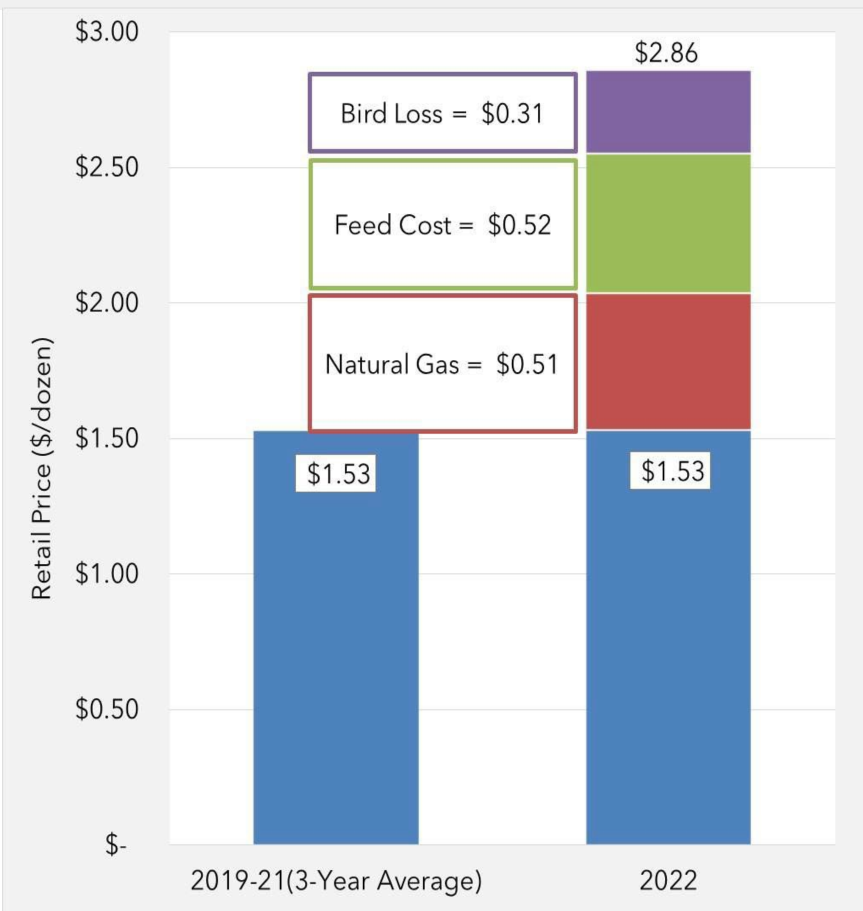
Source: Data are based on estimates derived using USDA (2023c) and BLS (2023) databases.

Figure 3. Feed Cost Index and Natural Gas Price Index: 2009–2022



Note: 1984:12 = 100 for the feed cost index, and 1982 = 100 for the natural gas price index.
Source: U.S. Bureau of Labor Statistics (2023), Producer Price Index database.

Figure 4. Retail Egg Prices in 2022 versus 2019–2021 (3-Year Average) and Change by Determining Factor



Note: The sum of the based price ($1.53) and determinant-specific price increases is $2.87, due to rounding error.
Source: Based on elasticity estimates derived from USDA (2023c) and BLS (2023).

Conclusion

The goal of this article was to assess the causes of high egg prices. Our analysis indicated that claims of price gouging may not be warranted given the influence of the price of natural gas, feed cost, and bird loss on both producer and retail egg prices. Although, the elasticity for natural gas prices was only 0.30, natural gas prices increased by 143.3% in 2022 compared to the previous period 3-year average (2019–2021), resulting in a relatively larger estimated impact on egg prices. In 2022, input prices were high overall, putting upward pressure on egg prices. Recent reports and news articles often cite avian influenza and bird loss as the primary cause of high prices. These reports are not necessarily wrong. However, our analysis reveals a very important issue that has not been thoroughly discussed. That is, current decreases in flock size due to avian influenza may be compounding the effects of higher input prices.

For More Information

AgWeb, 2022. "CRP Contract Termination to Offset Global Food Crisis Gains USDA's Approval." Available online: For More Information

Bureau of Labor Statistics (BLS). 2023. Inflation and Prices Databases. Available online: https://www.bls.gov/data/.
Google Trends. 2023. https://trends.google.com/trends/?geo=US.

Funk, J., and the Associated Press. 2023, January 25. Americans Are Furious at the Price of Eggs Skyrocketing by 137% and Urging the FTC to Investigate Potential Price Gouging. Fortune. Available online: https://fortune.com/2023/01/25/what-is-price-of-eggs-inflation-price-gouging-ftc-avian-flu/

Livestock Marketing Information Center (LMIC). 2023. https://lmic.info/

Lusk, J. 2023, January 27. "Egg Prices and Avian Influenza – A Deep Dive." Jayson Lusk [blog]. Available online: http://jaysonlusk.com/blog/2023/1/27/egg-prices-and-avian-influenza-a-deep-dive

Malone, T., K.A. Schaefer, and J.L. Lusk. 2021. "Unscrambling US Egg Supply Chains amid COVID-19." Food Policy 101: 102046.

Matthews, W.A., and D.A. Sumner. 2015. "Effects of Housing System on the Costs of Commercial Egg Production." Poultry Science 94(3): 552–557.

Oh, S.E., and T. Vukina. 2022. "The Price of Cage-Free Eggs: Social Cost of Proposition 12 in California. American Journal of Agricultural Economics 104(4): 1293–1326.

U.S. Department of Agriculture. 2023a. 2022-2023 Confirmations of Highly Pathogenic Avian Influenza in Commercial and Backyard Flocks. Washington, DC: USDA Animal and Plant Health Inspection Service. Available online: https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/avian/avian-influenza/hpai-2022/2022-hpai-commercial-backyard-flocks

U.S. Department of Agriculture. 2023b. Livestock, Dairy, and Poultry Outlook. Washington, DC: USDA Economic Research Service. Available online: https://www.ers.usda.gov/webdocs/outlooks/105645/ldp-m-343.pdf?v=8474.9

U.S. Department of Agriculture. 2023c. Quick Stats. Washington, DC: USDA National Agricultural Statistics Service. Available online: https://quickstats.nass.usda.gov/

Author Information: Andrew Muhammad is Professor and Blasingame Chair of Excellence in Agricultural Policy, Department of Agricultural Resource Economics, University of Tennessee Institute of Agriculture, Knoxville, Tennessee. Charles Martinez is Assistant Professor, Department of Agricultural Resource Economics, University of Tennessee Institute of Agriculture, Knoxville, Tennessee. Abdelaziz Lawani is Assistant Professor, Department of Agricultural and Environmental Sciences, Tennessee State University, Nashville, Tennessee.

Acknowledgments: We thank the editor and anonymous reviewers for their helpful comments throughout this process.

CHOICES

AAEA Agricultural & Applied Economics Association

Volume 38. Quarter 4

Uncovering the Impacts of Steel Tariffs on the Canned Foods Sector: Reevaluating Trade Policy Winners and Losers

Andrew Muhammad and Carlos J.O. Trejo-Pech

JEL Classifications: F13, Q11, Q17
Keywords: Canned foods, Steel, Tariffs, Trade war

Producers and users of steel are a perfect example of competing special interests: Both groups have lobbied the government on behalf of their sectors, respectively arguing for and against the tariffs on imported steel imposed by the Trump administration in 2018. One group on the "against" side is the U.S. canned food sector, which has relied on imported tinplate (tin-plated steel) for production. Tin-plated steel has been subject to both tariffs and quotas since 2018. In this article, we explore the impacts of these tariffs and their implications for canned food prices and domestic food security.

Economists are more likely to argue for complete trade liberalization (i.e., free and open trade) than for the protectionist policies favored by President Trump. As noted by Friedman and Friedman (1997), "Ever since Adam Smith there has been virtual unanimity among economists, whatever their ideological position on other issues, that free trade is in the best interests of trading countries and of the world." However, arguments for trade liberalization are often framed in the context of *producers* versus *consumers*, where protection benefits special interests (producers) at the expense of the broader, general interest of society. Consequently, protectionism is often viewed through the concentrated benefits/diffused costs lens, where the concentrated group (i.e., producers) has far more incentive to lobby for protection than the diffused group (i.e., consumers) to lobby against it. However, this does not fully apply to specific trade actions where there are competing special interests and concentrated gains (or losses) and lobbying efforts on both sides of the issue.

