Economic Impact Study of USDA Export Market Development Programs: Update of Previous 2016 "Economic Impact of USDA Market Development Programs" Study

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Glossary

Award: Same as funds allocated to USDA through ATP ($200 million in 2018 and $100 million in 2019.

Elasticity: a measure of responsiveness. In the context of this study, the relative change in demand due to a relative change in price or promotion expenditures. Higher elasticity indicates more responsive demand.

Employment: total full- and part-time jobs resulting from direct spending.

Excess Demand (Supply): the difference between the quantity demanded (supplied) in the US and the quantity supplied (demanded) in the US.

Expenditures: USDA spending from MAP, FMD, and/or ATP funds. Expenditures may be less than funding available in a given year if all funds are not spent in that year. Expenditures may also be greater than funding available in a given year because USDA is able to roll forward unspent funds in a given year to a future year for spending.

Funds/Funding: Amounts allocated annually to MAP ($200 million) and FMD ($34.5 million) and provided through ATP ($200 million in 2018 and $100 million in 2019).

IMPLAN: (IMpact Analysis for PLANning) input-output model, data and software used to analyze economics under the less than full employment scenarios.

Labor Income: employee compensation and proprietor income resulting from direct spending.

Output: overall economic activity (sales) in the region resulting from direct spending.

Spending/Funds Spent: Amount of funds used to promote exports over a given period. Spending can refer to funds used from MAP, FMD, or ATP programs, and/or cooperator funding as indicated in text of report.

Value-Added: contribution to regional gross domestic product (GDP) through wages, profits, interest, and indirect business taxes resulting from direct spending.

USDA Export Market Development Programs: the total of USDA Foreign Market Development (FMD) program funding, USDA Market Access Program (MAP) funding, Agricultural Trade Promotion Program (ATP) and associated industry market promotion contributions.

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Executive Summary

a) Introduction

This study updates the previous cost-benefit analysis study done in 2016 by measuring the economic impact of USDA's Market Access Program (MAP) and Foreign Market Development (FMD) Program and industry market promotion contributions on US agricultural exports and the broader effects on the farm economy and the overall economy. The USDA MAP and FMD programs along with the associated industry cooperator contributions are referred to jointly in this report as the USDA Export Market Development Programs. The study also includes the Agricultural Trade Promotion Program in the future funding analysis. The study:

- Evaluated the effectiveness of the USDA Export Market Development Programs, including the Foreign Market Development Program (FMD) and Market Access Program (MAP) on increasing US agricultural exports over 1977-2019.
- Conducted an analysis of the impact of market promotion funding on exports, the farm sector and the overall economy.
- Determined whether and to what extent the benefits of the USDA Export Market Development Programs outweigh their costs by calculating benefit-cost ratios (BCRs) over the same period.
- Measured the average annual lift the programs provide to the value of US agricultural exports over the history of the program and in the future funding scenarios.
- Analyzed the benefits that USDA Export Market Development Programs provide to the US farm economy and the overall US macro economy.
- Conducted future funding scenarios to provide guidance on the implications of maintaining, increasing, or eliminating funding for the USDA Export Market Development Programs.

Econometric models and IMPLAN models were used to conduct the various analyses in the study following the process used in the previous study. This study takes price effects into account since it is likely that market promotion funding not only impacts exports but also influences prices. This study conducted sensitivity analyses to comply with OMB guidelines and to test the stability of the models and key parameters to provide increased confidence in the study results.

Although the results of this study and the previous study are not strictly comparable given that this analysis is based on:

- Econometric results generated from extensively revised historical data for most variables;

- Includes a much larger set of commodities (such as wood products and sea food and ethanol) that are promoted by USDA than considered in the 2016 report; and
- The analysis covered different time periods regarding the historical analysis as well as the future funding scenarios; etc.

The findings of this study support the findings of previous studies regarding the benefits of the market development programs.

b) Major findings

- The results of this study support/corroborate the conclusions of previous studies that the USDA Export Market Development programs are highly effective at generating an extremely high return on investment and account for a high percentage of the level of U.S. agricultural exports despite the different analytical methods used, different time periods of the studies, and different data sets used in the various studies over the years.
- This study along with the previous study emphasizes the importance of using multiple measures to provide a comprehensive evaluation of USDA export market development program effectiveness. While BCRs are commonly used to determine the effectiveness of programs, they do not consider the overall scale of a program's impact. Analyzing other measures, such as changes in export revenues, farm income, GDP, etc., in conjunction with BCRs provides a more comprehensive understanding of the full impact of market development programs.
- The study provides overwhelming evidence that export promotion has a positive and statistically significant impact on increasing demand for US exports through other demand factors such as prices, incomes, and exchange rates have a greater impact.
    - For bulk/intermediate agricultural products, a 10% increase in promotion spending in a given year increases exports by 0.9% over three years.
    - Promotion spending has a somewhat larger effect on exports of consumer oriented (HVP) agricultural products. A 10% increase in promotion spending in a given year increases HVP exports by 1.2% over three years.
    - The impacts associated with promoting bulk/intermediate and high-value/consumer-oriented exports represent lower bounds and hence are conservative. If the elasticities of promotion were interacted with the coefficients associated with each of the lagged dependent variables, the impacts of promotion on exports would be higher than reported. Technically the respective models for bulk/intermediate and high-value exports represent partial adjustment models (Nerlove and Addison, 1958).
- The study shows that USDA Export Market Development Programs continue to achieve what Congress intended when they were created to:
    - Boost agricultural export revenue and volume;
    - Support the farm economy; and
    - Enhance the overall US economy.

- The USDA Export Market Development Programs generated high benefit-cost ratios (BCRs).
  - This study determined that the US agricultural export value increased by $24.5 over 1977-2019 for every dollar invested in export market development.
    - In comparison, the previous study determined that US agricultural export value increased by $28 over 1977-2014 for every dollar invested in export market development.
    - The BCRs in the two studies are not strictly comparable given that this analysis is based on econometric results generated from extensively revised historical data for most variables and includes a much larger set of commodities that are promoted by USDA than considered in the 2016 report. Also, with the greater number of commodities and higher level of funding used in this analysis, a lower BCR would be expected relative to the previous report consistent with the principle of diminishing returns.
  - A common error is to assume that a high BCR implies a high impact and a low BCR implies a low impact of the program. Just because a BCR is lower for the more recent time period than for an earlier time period does not mean the program is less effective.
  - Although high BCRs indicate the programs are very effective; they also suggest the programs are underfunded.
    - For example, the BCR of 24.5 to 1 in this study indicates $24.5 in additional agricultural export revenue is forfeited for every dollar not allocated to the USDA Export Market Development Programs.
- In addition to a high BCR, this updated report again indicates that the USDA Export Market Development Programs also benefit export revenues and volume, the farm economy and overall economy. Although the results of this study on the farm economy and overall US economy are not strictly comparable since this analysis is based on IMPLAN results generated from extensively revised historical data for most variables, a different time period, includes a much larger set of commodities that are promoted by USDA than considered in the 2016 report and uses 2015 dollars as a base value[1] , they are quite consistent.
  - Boost export revenues and volumes. The results of this study show the programs sharply increased revenues by:

[1] Compared with a base value of 2020 dollars in the previous study.

    - Adding $9.6 billion on average annually to export value from 1977-2019. The previous study added $8.15 billion annually to export value from 1977-2014.
    - Adding $413.7 over the entire 1977-2019 period than would have been generated without the programs.
    - The annual lift in export revenues in this study for 1977 to 2019 was 13.7%. The annual lift in the previous study was 15.3% Thus, the results of this study and the previous study, regardless of the methodology used, the export products included, or the time period analyzed, demonstrate the effectiveness of USDA Export Market Development Programs on exports.
  - The IMPLAN analysis demonstrates that the effects of the programs go well beyond generating additional exports. The programs also contribute substantially to the farm economy.
    - The results show that the programs benefitted the farm economy by:
      - ✓ This study (2002-2019) found that $12.2 billion (3.4%) was added annually to farm cash receipts, $3.1 billion (4.4%) annually to net cash farm income and $1.4 billion (0.06%) annually to farm assets.
      - ✓ The previous study (2002-2014) found that $8.4 billion (2.7%) was added annually to farm cash receipts, $2.1 billion (3.7%) annually to net cash farm income and $1.1 billion (0.1%) annually to farm assets.
  - The IMPLAN results show that the USDA Export Market Development Programs benefitted the macro economy by:
    - This study (2002-2019) found that $45 billion (0.1%) was added annually in economic output, $22.3 billion (0.1%) annually in GDP and $11.7 billion (0.1%) annually in labor income. Also 225,800 jobs were created across the entire economy.
    - The previous study (2002-2014) found that $39 billion (0.2%) was added annually in economic output, $16.9 billion (0.1%) annually in GDP and $9.8 billion (0.1%) in annually labor income. Creating 239,800 jobs across the entire economy.
  - Although the content of the study and impacts on the farm economy and overall economy are different from the previous study, the results are consistent and support the argument that the market development programs are effective and benefit the farm economy and overall economy.
- The study also analyzed the possible effects of alternative levels of future funding for the USDA Export Market Development Programs to provide a clearer picture of

the potential impact of increased or decreased funding on US exports and the farm and macro economy.