The current tariff situation and lobbying efforts of the U.S. canned food and steel sectors provide an ideal case for examining trade protections in this context (i.e., competing special interests). In the United States, the canned food sector was valued at an estimated $17.8 billion in 2019 (Statista, 2023), with tin-plated steel being the primary packaging material. The data suggest that the impacts of the section 232 tariffs on the canned food sector have not been negligible. However, more research is needed for a more quantitative assessment of their impacts and implications.

Background

During his time in office, President Trump advocated for greater trade protections, imposing tariffs on a broad range of products. In March 2018, President Trump signed a proclamation to impose a 25% tariff on all imported steel, based on a Department of Commerce report that indicated that imports had the potential to threaten U.S. national security. Section 232 of the Trade Expansion Act of 1962 allows the president to use trade barriers for national security concerns (The White House, 2022). A major concern was the unprecedented growth in China's crude steel production, which exceeded 1 billion metric tons in 2020, accounting for more than half of global production. Note that the next highest country (India) produced around 100 million metric tons and the United States produced around 70 million metric tons (World Steel Association, 2022). While higher prices via import quotas and tariffs benefited the U.S. steel sector, the negative impacts on downstream steel-consuming companies exceeded any gains. For instance, 75 times as many jobs were estimated to have been lost in downstream steel-consuming sectors compared to jobs gained in the steel-producing sector (Russ and Cox, 2020).

Food canning can be traced back to the 18th century in France, and the basic principles have not changed significantly since. Clearly, the direct benefit of canning is food preservation, in that the process allows for converting perishable food items into shelf-stable food, allowing for quality and nutritional properties to be maintained for years after being processed (Canned Food Alliance, 2023). The long-lasting nature of canned foods reduces food waste, common for fresh and perishable food items. Food waste and loss—caused by many factors from the farm through the final consumer and representing 30%–40% of the food supply—is a problem because a significant amount of food is sent to landfills, which also contributes to greenhouse gas emissions from activities prior to and during disposal (U.S. Department of Agriculture, 2023).

Food preservation and convenience make canned foods suitable for food security in times of crisis, such as natural disasters or pandemics. For instance, at the beginning of the COVID-19 pandemic, households could secure food by increasing canned food purchases when restaurants were in lockdown and trips to grocery stores were less frequent (Hillen, 2021; Pigott, 2022). Unfortunately, the steel tariffs lasted throughout the pandemic, a time when consumers would have benefited from relatively lower prices for shelf-stable food items. As discussed in the next section, canned food prices significantly increased after the steel tariffs were imposed in 2018, exceeding overall inflation in recent years.

U.S. Steel Tariffs and the Canned Foods Sector

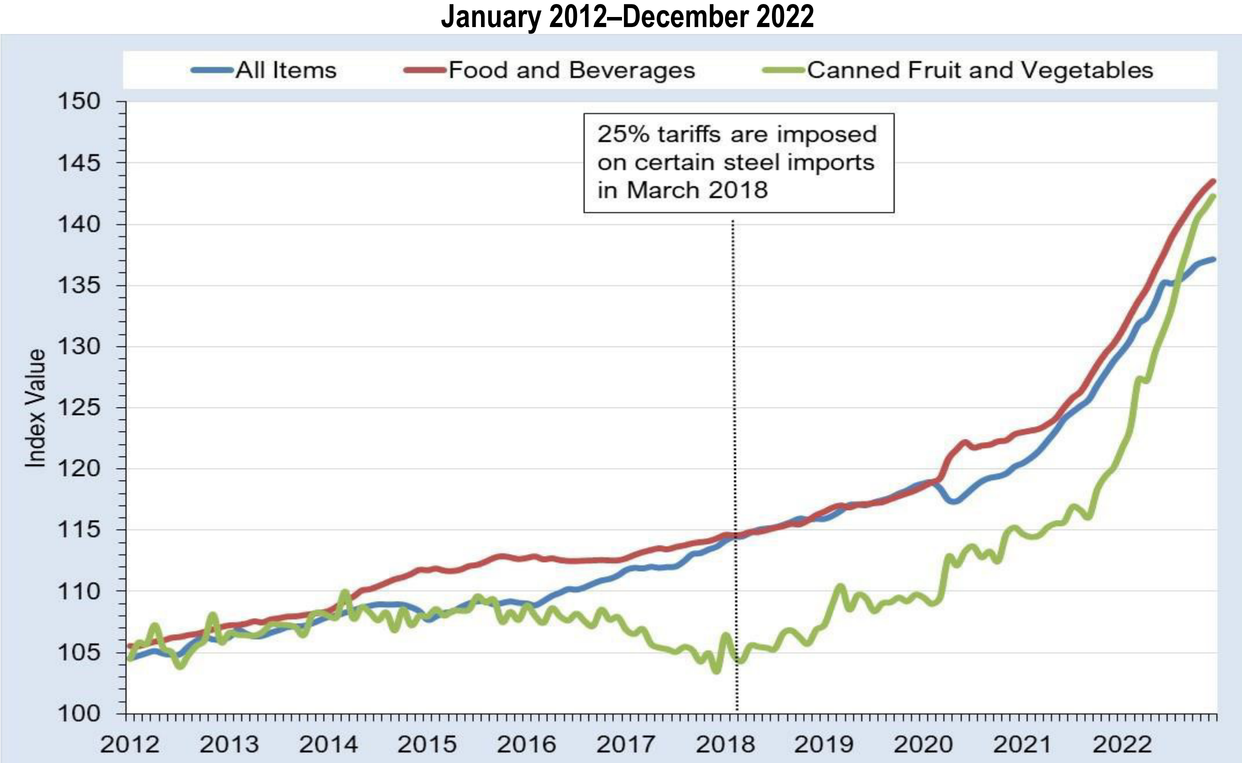
It was fitting that when the steel tariffs were first introduced, then-Commerce Secretary Wilbur Ross used a canned food item to defend the tariffs, suggesting a negligible impact on consumers and prices. In 2018, Secretary Ross noted (Horowitz, 2018),

> *This is a can of Campbell's soup, there's about 2.6 cents, 2.6 pennies, worth of steel. So, if that goes up by 25 percent, that's about six-tenths of one cent on the price of the can of Campbell's soup.*

Interestingly, canned food prices increased by more than Secretary Ross speculated they would. We asked the CEO of a U.S. canned food company why have prices increased significantly more than "six-tenths of one cent." He indicated that due to the tariffs, companies were paying significantly more for cans for several reasons. First, he noted the difficulties in transporting empty cans: shipping empty cans is tantamount to shipping air. Therefore, can manufacturing should be as close as possible to canning facilities. Import restrictions and tariffs make purchasing steel and producing cans more difficult, causing canned food companies to contract with can production facilities at greater and greater distances. Additionally, tinplate makes up a small share of U.S. steel production, and there is limited capacity to expand. This limited capacity has resulted in regional market power, allowing for higher mark-ups and putting additional upward pressure on prices.

To better understand how the steel tariffs might have affected canned food prices, we examined the consumer price indices for all items (CPI), food and beverages, and canned fruit and vegetables over the last decade

Figure 1. Consumer Price Indexes for All Items, Food and Beverages, and Canned Fruit and Vegetables, January 2012–December 2022