- The results of three alternative future scenarios (MAP/FMD Doubles scenario, MAP Funding Increases by 50% scenario, and MAP/FMD Funding Eliminated scenario) over the 2024-2029 period are compared to those of a Flat Funding (Baseline) scenario to provide measures of the likely effects of alternative funding levels on US agricultural export revenue over that period as well as the impacts on the farm economy and overall economy. The results of an ATP Effects Scenario are also measured against those of a Flat Funding (Baseline) Scenario.
    - **ATP Effects Scenario**: US export revenue effects and impacts on the farm and overall economies of Agricultural Trade Promotion funds to the USDA Export Market Development Programs from 2019 through 2026 were considered. The total amount of ATP funds assumed to be spent over 2019 through 2024 is $390 million, including $300 million in awarded funds and $90 in associated cooperator contributions and impact continues for two additional years.
        - The scenario results indicate ATP funding will generate $11.1 billion in additional agricultural export revenue over the 2019-2026 period. The ATP funding is forecast to generate a Gross Export Revenue BCR of about 28.4 to 1. That is, spending from ATP funds, assumed to occur are forecast to generate $28.4 in additional export revenue for every dollar of ATP funding spent.
        - The results also show that ATP funding will benefit the farm economy.
            - ✓ Generating $810 million annually and $6.44 billion in cash receipts over the 2019-2026 period.
            - ✓ Increasing net cash farm income $130 million annually and $1.05 billion over the 2019-2026 period.
            - ✓ Generating $90 million annually and $700 million over the same time period in net cash farm income.
        - The ATP funding will also benefit the overall economy.
            - ✓ Adding $11.2 billion to GDP over the 2019-2026 period.
            - ✓ Increasing US output by $22.56 billion over the same time period.
            - ✓ Generating $6.56 billion in US labor income during the same time period.
            - ✓ US employment would add 14,780 jobs.
    - **MAP/FMD Funding Doubles Scenario**: Combined MAP and FMD funding remains at the current authorized level through 2023 but then is assumed to double to $469 million per year beginning in 2024. Associated Cooperator

contributions are assumed to grow at the same historic rate as the baseline scenario of about 2.5% from 2020 through 2023. Because MAP and FMD funding is assumed to increase after 2024, however, associated Cooperator contributions are assumed to increase by about 10% in 2023 and then grow from that level at the historic rate of about 2.5% through 2029. ATP funds (expenditures and contributions) are assumed to be spent through 2024. This future funding scenario was not included in the previous study.

- In this forecast simulation scenario, the value of US agricultural exports increases by $2.4 billion (1.3%) in 2024, $5.9 billion (3%) in 2025, and then by an annual average of $9.0 billion (4.3%) through 2029.
  - ✓ Thus, a doubling of MAP/FMD funding would generate an additional $44.4 billion in US agricultural exports over the entire 2024-2029 period (3.6%), an annual average of $7.4 billion.
- The farm economy will also benefit.
  - ✓ With farm cash receipts increasing annually by $3.75 billion and $22.5 billion over the 2024-2029 period.
  - ✓ Net cash farm income will increase $630 million annually and $3.76 billion over the 2024-2029 period.
  - ✓ Farm assets will increase $400 million annually and $2.38 billion over the same time period.
- The overall economy will also benefit.
  - ✓ With GDP increasing by $6.27 billion annually and $37.62 billion over the 2024-2029 period.
  - ✓ US output would also be $12.64 billion higher annually and $75.84 billion over the 2024-2029 period.
  - ✓ US labor income would be $3.64 billion more annually and $21.84 billion during the same time period.
  - ✓ US employment annually would be 64,520 jobs higher.

o **50% MAP increase Scenario**: MAP and FMD funding is assumed to remain at the current authorized level through 2023 but then ONLY MAP funding is assumed to increase by 50% ($100 million) beginning in 2024. This scenario is intended to provide a measure of the effects that a continuation of the ATP funding might have on exports. FMD funding is assumed to remain at the current budgeted level of $34.5 million for the entire period of 2020 through 2029. Because MAP funding is assumed to increase beginning in 2024, MAP cooperator contributions are assumed increase by 3% in 2023 and then grow at the historic rate of 2.5% over the 2024 - 2029 period.

    - The simulation analysis shows that if MAP funding is increased by 50% over the 2024-2029 period, exports over that period would increase by $16.8 billion (1.4%) compared to the baseline, an annual average increase of $2.8 billion. The previous study increased both MAP and FMD funding by 50% over the 2015-2030 period and showed that exports over that period would increase by $3.5 billion annually over the 2015-2030 period.
    - The farm economy will benefit:
        - ✓ With farm cash receipts increasing annually by $1.35 billion and $8.1 billion over the 2024-2029 period. In the previous study farm cash receipts would increase $2.4 billion annually over the 2015-2030 period.
        - ✓ Net cash farm income will increase $220 million annually and $1.3 billion over the 2024-2029 period. In the previous study net cash farm income would increase $600 million annually over the 2015-2030 period.
        - ✓ Farm assets will increase $150 million annually and $890 million over the 2024-29 time period. In the previous study farm assets would increase $300 million annually over the 2015-2030 period.
    - The overall economy will also benefit:
        - ✓ With GDP increasing by $2.39 billion annually and $14.3 billion over the 2024-2029 period. In the previous study GDP would increase $4.7 billion annually over the 2015-2030 period.
        - ✓ US output would also be $4.8 billion higher annually and $28.8 billion over the 2024-2029 period. In the previous study output would increase $10.8 billion annually over the 2015-2030 period.
        - ✓ US labor income would be $1.4 billion more annually and $8.4 billion during the same time period. In the previous study labor income would increase $2.7 billion annually over the 2015-2030 period.
        - ✓ US employment would be 25,410 jobs higher. In the previous study US employment would be 66,900 jobs higher.
- ○ Although the future funding scenario in this study increased only MAP funding by 50% and covered less years, the results of this scenario are consistent and support the argument that the market development programs are effective.

- **MAP/FMD Funding Elimination Scenario**: MAP and FMD funding is assumed to remain at the current budgeted level through 2023 but then is completely eliminated for both programs over the 2024-2029 period. Because MAP and FMD funding is eliminated, cooperator contributions also are assumed to be reduced by 50% during that same period.
  - The effects of eliminating MAP/FMD funding in 2024 through 2029 include:
    - ✓ A loss of $5.2 billion in US agricultural export revenue in 2024 (2.7%) which builds slowly each year to a loss of $21.0 billion in 2029 (9.8%). The total loss in agricultural export revenue is $96.5 billion (7.9%) over the 2024-2029 period, an average annual loss of $16.1 billion. In the previous study agricultural exports would drop $14.7 billion annually over the 2015-2030 period.
  - The farm economy will also be adversely impacted:
    - ✓ With farm cash receipts decreasing annually by $5.27 billion and $31.65 billion over the 2024-2029 period. In the previous study farm cash receipts would fall $9.9 billion annually over the 2015-2030 period.
    - ✓ Net cash farm income will decrease $990 million annually and $5.9 billion over the 2024-2029 period. In the previous study net farm income would fall $2.5 billion annually over the 2015-2030 period.
    - ✓ Farm assets will decrease $480 million annually and $2.9 billion over the 2024-2029 time period. In the previous study farm assets would fall $1.3 billion annually over the 2015-2030 period.
  - The overall economy will also be adversely impacted:
    - ✓ With GDP decreasing by $13.7 billion annually and $82.4 billion over the 2024-2029 period. In the previous study GDP would decrease $19.5 billion annually over the 2015-2030 period.
    - ✓ US output would also be $27.6 billion lower annually and $165.3 billion over the 2024-2029 period. In the previous study output would decrease $45.3 billion annually over the 2015-2030 period.
    - ✓ US labor income would be $8.1 billion less annually and $48.65 billion during the same time period. In the previous study labor income would decrease $11.3 billion annually over the 2015-2030 period.