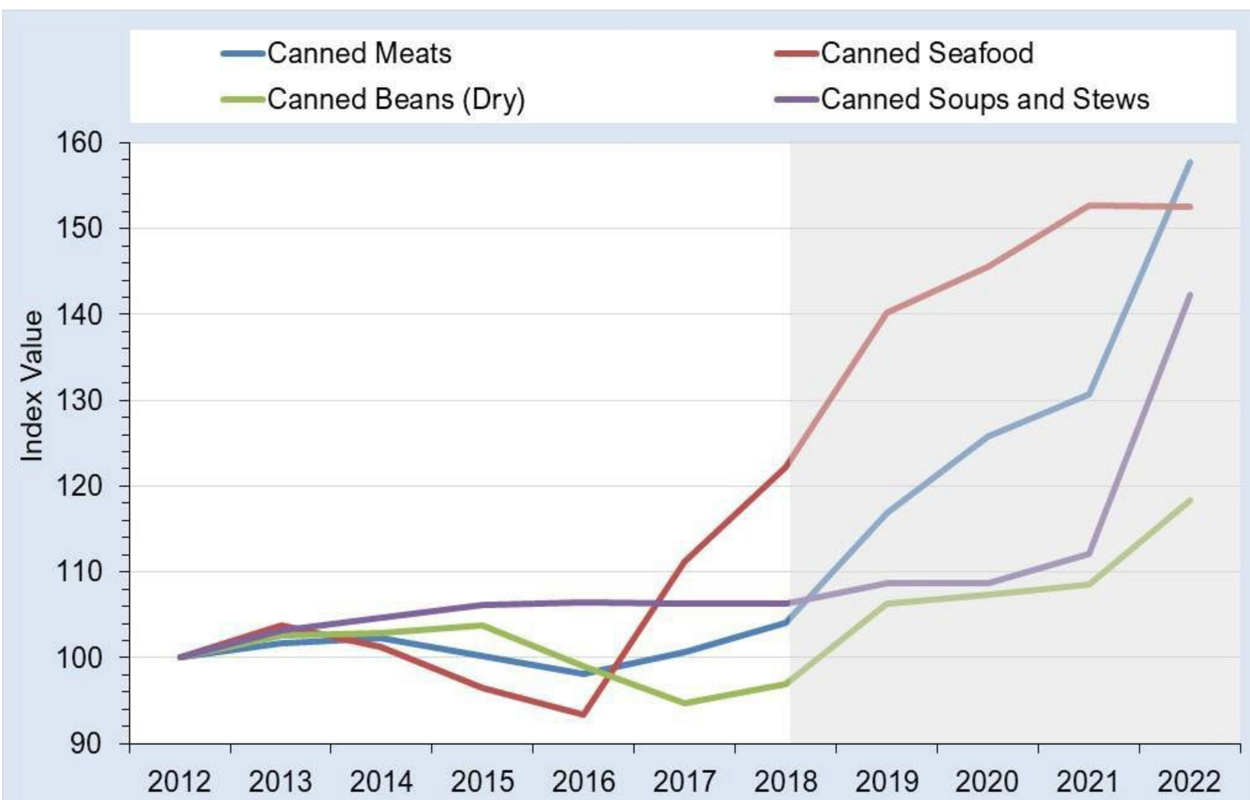
Note: Index values are the U.S. city average and seasonally adjusted. The indexes were rescaled based on the 2010 monthly average for comparison purposes.

Source: Bureau of Labor Statistics (2023).

(January 2012–December 2022) (see Figure 1). If the steel tariffs were inconsequential, then it could be argued that canned food prices would have followed a similar pattern as the CPI or food prices overall. Interestingly, the canned fruit and vegetables price index decreased from 2015 to 2018, even as the price indices for all goods and food and beverages increased. Even more interesting, the canned fruit and vegetables price index persistently declined right up to the point when the steel tariffs were imposed in March 2018, suggesting that the steel tariffs resulted in relatively higher canned food prices. Since the COVID-19 pandemic also caused prices to rise, Figure 1 might be capturing both the effects of the pandemic and the tariffs. However, the relatively faster price growth and the increase during 2018 and 2019 are likely due to the steel tariffs. Note that similar patterns occurred for other canned foods. Figure 2 shows the producer price indices for canned meats, seafood, beans, and soups and stews. Although canned seafood prices were rising before 2018 and the price of canned soups and stews did not significantly increase until 2022, both canned meats and canned bean prices (at the producer level) followed a similar pattern as the price index for canned fruits and vegetables: steady or decreasing prices until 2018, followed by a persistent upward trend thereafter. This provides even further evidence that the steel tariffs increased canned food prices.

Last, we considered U.S. tin-plated steel imports since 2012, as defined by three Harmonized System (HS) categories (72101200, 72121000, and 72101100) (see Figure 3). The Netherlands, Germany, and Canada supply a major share of U.S. tinplate imports, but South Korea and China also account for a significant share. The data show that imports were trending upward until 2018 and then declined and remained low throughout 2020. Compared to 2017, U.S. tinplate imports during this three-year period (2018–2020) were down 19% overall and down 35% for imports from South Korea, 23% for Germany, 15% for China, 13% for the Netherlands, and 9% for Canada. The relatively smaller decline in imports from Canada could be due to their tariffs being lifted in 2019. Interestingly, imports have fully recovered in recent years, which could be due to the United States and European Union reaching an agreement that converted the steel tariffs to tariff-rate quotas (Fefer, 2021). Is it important to note that Figure 3 includes tin-plated steel for all uses, so it is not clear whether the recovery in imports benefited the canned food sector specifically.

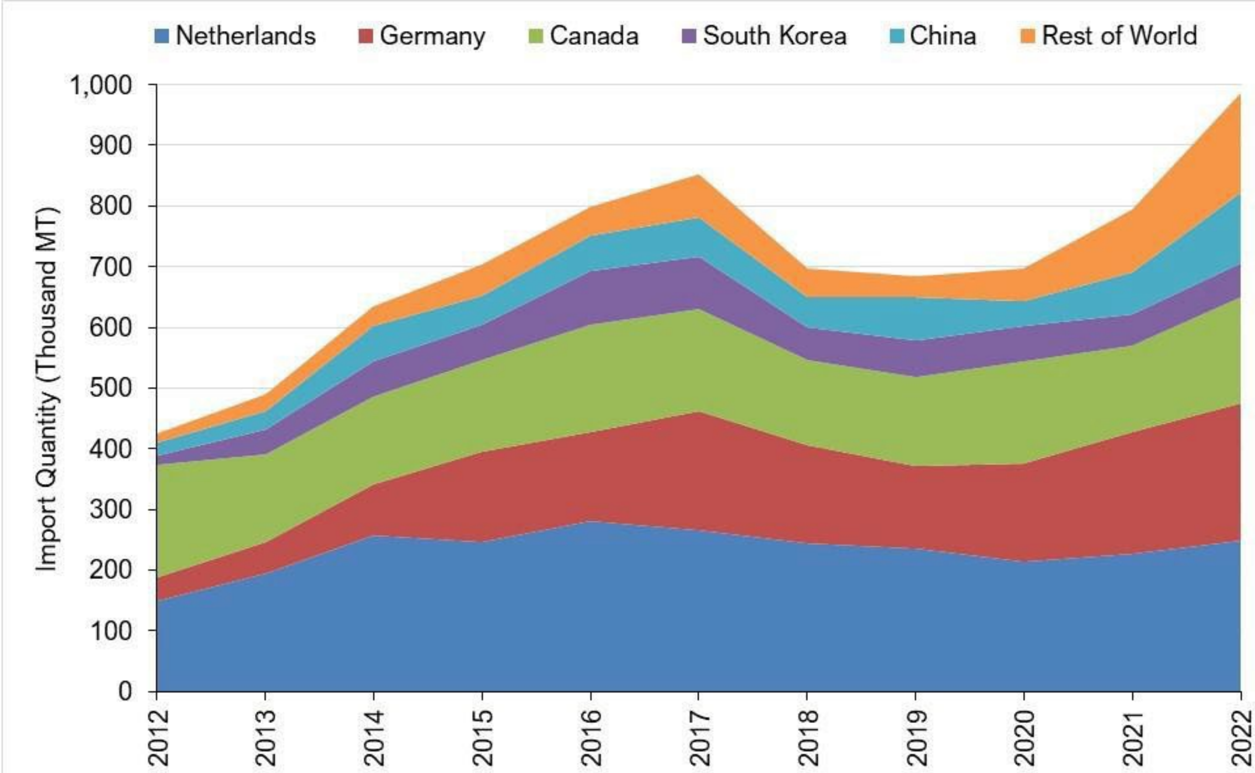
Figure 2. Producer Price Indexes for Select Canned Food Items, 2012–2022



Note: Index values were rescaled to 2012 for comparison purposes. Shaded area denotes the period when the steel tariffs were imposed.

Source: Bureau of Labor Statistics (2023).

Figure 3. U.S. Tin Plated Steel Imports by Source, 2012–2022



Note: Imports are an aggregation of the following Harmonized System (HS) categories: 72101200 *Iron/nonalloy steel, width ≥ 600mm, flat-rolled products, plated or coated with tin, less than 0.5 mm thick*, 72101100 *Iron/nonalloy steel, width ≥ 600mm, flat-rolled products, plated or coated with tin, thickness ≥ 0.5 mm*, and 72121000 *Iron/nonalloy steel, width ≤ 600mm, flat-rolled products, plated or coated with tin.*

Source: U.S. International Trade Commission (2023).