        - ✓ US employment would be 148,840 jobs lower. In the previous study US employment would be 278,600 jobs lower.
    - Although the future funding scenario in this study is the same as the previous study but covered less years and has a different year for the base value, the results of this scenario are consistent with the previous study in that the elimination of MAP/FMD funding would adversely affect exports, the farm economy and the overall economy.

The major takeaway from the future funding scenarios is that increasing funding for USDA Export Market Development Programs will significantly benefit export revenues, the farm economy and the overall macroeconomy. At the same time the elimination of MAP and FMD funding will have a significant negative impact on export revenues, the farm economy and the overall economy.

Background

a) USDA Export Market Development Programs

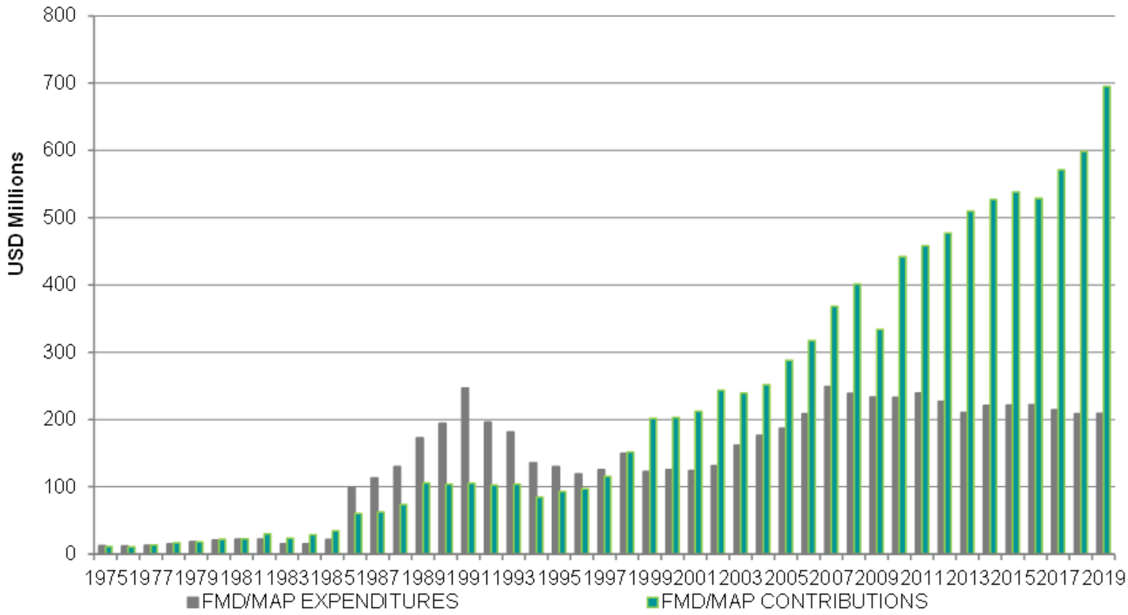
The Market Access Program (MAP) and Foreign Market Development program (FMD) are the US Department of Agriculture's (USDA) primary export promotion programs. These programs are public-private partnerships between the Foreign Agricultural Service (FAS) and nonprofit US agricultural trade associations, farmer cooperatives, nonprofit state-regional trade groups and small businesses to conduct overseas marketing and promotional activities. The USDA MAP and FMD programs along with the contributions of industry cooperators are referred to jointly in this report as the USDA Export Market Development Programs. The Foreign Agricultural Service (FAS) administers these programs within the USDA. FAS provides cost-share assistance to eligible US organizations for activities such as consumer advertising, public relations, point-of-sale demonstrations, participation in trade fairs and exhibits, market research, and technical assistance.

MAP promotes US agricultural and food product exports by focusing on consumer promotion, market research, trade shows, and trade servicing. In FY 2021, FAS provided cost-share assistance through MAP to nearly 60 eligible US agricultural trade associations, cooperatives, state regional trade groups and small businesses to share their costs of overseas marketing and promotional activities that help build commercial export markets for their products. MAP funding is used for both generic and brand promotion of processed products, fruits, vegetables, nuts and other consumer-oriented or high value (HVP) products as well as some bulk and intermediate products. When MAP funds are used for promoting generic commodities, participants must contribute a minimum 10 percent match. For promotion of branded products, a dollar-for-dollar match is required. The MAP program began in 1985.

The intent of the FMD program is to provide trade servicing and trade capacity building through efforts to open, expand, and maintain long term markets for US agricultural products. FAS partners with US agricultural producers and processors represented by non-profit commodity or trade associations called cooperators. The FMD program was first established in 1956 under authority of Public Law 480 and then reauthorized by Title VII of the Agricultural Trade Act of 1978. In FY 2021, the FMD program allocated funding to 21 agricultural trade organizations for generic promotion of US agricultural exports.

MAP and FMD funding for 2019 funded under the 2018 Farm Bill amounted to $234.5 million ($200 million for FMD and $34.5 million for MAP). Expenditures of FMD and MAP funds in that year amounted to $175.52 million and $33.58 million, respectively ($209.1 million total). In comparison, MAP and FMD contributions by cooperating organizations in 2019 totaled $604.62 million and $90.42 million, respectively. Total spending on export market development and promotion by the government and contributions by industry partners climbed steadily over the period 1975 to 2019, reaching a high of $904 million in 2019. Total annual expenditures on export market development and contributions by industry partners has increased sharply since 2009, amounting to nearly $700 million in 2019.

Exhibit 1: USDA Export Market Development Program Funding, 1975-2019



Note: Includes market promotion funding through the FMD and MAP Programs and industry contributions. Calendar year basis.

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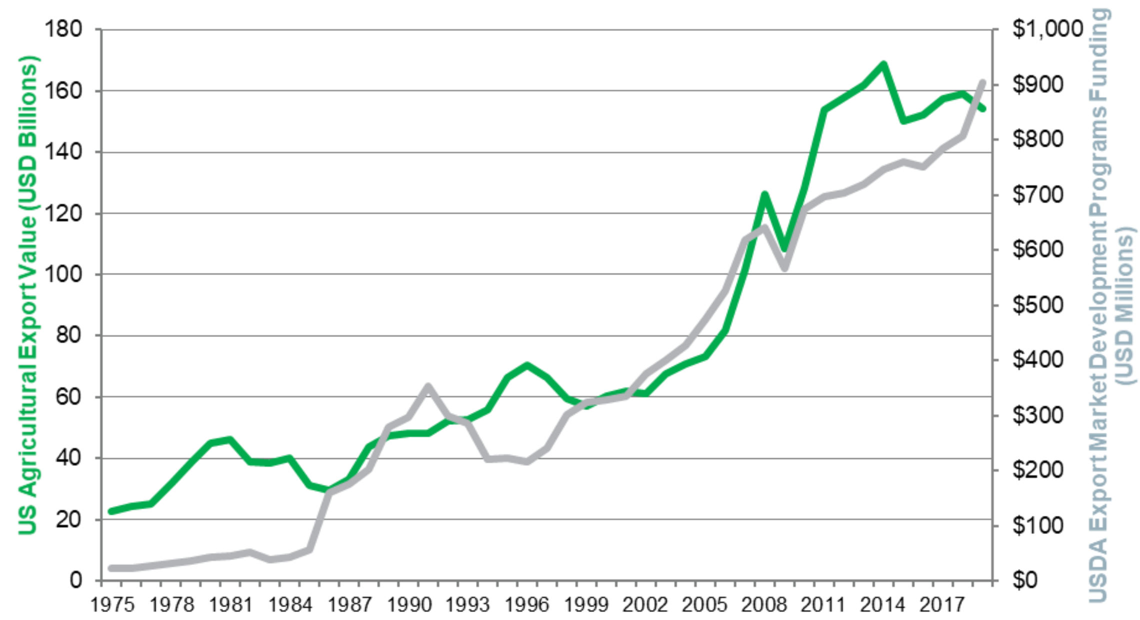
Since 2013, industry contributions have been 70 to 77 percent of the total USDA Export Market Development Programs. In 2019, industry contributions accounted for 77 percent of the total USDA Export Market Development Programs. The growth in contributions demonstrates that industry partners recognize the success of the MAP and FMD programs in opening, expanding, and maintaining export markets.