Closing

Producers in the U.S. canned food industry compete on price, making the industry one of the lowest-margin sectors (Wood, 2023). Thus, the proclamation by President Trump imposing 25% tariffs on imported steel caused concern for the canned food sector. The data in this study show that sector was likely impacted beyond the negligible expectations of the previous administration. This was in part evidenced by the relatively larger increases in canned food prices since 2018 compared to overall food prices and inflation. Downstream industries like the canned food sector that faced steel tariffs experienced declines due to higher production costs, decreased profits, and even decreased sales due to higher prices. However, a more quantitative assessment is needed to assess the degree to which all of these have occurred.

For More Information

Bureau of Labor Statistics. 2023. *Data Tools, Inflation and Prices.* Available online: https://www.bls.gov/data/#prices

Canned Food Alliance. 2023. “Canned Food Fact Sheets.” Available online: https://www.mealtime.org/fact-sheets/

Fefer, R.F. 2021. *What’s in the New U.S.-EU Steel and Aluminum Deal?* Report IN11799. Washington, DC: Congressional Research Service.

Friedman, M., and R.D. Friedman. 1997. “The Case for Free Trade.” *Hoover Digest*. Available online: https://www.hoover.org/research/case-free-trade

Hillen, J. 2021. “Online Food Prices during the COVID-19 Pandemic.” *Agribusiness* 37:91–107.

Horowitz, J. 2018. “Wilbur Ross defends Trump tariffs with a can of Campbell's soup.”

CNN Business (March 2, 2018). Available online: https://money.cnn.com/2018/03/02/news/economy/wilbur-ross-soup-cnbc-interview/index.html

Pigott, M. 2022. *Metal Can and Container Manufacturing in the US*. IBISWorld Industry Report 33243.

Russ, K., and L. Cox. 2020. “Steel Tariffs and U.S. Jobs Revisited.” *EconoFact.* Available online: https://econofact.org/steel-tariffs-and-u-s-jobs-revisited

Statista.com. 2023. “Estimated Canned Food Market Value in the United States from 2014 to 2025.” Available online: https://www.statista.com/statistics/1009399/us-canned-food-market-value/

U.S. Department of Agriculture. 2023. *Food Waste FAQs*. Available online: https://www.usda.gov/foodwaste/faqs

U.S. International Trade Commission. 2023. *DataWeb*. Available online: https://dataweb.usitc.gov/

The White House. 2022. *A Proclamation on Adjusting Imports of Steel into the U.S.* (March 31, 2022) Available online: https://www.whitehouse.gov/briefing-room/presidential-actions/2022/03/31/a-proclamation-on-adjusting-imports-of-steel-into-the-united-states-2/

Wood, G. 2023. *Canned Fruit and Vegetable Processing in the US*. IBISWorld Industry Report 31142.

World Steel Association. 2022. “World Steel in Figures.” Available online: https://worldsteel.org/steel-topics/statistics/

Author Information: Andrew Muhammad is Professor and Blasingame Chair of Excellence with the Department of Agricultural and Resource Economics at the University of Tennessee Institute of Agriculture. Carlos J.O. Trejo-Pech is Associate Professor with the Department of Agricultural and Resource Economics at the University of Tennessee Institute of Agriculture, Knoxville, Tennessee.

Acknowledgments: Special thanks to C-FARE and USDA for organizing and sponsoring the pre-conference at the ASSA Meetings in New Orleans in 2023 where this work was presented.

How the Trade War Is Hitting American Beer, Wine, and Spirits in Canada

Thursday, April 9, 2026

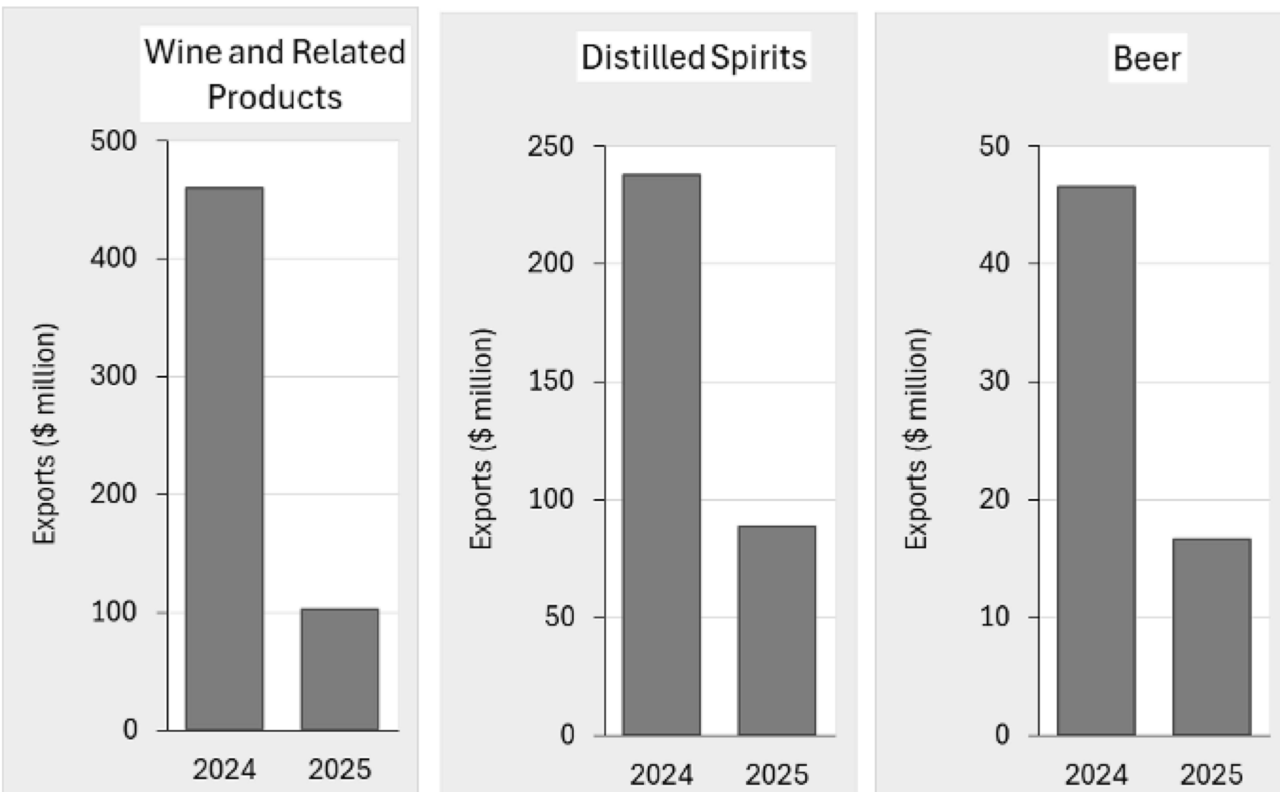
We often forget that beer, wine, and spirits are fundamentally agricultural products, rooted in the cultivation of corn, barley, rye, wheat, grapes, and other farm commodities. As a result, disruptions to alcohol trade are not just shocks to beverage markets, but direct blows to farmers, rural communities, and the wider agricultural economy that supplies these products (Muhammad et al., 2025). This broader agricultural story now runs straight through Canada, where trade tensions transformed alcohol import demand into a geopolitical statement. Canada has long been an important export destination for U.S. beer, wine, and spirits, supported by geographic proximity, integrated supply chains, and decades of tariff-free trade. In 2024, for instance, Canada was the leading market for U.S. wine exports and the second leading market for U.S. distilled spirits and beer exports (USDA, 2026). This relationship shifted abruptly in 2025 when trade tensions escalated beyond conventional tariff retaliation and entered the retail marketplace.

At the heart of the disruption was Canada's decision to remove American alcohol from store shelves entirely. Rather than relying solely on retaliation through tariffs, multiple provinces instructed their liquor authorities to stop purchasing and selling American beer, wine, and spirits. In early February 2025, the United States announced broad tariffs on Canadian imports. Canada responded in March with retaliatory tariffs on a range of U.S. goods, including alcohol (Kitamura, 2026). Provincial governments escalated further by directing liquor boards in Ontario, Quebec, British Columbia, Nova Scotia, and other provinces to halt purchases of U.S. alcohol and remove existing products from shelves and digital platforms. Throughout the spring and summer of 2025, these delistings remained largely in place, with only limited reversals in select provinces (DISCUS, 2026).

Figure 1 summarizes the year-over-year change in U.S. beer, wine, and distilled spirits exports to Canada between 2024 and 2025, reflecting the impact of the trade war on each product category. As shown in the figure, wine and related products experienced the largest decline, falling from $460 million in 2024 to $103 million in 2025, a 77.6% reduction or a $357 million loss. Distilled spirits exports declined from $238 million to $89 million, a 62.7% decrease, resulting in a $149 million loss. Beer exports also dropped sharply, falling from $47 million to $17 million, a 64.4% decline or $30 million loss. Taken together, total U.S. alcohol exports to Canada fell from $744 million to $208 million, a 72% decrease amounting to an overall dollar loss of $536 million.

These shelf removals sent a clear political signal to U.S. policymakers while simultaneously encouraging Canadian consumers to substitute toward domestic or non-U.S. products. It also exposed the vulnerability of exporters operating in markets where governments control distribution infrastructure, demonstrating how trade wars can extend beyond borders and tariffs to reshape retail availability itself. Even as some punitive measures were later eased, this episode underscored how quickly trade relationships built over decades can be disrupted when retaliation targets market access rather than prices alone.

Figure 1. U.S. Beer, Wine, and Spirits Exports to Canada: 2024 and 2025



Source: U.S. Department of Agriculture, Foreign Agricultural Service, Global Agricultural Trade System (GATS) (USDA, 2026)

References

Distilled Spirits Council of the United States (DISCUS) (2026). *Annual Economic Briefing* https://distilledspirits.org/wp-content/uploads/2026/02/FINAL-DISCUS-

Annual-Economic-Briefing-Presentation-2026-2.5.2026-l l-AM.pdf

Kitamura, K.H. (2026) *U.S.-Canada Trade Relations.* Report IFl 2595. Congressional Research Service. https://www.congress.gov/crs-product/1Fl 2595

Muhammad, A., Menard, R. J., and Smith, S. A. (2025). "Tennessee and Kentucky Distilled

Spirits: What's at Stake from a New Trade War?" *Choices* 40(3). https://doi.org/l 0.22004/ AG.ECON.358876

U.S. Department of Agriculture (USDA) (2026). Global Agricultural Trade System. Foreign Agricultural Service. https://apps.fas.usda.gov/gats/default.aspx

---

Muhammad, Andrew. "American Beer, Wine, and Spirits in Canada and the Fallout of the Trade War:' *Southern Ag Today6(15.4).* April 9, 2026. Permalink

Andrew Muhammad

UTIA INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

SOUTHERN AG TODAY

U.S. **Agricultural Export Trends: Stability, Growth, and a China-Driven Rollercoaster**

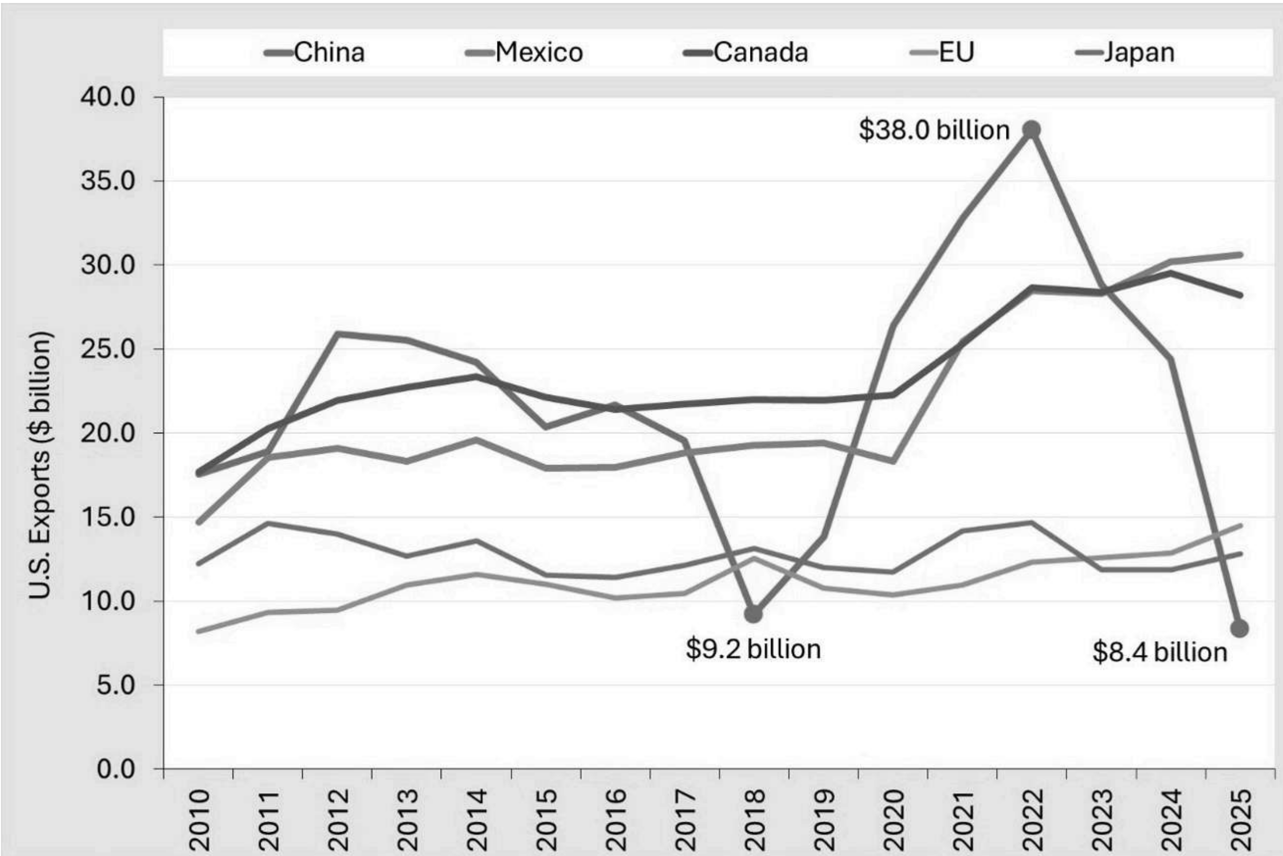
Thursday, March 12, 2026

Now that the December 2025 trade data have been released, we can look back over the past fifteen years to evaluate how U.S. agricultural exports have evolved across major markets and how shifting global dynamics, especially the dramatic rise and subsequent decline of exports to China, have shaped overall performance. U.S. agricultural exports from 2010 through 2025 reveals a story of both stability and notable volatility. Total agricultural exports rose from $119 billion in 2010 to a high of $196 billion in 2022, before settling at $171 billion in 2025. Exports in 2025 were more than $5.0 billion lower than the previous year, driven primarily by reduced soybean shipments, along with declines in coarse grains, beef, wine, and rice. Much of the variation in U.S. agricultural trade can be traced to the dramatic rise and fall of U.S. exports to China, a market that transformed from the leading U.S. destination to a source of sharp decline. Indeed, the widening U.S. agricultural trade deficit, which grew from -$37.6 billion in 2024 to -$41.7 billion in 2025, stems largely from the steep collapse in exports to China (USDA, 2026).

Figure 1 shows U.S. agricultural exports to the major destinations-China, Mexico, Canada, the European Union, and Japan. With the exception of China, most major U.S. export markets exhibit steady or gradually increasing demand, even during periods of heightened trade tensions and uncertainty. However, it's hard to ignore the extremely volatile path of U.S. agricultural exports to China. Beginning at $18 billion in 2010, exports to China climbed substantially, peaking at $38 billion in 2022, primarily due to rising exports from the Phase One Trade Agreement and relatively high commodity prices. However, exports to China have significantly declined since, falling to just $8 billion in 2025, representing a loss of $30 billion in only three years. No other major market exhibits such a rollercoaster pattern. This deterioration also helps explain why total U.S. exports fell from $196 billion in 2022 to $171 billion in 2025, despite persistent exports elsewhere.