Funding under the USDA Export Market Development Programs has grown with the value of US agricultural exports largely on the strength of growing industry contributions. The correlation of export market promotion funding with the value of total US agricultural exports (bulk/intermediate exports plus consumer-oriented exports) is close to 0.95. This parallel movement of export market promotion funding and the value of total agricultural exports is illustrated in Exhibit 2.

Exhibit 2: Value of US Agricultural Exports and USDA Export Market Development Programs Funding, 1975-2019



Note: Includes market promotion funding through the FMD and MAP Programs and industry contributions. Calendar year basis.
Source: Data provided to authors directly by the Foreign Agriculture Service (USDA).

U.S. Secretary of Agriculture Sonny Perdue announced additional funding for U.S. Department of Agriculture (USDA) of $200 million in 2018 and $100 million in 2019 through the Agricultural Trade Promotion Program (ATP) (Foreign Agricultural Service, 2019). The funds were allocated to applicants in January 2019 ($200 million) and July 2019 ($100 million). The ATP provides cost-share assistance to US agricultural industries to conduct activities that promote US agricultural commodities in foreign markets for commodities impacted by tariffs, including activities that address existing or potential non-tariff barriers to trade. Such activities include consumer advertising, public relations, point-of-sale demonstrations, participation in trade fairs and exhibits, market research, and technical assistance. The ATP funding is available to all sectors of US agriculture, including fish and forest product producers, mainly through partnerships with non-profit national and regional organizations. FAS administers the ATP under authority of the Commodity Credit Corporation Charter Act.

b) Commodity Breakouts and Export Trends

This study developed two separate trade econometric models, similar to what was done in the previous study (Williams et al. 2016), including bulk and intermediate products combined and consumer-oriented/high-value products. Using the terminology developed by the FAS, bulk agricultural products include those commodities which have received little or no processing, such as wheat, corn, soybeans, and cotton. Tropical products, such as green coffee, cocoa, raw sugar, and natural rubber, are also included in this category but are excluded from the analysis conducted is this study because they are not promoted commodities. In contrast, intermediate products generally include agricultural products that have a higher per-unit value than bulk commodities and often are partly processed but not necessarily ready for consumers. Examples include soybean meal, wheat flour, vegetable oils, feeds and fodders, animal fats, hides and skins, and live animals. In addition, bulk/intermediate exports include wood products, ethanol, and biodiesel products. Finally, high-value products (HVP) are usually (but not always) ready, or easily made ready, for immediate use by consumers. Examples include snack foods, breakfast cereals, bakery mixes, eggs and products, dairy products, fresh or processed red meats and poultry meats, fresh or processed fruits and vegetables, tree nuts, pet foods, wine, seafood, nursery products, distilled spirits, etc. The list of export commodity groups is in Appendix A.

The value of US exports of agricultural products was $154 billion in calendar year 2019. Since 2011, the value of US agricultural exports ranged from a low of $150 billion to a high of $169 billion. Over the same period, the value of bulk/intermediate exports ranged from a low of $79.1 billion in 2019 to a high of $93.4 billion in 2014 (Exhibit 3). The value of consumer-oriented/high-value exports varied from a low of $61.7 billion in 2011 to a high of $75.3 billion in 2014 (Exhibit 3). From 1975 through 2019, the value of bulk/intermediate product exports was always higher than the value of consumer-oriented/high value exports although the gap is narrowing.

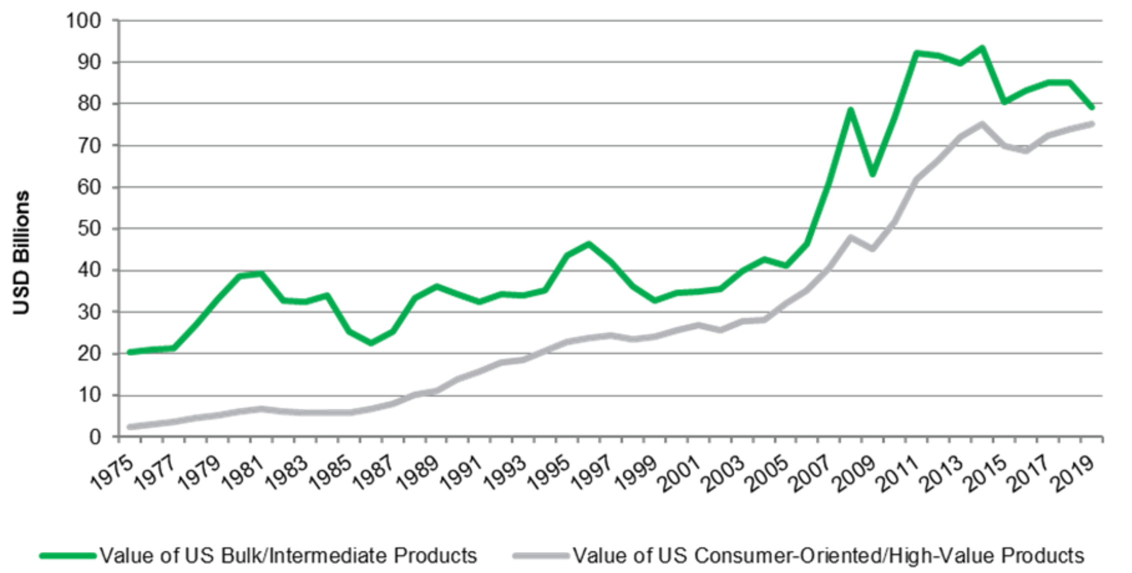
USDA Market Development Program spending to promote consumer-oriented products was about equal to that for bulk/intermediate product exports in 1986 at about $84 million (Exhibit 4). However, spending to promote consumer-oriented products grew at a more rapid pace over time, reaching $632.4 million in 2019 and accounting for just over two-thirds of total spending (67.5%). Total USDA Market Development Program spending (including both expenditures from federally allocated funds and contributions from contributors) grew from about $23.6 million in 1975 to $936.6 million in 2019 (Exhibit 4).

Econometric Analysis of US Agricultural Export Demand

Two export demand equations representing US bulk/intermediate (BULK) exports and consumer-oriented/ high value product (HVP) exports were developed and estimated through econometric analysis using annual data for 1975 through 2019. The method of estimation was ordinary least squares (OLS), and the software package used to produce the econometric results was EVIEWS 11.0.

Econometric analysis allows analysts to discern the impacts of selected economic factors like promotion expenditures on agricultural exports by statistically accounting for the influence of other factors that may potentially influence agricultural exports. This process essentially isolates the impact of the factor of interest from those of all other hypothesized impact factors on the changes in the level of agricultural exports.

Exhibit 3: Value of US Exports of Bulk/Intermediate and High-Value Products, 1975-2019



Note: Calendar year basis.
Source: Data provided to authors directly by the Foreign Agriculture Service (USDA).

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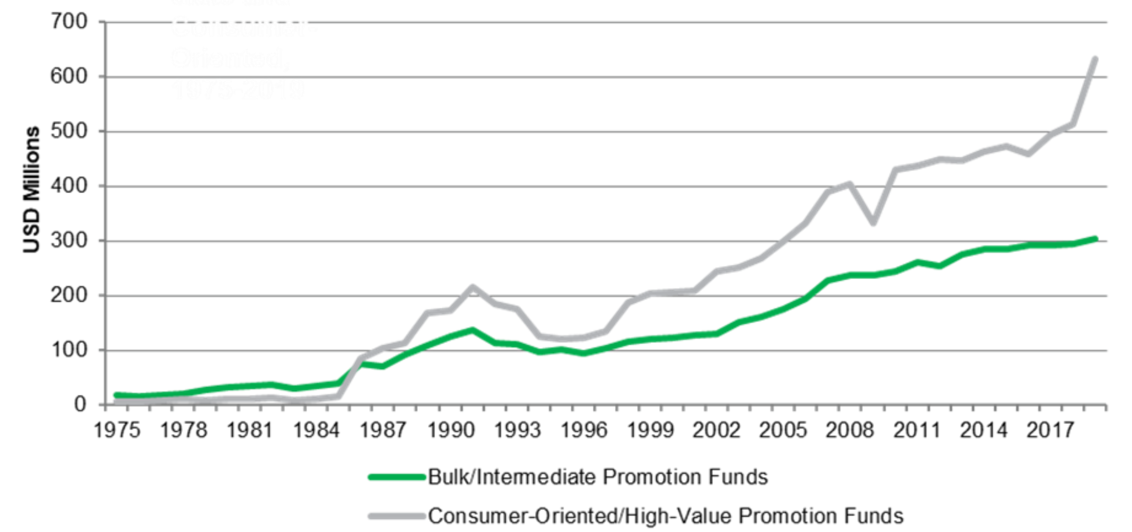
Exhibit 4: USDA Market Development Program Promotion Funds Spent for Bulk/Intermediate and Consumer oriented Products, 1975 – 2019



Note: Calendar year basis.
Source: Data provided to authors directly by the Foreign Agriculture Service (USDA).

a) Bulk and Intermediate Export Demand Analysis

Following the 2016 study by Williams et al., the generalized bulk/Intermediate export demand equation specification is as follows:

(1) $BULK_t = f(UBP_t, RGDP_t, XUSTW_t, WGDEF_t, RBPROD_t, RPOP_t, BULK_{t-1}, GBULK_t, ZB_t)$

where BULK is US bulk and intermediate agricultural exports (1,000 mt), UBP is the BULK export price ($/mt unit value), RGDP is foreign real GDP ($US billion), XUSTW is the US agricultural trade-weighted exchange rate index, WGDEF is the world GDP deflator, RBPROD is the production of bulk commodities by the rest of the world (1,000 mt), RPOP is the population of non-US countries (the rest of the world or ROW) (millions), GBULK is the “goodwill” stock of USDA Export Market Development Programs spending (expenditures plus cooperator contributions) to promote exports of US bulk and intermediate commodities ($US million), and ZB represents specific other factors and events affecting the demand for US bulk and intermediate agricultural exports. The proxy for RBPROD in this analysis is foreign crop production.

In estimating the parameters associated with the right-hand side variables in equation (1), RPOP was highly correlated with other variables in the model specification. To mitigate this degrading collinearity issue, we divided rest-of-the-world GDP (RGDP) by RPOP. Also, to account for changes in the purchasing power of foreign currency over time, the price (per unit value) of US bulk exports (UBP) and the USDA Export Market Development Programs promotion expenditures in GBULK were inflation-adjusted using the world GDP deflator (WGDEF) and exchange-rate-adjusted using the US agricultural trade-weighted exchange rate index (XUSTW)[2]. Thus, the BULK export demand equation was operationalized for estimation as follows:

(2) $BULK_t = f(UBP_t*XUSTW_t/WGDEF_t, RGDP_t/RPOP_t, RBPROD_t, BULK_{t-1}, GBULKP_t, ZB_t)$

$GBULKP_t$ is total deflated, exchange-rate-adjusted spending for the promotion of bulk and intermediate US agricultural commodities. $GBULKP_t$ is constructed as $BULKTOT_t*XUSTW_t/WGDEF_t$ and $BULKTOT_t$ is the total USDA Export Market Development Programs promotion spending for BULK exports which includes both contributions by cooperators and FMD/MAP expenditures to promote bulk and intermediate commodities.

Exhibit 5 shows the volume of US exports of bulk/intermediate products from 1975 to 2019. On average, the volume of bulk/intermediate products was 152 million metric tons, ranging from 96 million metric tons to 202 million metric tons over this period. In 2019, the volume of US exports of bulk/intermediate products was 180 million metric tons.

Export demand equations typically are estimated with lagged exports as an explanatory variable in what is formally referred to as a Nerlovian partial adjustment model. Rigidities in a system like international trade due to adjustment costs and incomplete information imply that the adjustment of exports to changes in the explanatory variables is not instantaneous but rather takes time. Thus, changes in exports in one year are hypothesized to be positively related to changes in those exports in the previous year.

Importantly, we followed the common procedure of using the Almon polynomial distributed lag (PDL) formulation to account for the time lag between the expenditure of promotion funds and the impact on US exports of bulk and intermediate commodities[3]. The search for the pattern, polynomial degree, and time period over which the promotion expenditures influence US exports of bulk and intermediate

[2] "Any effects of "economic downturns" on Bulk exports are captured through the price, macroeconomic, and indicator variables (used to represent ZB as discussed below) included in the equation".

[3] With the distributed lag approach, one obtains short-run effects as well as long-run effects. The short-run effects are tantamount to the contemporaneous response of exports to promotion. The sum of the coefficients associated with the lag distribution of promotion correspond to the long-run effects. This approach is standard practice in the economics literature. This distributed lag approach is better than providing impacts for each year separately. Changes in export promotion not only result in changes in exports but also the consequential impacts are distributed over time.

agricultural commodities involved a series of nested OLS regressions. Lags of up to 10 years and up to fourth degree polynomials with alternative choices of head and tail restrictions were considered. As such, no assumptions were made concerning the length of the lag. Based on a composite set of criteria, including the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC), the Hannan-Quinn criterion (HQC), and heuristic measures[4] (e.g., significance and signs of the estimated parameters in the equation), a second order PDL of the current period and two lags with head and tail restrictions was selected. As stated previously, before being transformed in this way to create the estimated form of $GBULKP_t$, $BULKTOT_t$ was first deflated, and exchange rate adjusted.

US bulk/intermediate agricultural exports also are likely impacted by qualitative events from year to year (ZB_t in equation (2)). While income, population, inflation, prices, and other variables largely explain the longer-term trends in exports, various events account for much of the deviation of exports around these trends from year to year. To determine what events have impacted exports, we hypothesize that a number of qualitative events potentially affect the level of bulk/intermediate exports over time. These events are treated as indicator variables econometrically. An indicator variable takes on the value of 1 in the year of the event and 0 in other years. We sequentially tested the significance of each of 50 hypothesized events to determine the significance of each in impacting bulk/intermediate agricultural exports. These variables were related to: (1) weather and natural events; (2) animal & crop disease events; (3) trade issues/events; (4) economic events; (5) farm policy events; and (6) political events variables. We provide the complete list of these indicator variables in Appendix B[5].

To capture diminishing marginal returns to the export promotion expenditures over time, we used a logarithmic transformation of GBULKP as is commonly done in other studies of domestic and export promotion (see, for example, Kaiser 2010a, Kaiser 2010b, Global Insight 2006 and 2010, Williams et al. 2016, and Williams and Capps 2020 to name just a few). We also employed a logarithmic transformation for all other non-discrete variables in the model. Consequently, the estimated parameters associated with the explanatory variables are elasticities. With the log-log functional

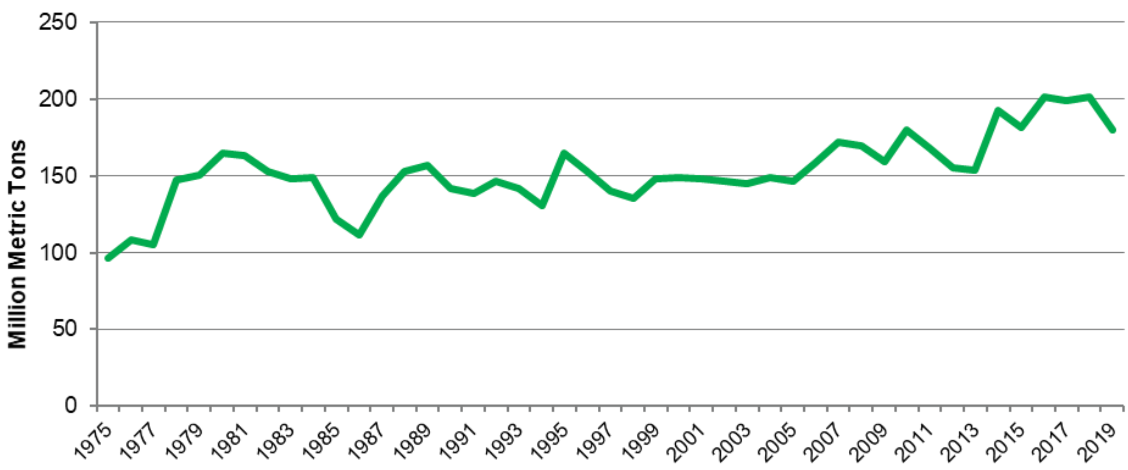
[4] The heuristic aspect of the composite criteria may be viewed as *ad hoc* but is equivalent to restricting the class of models to be only those consistent with underlying theory. This procedure is commonly encountered in the literature, especially in analyses where equilibrium displacement models are used and only parameter values consistent with theory are utilized.