In contrast, exports to nearly every other major destination remained stable or even trended upward. Mexico increased from $15 billion in 20l Oto $31 billion in 2025. Canada remained consistently strong, rising from $18 billion to $28 billion over the same period. The EU and Japan both show moderate, incremental increases, with none experiencing sharp swings comparable to China. Overall, recent trends illustrate two simultaneous dynamics: the inherent volatility of U.S. agricultural trade with China and the remarkable stability of U.S. exports to virtually every other major market. While the collapse in Chinese demand resulted in a noticeable drop in total exports after 2022, the resilience of other destinations helped buffer the decline. These trends highlight both the opportunities and the vulnerabilities that come with relying heavily on a single, now-unpredictable trading partner.

Figure I. U.S. Agricultural Exports to the Top Destination Markets: 2010-2025



Source: U.S. Department of Agriculture, Foreign Agricultural Service, Global Agricultural Trade System (GATS) (USDA, 2026)

Reference

U.S. Department of Agriculture (USDA) (2026). *Global Agricultural Trade System.* Foreign Agricultural Service. https://apps.fas.usda .gov/gats/default.aspx

Muhammad, Andrew. "U.S. Agricultural Export Trends: Stability, Growth, and a China-Driven Rollercoaster." *Southern Ag Today* 6(11.4). March 12, 2026.

Permalink

Andrew Muhammad

SOUTHERN AG TODAY

When China Stops Buying: Is this the New Reality for U.S. Cotton?

Thursday, February 26, 2026

U.S. cotton is among the most export-dependent agricultural commodities, with more than 80% of annual production moving into global markets rather than being used domestically (U.S. Department of Agriculture, 2026a). Although China has not always been a consistent buyer, importing less than 15% of U.S. cotton exports in some years and more than 30% in other years, it has nevertheless remained a somewhat reliable partner, accounting for nearly 30% of U.S. cotton exports in more recent years (2020-2024) (U.S. Department of Agriculture, 2026b).

Once the most important market for U.S. cotton, China has become a far less reliable partner in 2025, as recent import patterns show greater volatility and reduced engagement with the U.S. agricultural sector. In 2025, China's purchases of U.S. cotton fell from $1.5 billion to just $0.2 billion, an 85% decline, while its import volume dropped at nearly the same rate, from 0.8 million metric tons (MMT) to 0.1 MMT. In contrast, exports to markets outside China expanded substantially over the same period. The value of U.S. cotton exports to non-China destinations rose from $3.5 billion to $4.6 billion, a 32% increase, while quantities surged 51%, from 1.7 MMT to 2.6 MMT (Table 1) (U.S. Department of Agriculture, 2026b).

Why did China sharply reduce its imports of U.S. cotton? While the trade war and subsequent political tensions certainly accelerated the decline, the underlying shift runs deeper than tariffs. China's overall import strategy has fundamentally changed as its domestic cotton sector has undergone major structural adjustments since 2010. Over the past decade, China has increased production, drawn down its massive state-held stockpiles, and reduced its dependence on foreign fiber. Since 2021 alone, domestic output has risen by more than 30% (U.S. Department of Agriculture, 20250). As a result, China is increasingly able to meet the needs of its textile and apparel industry with domestic cotton rather than imports. Taken together, these developments suggest that China's reduced reliance on U.S. cotton is not simply a temporary response to trade tensions but part of a longer-term realignment.

Table2 makes clear that the steep decline in U.S. cotton exports to China was not simply the result of tariffs or bilateral tensions, but part of a much broader contraction in China's overall import demand. China's total cotton import value fell from $5.3 billion in 2024 to $1.9 billion in 2025, while import volumes dropped from 2.6 million to 1.1 million metric tons. Every major supplier experienced significant losses: Brazil's shipments fell by more than 50%, India's collapsed by over 90%, and Australia also recorded substantial reductions.

The across-the-board declines underscore a structural shift in China's sourcing strategy rather than a U.S.-specific outcome.

Table l. U.S. Cotton Exports: 2024 and 2025

	2024	2025	Change	%Change
	Value ($ billion)			
China	$1.5	$0.2	-$1.3	-85.1%
Total (w/o China)	3.5	4.6	1.1	32.0%
Total (w/ China)	5.0	4.8	-0.1	-2.8%
	Quantity (million metric tons)			
China	0.8	0.1	-0.6	-84.6%
Total (w/o China)	1.7	2.6	0.9	51.0%
Total (w/ China)	2.5	2.7	0.2	9.6%

Source: U.S. Department of Agriculture (2026b)

Table 2. China's Cotton Imports (Major Exporting Countries): 2024 and 2025

	2024	2025	Change	%Change
	Value ($ billion)			
Total	$5.3	$1.9	-$3.4	-63.6%
Brazil	2.2	0.8	-1.4	-63.4%
U.S.	1.9	0.2	-1.6	-87.8%

Australia	0.7	0.6	-0.1	-13.8%
India	0.1	0.0	-0.1	-91.1%
Turkey	0.1	0.1	0.0	3.7%
	Quantity (million metric tons)			
Total	2.6	1.1	-1.5	-59.2%
Brazil	1.1	0.5	-0.6	-57.8%
U.S.	0.9	0.1	-0.8	**-86.8%**
Australia	0.3	0.3	0.0	0.2%
India	0.1	0.0	-0.1	-90.9%
Turkey	0.1	0.1	0.0	**-4.1%**

Source: Trade Date Monitor®(2026)

References

Trade Data Monitor®. (2026). https://tradedatamonitor.com/

U.S. Department of Agriculture (USDA) (20260). *PSD Online.* Foreign Agricultural Service. https://apps.fas.usda.gov/psdonline/app/index.html#/app/advQuery

U.S. Department of Agriculture (USDA) (2026b). *Global Agricultural Trade System.* Foreign Agricultural Service. https://apps.fas.usda.gov/gats/default.aspx

---

Muhammad, Andrew. "When China Stops Buying: Is this the New Reality for U.S. Cotton?" *Southern Ag Today6(9.4).* February 26, 2026. Permalink

Andrew Muhammad

UTIA INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

SOUTHERN AG TODAY

Recent Trade Tensions Cause U.S. Beef to Lose Ground in China, Spurs Gains for Australia and Brazil

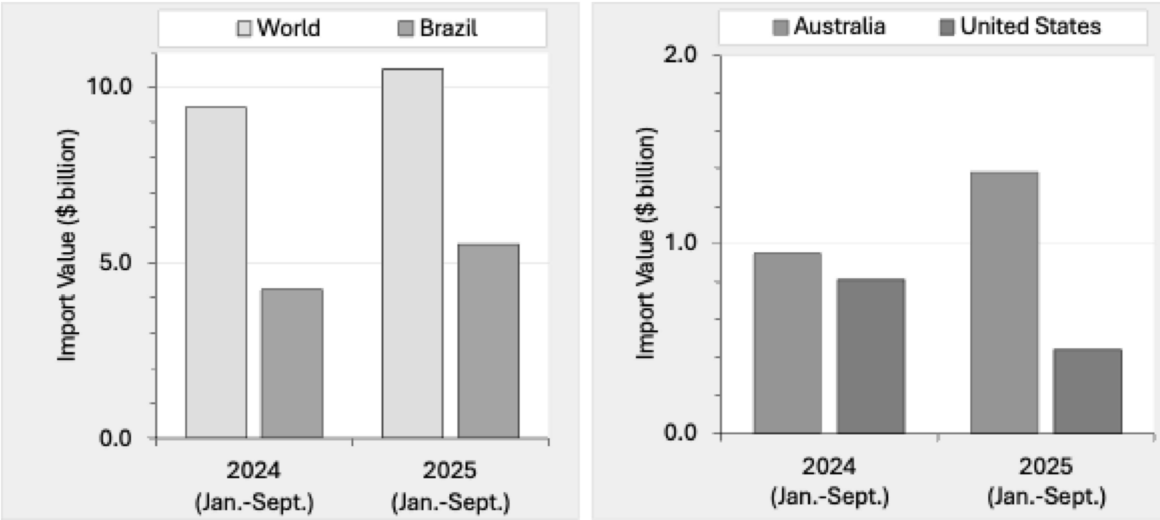
Thursday, October 30, 2025

Over the past decade, China has gone from a minor player to the world's largest beef importer, with purchases rising from around a $100 million in 2010 to nearly $18 billion in 2022, which is a staggering increase of over 17,000%. This surge isn't just about spending more. The actual volume of beef purchased has grown by more than 8,000%, driven by rising incomes, urban lifestyles, and shifting diets that favor beef over traditional staples like pork. The outbreak of African Swine Fever in 2018, which devastated China's pig population, further accelerated the shift, while government dietary guidelines have promoted beef as a healthier option. Due to rising demand and imports, coupled with lifting the import restriction on U.S. beef in 2017, China is now the third largest foreign market for U.S. beef-around $1.5 billion in 2024. This rise has been highlighted in previous Southern Ag Today articles (For example, see: https://southernagtoday.org/2025/04/17/high-tariffs-could-halt-u-s-beef-exports-to-china/).

Rising trade tensions between the U.S. and China, which started earlier this year, raised concerns for U.S. beef exporters. Chinese tariffs on American beef soared as high as 145%, making it far more expensive than beef from countries like Brazil and Australia. Although those tariffs were later lowered to around 33%, the decline had already begun. On top of that, China let export approvals expire for nearly 400 U.S. beef processing plants in March, about 60% of all facilities allowed to ship beef to China, effectively blocking a large portion of U.S. supply (Marianetti, 2025). This move, seen as a non-tariff barrier, has created uncertainty, shaking confidence in the reliability of U.S. beef exports.

In 2025, rising trade tensions quickly took a toll on American beef in China (see Figure 1). From January to September, U.S. beef exports fell sharply-from $814 million in 2024 to $442 million in 2025-a 46% drop driven mostly by lower volumes. The decline was even steeper in the second and third quarters, after China let key export approvals expire, with U.S. beef falling nearly 70%. This happened even as China's overall beef imports grew in value. Meanwhile, Australia and Brazil gained ground: Australia's exports to China rose 42%, and Brazil's increased nearly 25%. In 2024, the U.S. held about 9% of China's beef import market, compared to Brazil's 48% and Australia's 9%. By the third quarter of 2025, the U.S. share had dropped to less than 1%, while Brazil and Australia accounted for 59% and 13%, respectively. It's a clear sign that when trade tensions rise, other suppliers are quick to take the lead.

Figure I. Chinese Beef Imports: 2024 and 2025 (Year-to-date: January-September)



Note: Imports are defined according to the Harmonized System (HS) classification HS 0202 *meat of bovine animals, frozen.* Frozen beef accounts for over 90% of China's beef imports.
Source: Trade Data Monitor®

References

Marianetti, J. (2025). USA Dairy Pork and Poultry Registrations Renewed while Beef Remains Overdue (GAIN Report No. CH2025- 0056). Foreign Agricultural Service, Washington, D.C.

Trade Data Monitor. (2025). https://tradedatamonitor.com/

Muhammad, Andrew. "Recent Trade Tensions Cause U.S. Beef to Lose Ground in China, Spurs Gains for Australia and Brazil." *Southern Ag Today* 5(44.4). October 30, 2025. Permalink

Andrew Muhammad

SOUTHERN AG TODAY

China's Agricultural Imports **from** U.S. **and Brazil Decline in** 2025 - **But the** U.S. **Faces** Sharper Losses

Thursday, October 2, 2025

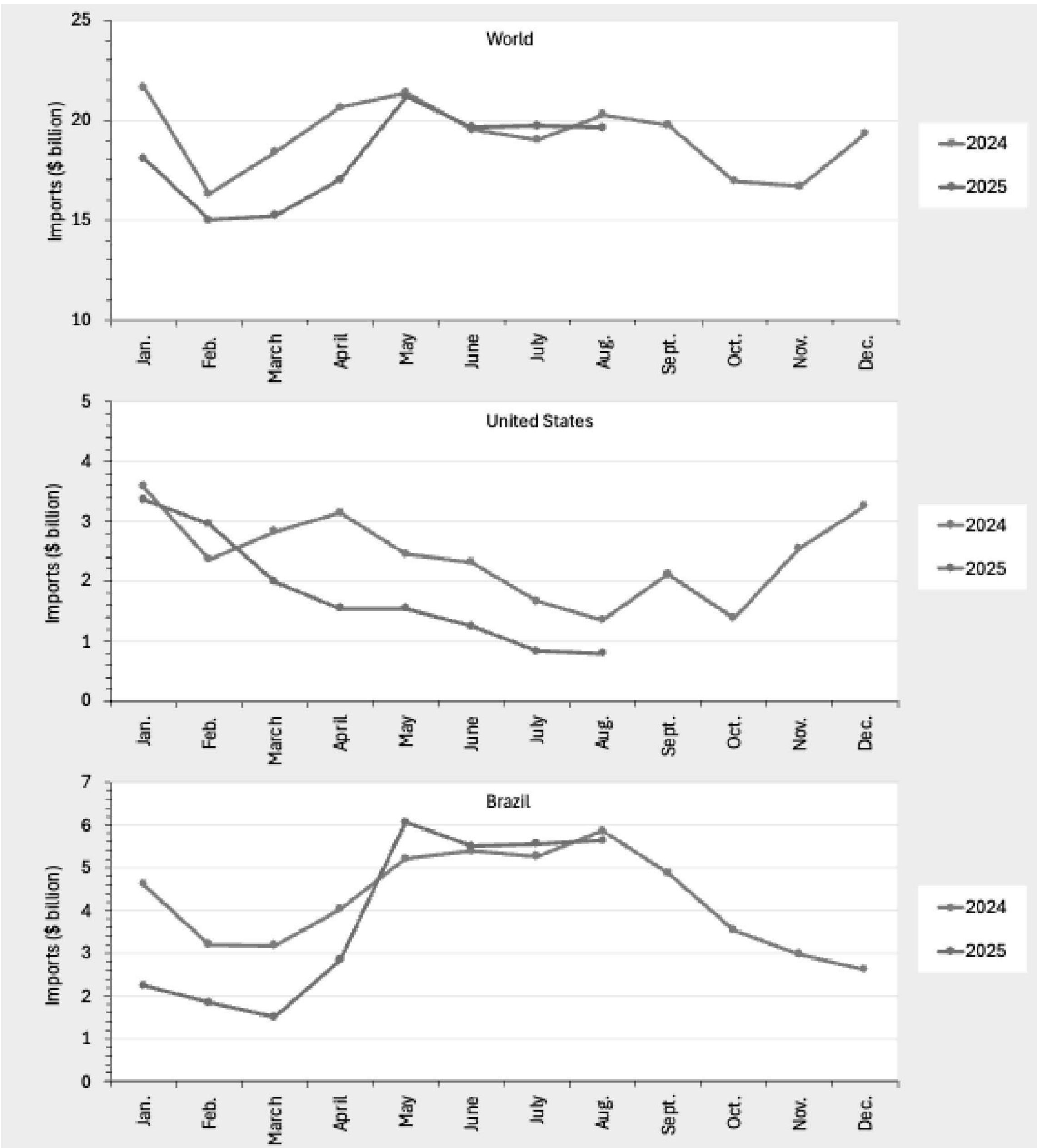
The decline in U.S. agricultural exports to China has made headlines, most notably due to China's decision not to purchase U.S. soybeans this season. Soybeans are the largest agricultural export for the United States, and China has traditionally been the top foreign buyer of U.S. soybeans, making this shift particularly significant for American producers. While stories have been mostly about declines in U.S. exports to China, it is important to note that China's agricultural imports-including related products like forestry, biodiesel, and seafood-are down overall in 2025 compared to 2024, reflecting a broader contraction in trade.

Figure I shows China's total agricultural imports from global sources, including the United States and Brazil. Overall, total imports declined in 2025 compared to 2024, with the most significant drop occurring during the first half of the year. For example, imports in January 2025 fell to approximately $18 billion, down from $22 billion in January 2024. A year-to-date comparison (January-August) shows total imports decreased from $157 billion in 2024 to $145 billion in 2025, a reduction of $12.I billion, or 7.5%. In terms of quantity or volume, the decline was even steeper-nearly 12% (Trade Data Monitor®, 2025), suggesting that lower import values were not solely driven by price changes but also by reduced quantities.