[5] The process of testing the significance of the large number of indicator variables was about sensitivity of the results to different specifications regarding various events. Many of the events covered the same or similar time periods so that collinearity among indicator variables was an issue. The indicator variables found to be significant likely picked up effects of multiple events. Additionally, US-China trade tensions occurred at the very end of the period of analysis. As such, it should not be surprising that the US-China trade tension indicator variable was not a statistically significant driver of exports. "In future analyses, this event could well prove to have a statistically significant influence on the volume of exports."

form for non-discrete explanatory variables, the elasticities are constant over the period of the analysis.

The econometric results associated with bulk/intermediate exports are shown in Exhibit 6, where all non-discrete variables are in natural log form. The parameters of the equation were estimated over the 1975-2019 sample period[6]. As suggested by the Office of Management and Budget (OMB) guidelines for conducting benefit-cost analyses (OMB 1992), we conducted a sensitivity analysis of the estimated model, comparing the actual historical data for BULK exports to the model-generated values of the historical levels of those exports. As indicated by the R^2 statistic, the model explains over 95% of the annual variations in bulk and intermediate exports, meaning that the model predictions are an excellent fit of the actual values of BULK exports over the sample period. In addition, the within-sample mean absolute percent error (MAPE) is 2.16%, also indicative of exceptional goodness-of-fit. All estimated parameters are statistically different from zero and their signs and magnitudes are all consistent with *a priori* expectations. As well, the Durbin Watson, Durbin-h, and Breusch-Godfrey statistics indicate no evidence of autocorrelation. Importantly, this finding supports the use of OLS as the estimation method.

Exhibit 5: Volume of US Exports of Bulk/Intermediate Products, 1975-2019



Source: Data provided directly to authors by the Foreign Agricultural Service (USDA). © 2021 IHS Markit

[6] In the simulation analysis to follow, the simulation is conducted over the 1977-2019 period because two observations are lost given the two-year estimated lag in promotion expenditures.

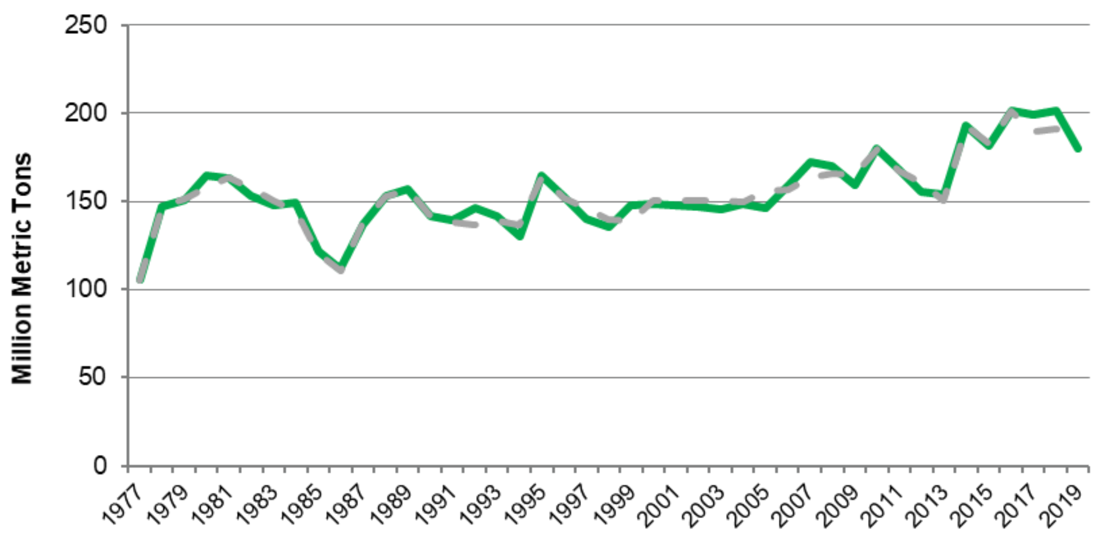
Exhibit 6. Econometric Analysis of Bulk/Intermediate Agricultural Export Demand, 1977 – 2019

Parameter Estimates				
Variables (in natural logs except indicator variables)	Estimate	Standard Error	t-statistic	p-value
Intercept	15.8381	2.0983	7.55	0.0000
Real exchange-rate-adjusted bulk export price (UBPR)	-0.0926	0.0659	-1.40	0.1711
Foreign real per capita GDP (RGDPP)	0.6515	0.1070	6.09	0.0000
Foreign bulk commodities production (RBPROD)	-0.6783	0.0983	-6.90	0.0000
Lagged dependent variable $(BULK)_{t-1}$	0.6181	0.0915	6.76	0.0000
US Enhancement Program indicator variable (1987)	0.2240	0.0439	5.10	0.0000
US Enhancement Program indicator variable (1988)	0.1797	0.0392	4.59	0.0000
Japanese Beef Agreement indicator variable (1989)	0.1254	0.0403	3.11	0.0042
Chinese corn & soybean trade policy indicator variable (1995) (DT6)	0.2072	0.0391	5.30	0.0000
Droughts in California indicator variable (1977)	-0.1454	0.0540	-2.69	0.0119
USSR crop problems indicator variable (1978)	0.2094	0.0521	4.02	0.0004
Russian drought export ban indicator variable (2010)	0.1092	0.0385	2.84	0.0084
China's approval of MIR 162, EU Cap reform indicator variable (2014)	0.2039	0.0410	4.97	0.0000
Drought in South America indicator variable (2016)	0.1191	0.0390	3.06	0.0049
Goodwill Variable of Bulk Promotion Expenditures (GBULKP)				
Real, exchange-rate-adjusted bulk promotion expenditures in current period ($GBULKP_t$)	0.0264	0.0099	2.68	0.0123
Real, exchange-rate-adjusted bulk promotion expenditures lagged one period ($GBULKP_{t-1}$)	0.0352	0.0132	2.68	0.0123
Real, exchange-rate-adjusted bulk promotion expenditures lagged two periods ($GBULKP_{t-2}$)	0.0264	0.0099	2.68	0.0123
Sum of lags	0.0881	0.0329	2.68	0.0123
Regression statistics: $R^2 = 0.9521$ DW = 1.9223 Durbin-h = 0.3186				

Source: Estimation done with the use of the software package EVIEWS 11.0.

Exhibit 7 illustrates the ability of the model to replicate the level of the actual volume of US agricultural exports of bulk/intermediate products. Over the period 1977 to 2019, the actual and predicted values of the volume of US agricultural bulk/intermediate products are in close alignment.

Exhibit 7: Bulk/Intermediate Exports, Actual and Predicted Values, 1977-2019



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The estimated own-price elasticity of -0.0926 indicates that US bulk/intermediate agricultural export demand is price inelastic. A 10% increase in the price of bulk exports results in a 0.93% decline in bulk exports, holding all else constant. This result is consistent with the conventional expectation that the demand for bulk/intermediate agricultural commodities is not highly sensitive to changes in unit prices. This estimated price elasticity is lower than the -0.2761 reported in the previous study (Williams et al. 2016).

The estimated income elasticity is 0.6515. Not surprisingly, the relationship is inelastic such that a 10% increase in foreign real per capita income increases bulk/intermediate commodity exports by 6.52%, holding all else constant. This result is consistent both with the long-held expectation that the demand for bulk/intermediate agricultural commodities is inelastic with respect to changes in income (see, for example, World Bank 1994) and with the 0.5275 income elasticity estimated by Williams et al. (2016).

Also, as expected, increases in foreign crop production have a negative, inelastic impact on US bulk exports. A 10% increase in foreign crop production reduces US bulk/intermediate exports by 6.78%, holding all else constant. The previous study found a similar effect of foreign crop production on US bulk/intermediate exports with an elasticity of -0.47.

Bulk/intermediate exports in the current year are positively related to those exports in the previous period as expected. A 10% increase in bulk/intermediate exports in the previous year increases bulk/intermediate exports in the current year by 6.18%. This impact is larger than the results in the previous study wherein a 10% increase in bulk/intermediate exports in the previous year increased bulk/intermediate exports in the current year by 2.83%.

Seven events were found to have statistically significant positive effects on US bulk and intermediate agricultural exports: (1) USSR crop problems in 1978; (2) the Chinese ban on their corn exports in 1995; (3) droughts in South America in 1989, 2014 and 2016; (4) China's approval of MIR 162 and EU CAP reform in 2014; (5) the US Export Enhancement Program (EEP) in 1986 and1987; (6) the Japanese Beef Agreement in 1989; and (7) the Russian drought export ban in 2010. The only event with a statistically significant negative effect on US bulk and intermediate agricultural exports was the drought in California that occurred in 1977.

The estimated elasticities of the goodwill variable (GBULKP) in equation (2) indicated that total USDA Export Market Development Programs spending to promote bulk and intermediate agricultural exports had a statistically significant and positive effect on those exports over time. The promotion elasticity, normally referred to as the long-run promotion elasticity, was estimated at 0.08811 and was calculated as the sum of the elasticities in the current and two past periods (see Exhibit 6). This estimated long-run elasticity is consistent with such elasticities estimated for other export demand promotion programs. This long-run elasticity is a *static* measure of promotion impact and assumes that all else is held constant. As such, if total USDA Export Market Development Programs promotion were to increase by 10%, then US bulk/intermediate exports would increase by nearly 0.88% over three years. Further, if total USDA Export Market Development Programs promotion were to double (tantamount to a 100% increase), then US bulk/intermediate exports would rise by almost 9%. Note that this measure of the effect of promotion on exports assumes that the export price remains unchanged with changes in promotion. Any price effects caused by promotion, which would also affect the level of exports, are ignored. This issue is discussed in more detail in a subsequent section of this report.

Given the presence of the lag in the dependent variable, a *dynamic* long-run elasticity also can be calculated by dividing the *static* long-run promotion elasticity by one minus the estimated coefficient of the lagged bulk/intermediate exports. The result was a *dynamic* long-run elasticity of 0.2307, larger than the long-run elasticity of 0.1482 in the previous report[7].

To test the robustness of the estimated export demand promotion elasticity for bulk/intermediate exports, we conducted a sensitivity analysis in conformance with OMB guidelines for conducting benefit-cost analyses (OMB 1992). Confidence intervals set at a level of significance of five percent (the industry standard) were computed for bulk/intermediate long-run market development/promotion elasticity. This is the interval over which true promotion elasticity would be expected to fall 95% of the time. The 95% confidence interval for the bulk/intermediate *static* long-run elasticity ranges from 0.0236 to 0.1527.

b) High Value Product (HVP) Export Demand Analysis

The generalized HVP or consumer-oriented export demand equation specification also follows Williams et al. (2016) and is expressed as follows:

(3) $HVP_t = f(UHP_t, RGDP_t, XUSTW_t, WGDEF_t, RHPROD_t, RPOP_t, HVP_{t-1}, GHVP_t, ZH_t)$

where HVP is US consumer-oriented/high-value product (HVP) exports, UHP is the HVP export price (unit value), RGDP is foreign real GDP, XUSTW is the US agricultural trade-weighted exchange rate index, WGDEF is the world GDP deflator, RHPROD is the production of high value products by the rest of the world, RPOP is the population of non-US countries (the rest of the world or ROW), GHVP is the "goodwill" stock of USDA Export Market Development Programs spending (expenditures plus cooperator contributions) to promote US HVP exports, and ZH represents specific other forces and events affecting the demand for US HVP exports. The proxy for RHPROD in this analysis is foreign meat production.

As with the BULK export equation, due to the high correlation of RPOP with other right-hand-side variables, we divided rest-of-the-world GDP (RGDP) by RPOP to mitigate this degrading collinearity issue. Also, to account for changes in the purchasing power of foreign currency over time, the prices (per unit value) of US HVP exports (UHP) and the USDA Export Market Demand Programs promotion expenditures in GHVP also were inflation-adjusted using the world GDP deflator (WGDEF) and exchange-rate-adjusted using the US agricultural trade-weighted exchange rate index (XUSTW)[8]. Thus, the HVP export demand equation was operationalized as follows:

[7] Consequently, the impacts reported represent lower bounds and hence are conservative.

[8] "Any effects of "economic downturn" on HVP exports are captured in the same manner as for BULK exports. See footnote 3."

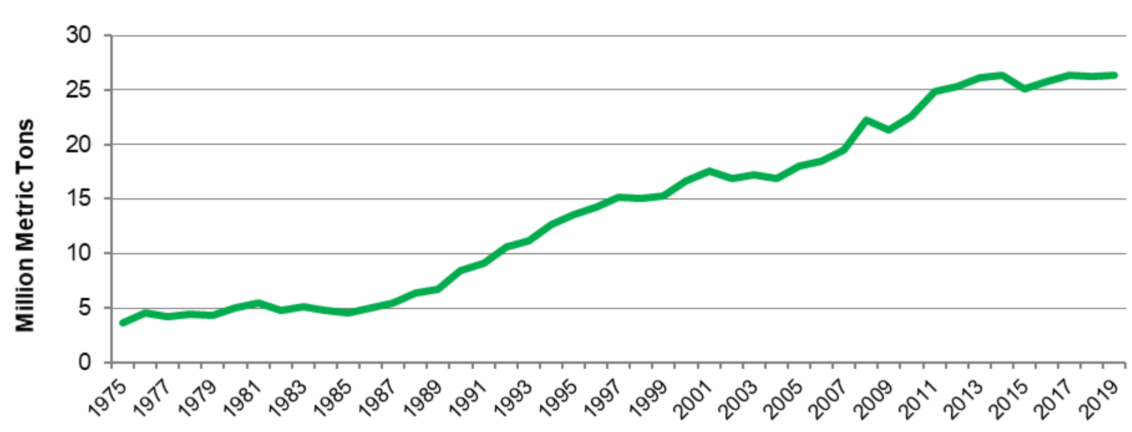
(4) $HVP_t = f(UHP_t{*}XUSTW_t/WGDEF, RGDP_t/RPOP, RHPROD_t, HVP_{t-1}, GHVP_t, ZH_t)$

where $GHVP_t$ is total deflated, exchange-rate-adjusted spending for the promotion of US consumer-oriented/high value product exports and is constructed as $HVPTOT_t{*}XUSTW_t/WGDEF_t$. $HVPTOT_t$ is total USDA Export Market Development Programs promotion spending which includes both contributions by cooperators and FMD/MAP expenditures to promote HVP exports.

Exhibit 8 shows the volume of US exports of consumer-oriented/high-value products from 1975 to 2019. On average, the volume of bulk/intermediate products was between 14 and 15 million metric tons, ranging from a low of 3.6 million metric tons to a high of 26.4 million metric tons over this period. In 2019, the volume of US exports of bulk/intermediate products was 26.1 million metric tons.

Similar to the situation with the US bulk/intermediate export demand equation, the HVP export demand equation was estimated with lagged exports as an explanatory variable in a Nerlovian partial adjustment model. We also use the Almon polynomial distributed lag (PDL) formulation to account for the time lag in the impact of the promotion investments on US HVP exports. The search for the pattern, polynomial degree, and time period over which the promotion expenditures influence US exports of consumer-oriented/high value products involved a series of nested OLS regressions. Lags of up to 10 years and up to fourth degree polynomials with

Exhibit 8: Volume of US Exports of Consumer-Oriented or High-Value Products, 1975-2019



Source: Data provided directly to authors by the Foreign Agricultural Service (USDA).

alternative choices of head and tail restrictions were considered. Based on a composite set of criteria, including the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC), the Hannan-Quinn criterion (HQC), and heuristic measures (e.g., significance and signs of the estimated parameters in the equation;

see footnote 1), a second order PDL of the current period and two lags with head and tail restrictions was selected. As done with spending to promote bulk/intermediate exports, spending to promote HVP exports (HVPTOT) adjustments were made to account for inflation and exchange rates to create the goodwill variable of those expenditures (GHVP).

US consumer-oriented/high-value product exports also are likely impacted by qualitative events from year to year (ZH_t in equation (4)). While income, population, inflation, prices, and other variables largely explain the longer-term trends in the export data, various events account for much of the deviation of exports around the trend from year to year. To determine what events have impacted these exports, we hypothesize that a number of qualitative events potentially affect the level of consumer-oriented/high-value product exports over time. These events are treated as indicator variables econometrically. An indicator variable takes on the value of 1 in the year of the event and 0 in other years. We sequentially tested the significance of each of 50 hypothesized events to determine the statistical significance of each in impacting aggregate consumer-oriented/high-value product exports. These qualitative variables correspond to: (1) weather and natural events; (2) animal & crop disease events; (3) trade issues/events; (4) economic events; (5) farm policy events; and (6) political events variables. Again, we provide the complete list of these indicator variables in Appendix B.