Although China's agricultural imports declined overall, imports from the United States experienced a sharper and more sustained drop, beginning later in the year. In January 2025, imports from the U.S. were down by only $220 million compared to the previous year, and in February, they were up by nearly $600 million. However, starting in March, imports consistently fell below 2024 levels. By August, year-to-date China's imports of U.S. agriculture and related products had dropped from $20 billion in 2024 to $14 billion in 2025, a decline of more than $5 billion, or 27.5%.

Brazil also experienced a decrease in agricultural export sales to China in 2025, though the decline was less severe than that of the United States. As of August 2025, imports from Brazil fell from $36.7 billion in 2024 to $31.2 billion, representing a 15.0% decrease. Month-to-month comparisons show sharper early-year declines: imports were down 51% in January, 43% in February, and 53% in March compared to the same months in 2024. However, beginning in May 2025, import levels from Brazil became more comparable to the previous year and even exceeded 2024 figures in some months. This mid-year rebound suggests that Brazil is benefiting from seasonal demand as well as favorable trade conditions.

Figure 1. China's total agricultural imports from the World, United States, and Brazil: January 2024 - August 2025



Note: Agricultural import values include related products like forestry, biodiesel, and seafood.
Source: Trade Data Monitor® (2025)

Reference

Trade Data Monitor®. (2025). Retrieved from https://www.tradedatamonitor.com

---

Muhammad, Andrew. "China's Agricultural Imports from U.S. and Brazil Decline in 2025 - But the U.S. Faces Sharper Losses." Southern Ag Today 5(40.4). October 2, 2025. Permalink

Andrew Muhammad

UTIA INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

Outlook for U.S. Agricultural Trade in 2025: Exploring the Recent August Forecasts

Thursday, September 4, 2025

The August 2025 *Outlook for U.S. Agricultural Trade* provides a snapshot of the current challenges and opportunities in global markets (USDA, 2025a). The quarterly report has long been a valuable tool for understanding how international trends affect the U.S. farm economy. In the past, it included both data and written commentary to explain possible causes behind trade shifts. However, the May 2025 report sparked controversy when its release was delayed. The issue centered on explanatory text that linked rising agricultural trade deficits to tariffs (Ingwersen & Douglas, 2025). As a result, the USDA removed the commentary and now publishes only data tables. This change has raised concerns about transparency and the loss of expert interpretation that helped make sense of complex trade dynamics.

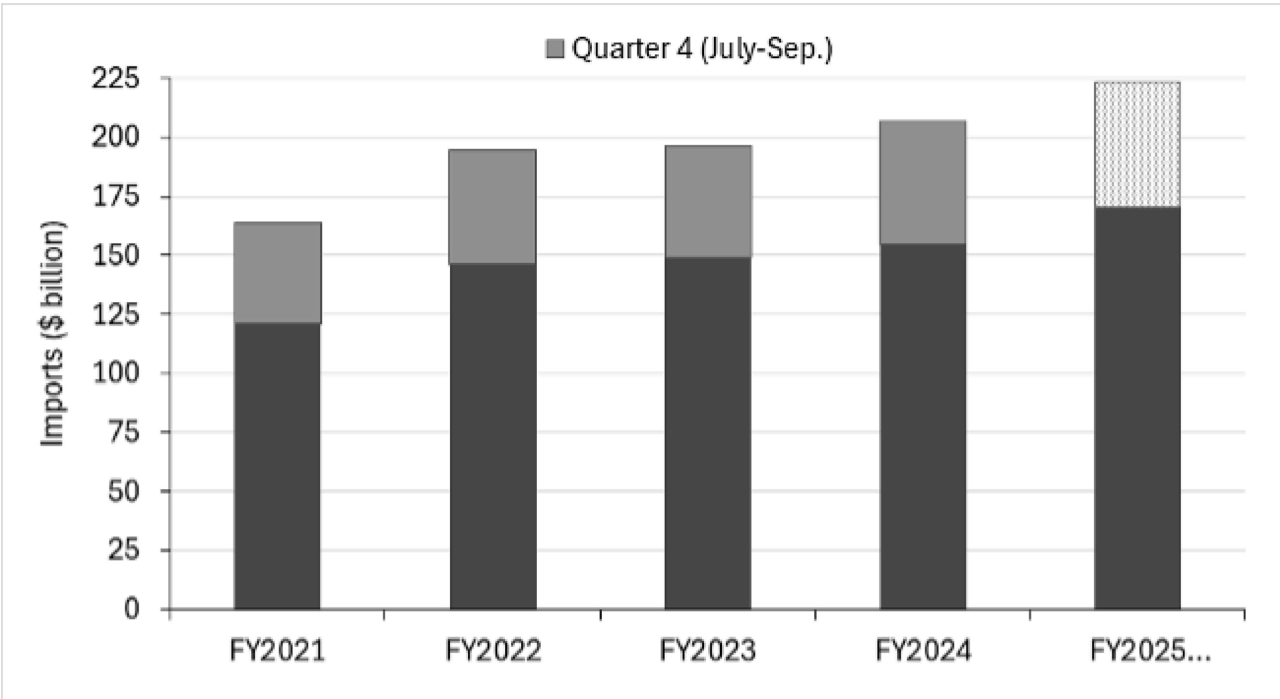
The August report shows that the U.S. will continue to import more agricultural goods than it exports. However, the projected trade deficit for fiscal year (FY) 2025-running from October to September-was revised downward from $49.5 billion in the May report to $47.0 billion. This adjustment was driven by an upward revision in forecasted exports, while the import forecast remained unchanged from May at $220 billion. For FY2025, exports are now expected to reach $173 billion, with imports holding at $220 billion.

These revisions raise important questions. Are they justified based on the available data? Most notably, is there clear evidence of increased export activity to support the upward revision? And given current trends, should the import forecast have been adjusted as well-either upward or downward? A closer look at recent trade is needed to assess whether these changes reflect actual market conditions or optimism.

Year-to-date (October to June) export values are reported in Table 1. The data suggest that the value of agricultural exports will remain relatively flat. During the first three quarters of the fiscal year, export values increased slightly from $135.0 billion in 2024 to $135.7 billion in 2025, which is a modest 0.6% rise. However, the volume of exports grew significantly, increasing from 162.4 million metric tons (MMT) to 175.9 MMT, an 8.3% increase. This growth in quantity was offset by a 7.2% decline in average prices (unit value), which fell from $831 /MT to $772/MT, suggesting lower prices per unit across many commodities. Depending on prices, the upward revision in the export forecast could be justified despite current trade tensions (USDA, 2025b).

Assuming fourth-quarter imports in FY2025 will follow patterns seen in recent years, available data suggest that total imports could reach $223 billion. This supports the decision to hold the official import forecast steady at $220 billion given the small $3 billion difference (USDA, 2025b). If ongoing trade tensions continue, it would not be surprising if actual imports were lower than $220 billion.

Figure I. U.S. Agricultural Imports: FY2021-FY2025



Note: FY is the fiscal year (October - September)
Source: U.S. Department of Agriculture, Foreign Agricultural Service, Global Agricultural Trade System (GATS) (2025b)

Table I. U.S. Agricultural Exports: FY2024 and FY2025 (year-to-date: October - June)

Exports	Oct. -June 2024	Oct. - June 2025	%Change
Value ($ billion)	$135.0	$135.7	0.6%
Quantity (MMT)	162.4	175.9	8.3%

Unit Value ($/MT)	$831.1	$777.5	-7.2%

Note: FY is the fiscal year (October - September)
Source: U.S. Department of Agriculture, Foreign Agricultural Service, Global Agricultural Trade System (GATS) (2025b

Reference

U.S. Department of Agriculture (USDA). 2025a. *Outlook for U.S. Agricultural Trade: August 2025.* https://www.fas.usda.gov/sites/default/files/2025-08/AES-133.pdf

U.S. Department of Agriculture (USDA). 2025b. *Global Agricultural Trade System (GATS).* Foreign Agricultural Service, Washington, D.C. https://apps.fas.usda.gov/GATS/default.aspx

Ingwersen, Julie and Leah Douglas. 2025. "USDA redaction of trade analysis causes concern about report integrity" *Reuters.* https://www.reuters.com/world/us/usda-redaction-trade-analysis-causes-concern-about-report-integrity-2025-06-06/

Muhammad, Andrew. "Outlook for U.S. Agricultural Trade in 2025: Exploring the Recent August Forecasts." *Southern Ag Today5(36.4).* September 4, 2025. Permalink

Andrew Muhammad