To capture diminishing marginal returns to export promotion expenditures over time, we used a logarithmic transformation of GHVPP as is commonly done in other studies of domestic and export promotion (see, for example, Kaiser 2010a, Kaiser 2010b, Williams et al. 2011, and Global Insight 2006 and 2010) and as done for US bulk/intermediate exports. We also employed a logarithmic transformation for all other non-discrete variables in the model. Consequently, the estimated parameters associated with the explanatory variables are elasticities. With the log-log functional form, these elasticities are constant over the period of the analysis from 1975 to 2019.

The econometric results associated with consumer-oriented or high-value products are exhibited in Exhibit 9, where all non-discrete variables are in natural log form. The parameters of the equation were estimated over the 1975-2019 sample period (see footnote 2). As suggested by the Office of Management and Budget (OMB) guidelines for conducting benefit-cost analyses (OMB 1992), we conducted a sensitivity analysis of the estimated model, comparing the actual historical data for HVP exports to the model-generated values of the historical levels of those exports. As indicated by the R^2 statistic, the model explains over 99% of the annual variations in consumer-oriented or high-value exports. Because the model explains nearly all the variation in HVP exports, the model predictions are an excellent fit of the actual values of HVP exports over the sample period. The within-sample mean absolute percent error is 2.59%, also indicative of exceptional goodness-of-fit. All estimated parameters are statistically different from zero and their signs and magnitudes are all consistent with *a priori* expectations. The Durbin Watson, Durbin-h, and Breusch-Godfrey statistics indicate no evidence of autocorrelation. As with the US bulk/intermediate export equation, this finding supports the use of OLS as the estimation method.

Exhibit 10 illustrates the ability of the model to replicate the actual volume of US agricultural exports of consumer-oriented/high-value products. Over the period 1977 to 2019, the actual and predicted values of the volume of US agricultural consumer-oriented/high-value products are nearly identical.

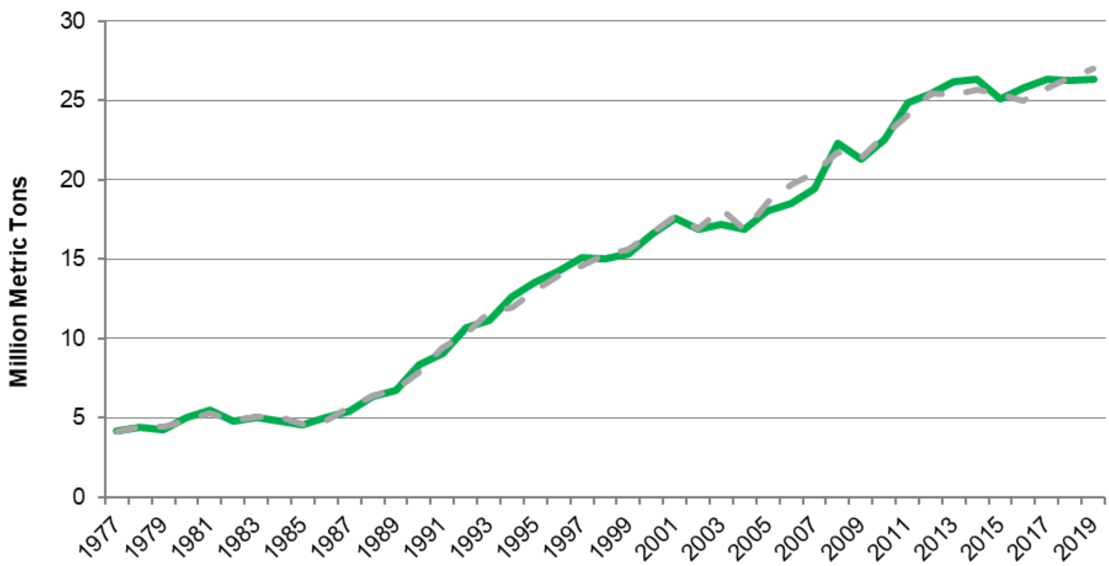
The elasticity of the real, exchange-rate-adjusted price of HVP exports is negative as expected (-0.4283), indicating that US HVP export demand is inelastic with respect to changes in its own price. That said, this own-price elasticity is roughly four and a half times greater than the own-price elasticity for BULK exports. A 10% increase in the price of HVP exports results in a 4.28% decline in HVP exports, holding all else constant. The results from the previous study (Williams et al., 2016) are in accord with the updated results regarding the own-price elasticity of agricultural exports. In the previous study, the magnitude of the own-price elasticity of HVP exports (-0.5549) was roughly twice that of the own-price elasticity of BULK exports (-0.2761).

Changes in foreign real per capita income are estimated to have a positive impact on HVP exports. The income elasticity associated with consumer-oriented/high-value products is 0.3660. Hence, a 10% increase in foreign real income increases per capita.

Exhibit 9. Econometric Analysis of Consumer-Oriented/High-Value Agricultural Export Demand, 1977 to 2019

Estimation Results				
Variables (in natural logs except indicator variables)	Estimate	Standard Error	t-statistic	p-value
Intercept	7.1552	2.1379	3.35	0.0022
Real exchange-rate-adjusted HVP export price (UHPR)	-0.4283	0.0977	-4.38	0.0001
Foreign real per capita GDP (RGDPP)	0.3660	0.2060	1.78	0.0855
Foreign HVP commodity production (RHPROD)	-0.2856	0.2364	-1.21	0.2361
Lagged dependent variable $(HVP)_{t-1}$	0.7727	0.0669	11.54	0.0000
Droughts in Asia and Europe indicator variable (DE6)	-0.1778	0.0494	-3.60	0.0011
US/World economic concerns, US drought indicator variable (1982)	-0.1150	0.0427	-2.69	0.0114
US drought, California Medfly indicator variable (1989)	-0.0791	0.0424	-1.87	0.0715
EU hoof & mouth disease; Starlink indicator variable (2002)	-0.1009	0.0404	-2.50	0.0180
BSE; US soybean aphid infestation; US animal disease issues indicator variable (2004)	-0.1158	0.0406	-2.85	0.0076
Financial meltdown; recession indicator variable (2009)	-0.0958	0.0399	-2.40	0.0226
Goodwill Variable of HVP Promotion Expenditures (GHVP):				
Real, exchange-rate-adjusted HVP promotion expenditures in current period $(GHVP_t)$	0.0354	0.0050	7.02	0.0000
Real, exchange-rate-adjusted HVP promotion expenditures lagged one period $(GHVP_{t-1})$	0.0472	0.0067	7.02	0.0000
Real, exchange-rate-adjusted HVP promotion expenditures lagged two periods $(GHVP_{t-2})$	0.0354	0.0050	7.02	0.0000
Sum of lags	0.1180	0.0168	7.02	0.0000
Regression statistics: $R^2 = 0.9975$ DW = 2.0754 Durbin-h = -0.2751				

Exhibit 10: Consumer-Oriented/High-Value Exports, Actual and Predicted Values, 1977-2019



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HVP exports by 3.66%, holding all else constant. In the previous report, the income elasticity associated with HVP exports was 1.7448, nearly five times greater than the updated income elasticity. Although the updated HVP export income elasticity estimated may be somewhat low, the previously estimated elasticity was likely much too high.

Additionally, as expected, increases in foreign meat production are estimated to have a negative, inelastic impact on US consumer-oriented/high-value exports. A 10% increase in foreign meat production reduces US HVP exports by 2.86%, holding all else constant. The previous study found HVP exports to be highly sensitive to changes in foreign HVP production. The previous elasticity in conjunction with foreign meat production was estimated to be -1.6144, more than five times greater than the updated elasticity.

HVP exports in the current year are positively and significantly related to those exports in the previous period as expected. A 10% increase in consumer-oriented or high-value exports in the previous year increases high-value exports in the current year by 7.73%, a result that is nearly identical to that of the 2016 study (7.39%).

Of the 50 events identified to have potential effects on US HVP exports, six had statistically significant effects on the aggregate HVP export group over the sample period. That does not mean, of course, that other events had no effects on exports.

Indeed, many other factors have likely affected the aggregate HVP or consumer-oriented export group over the years. Some events have offsetting effects, however, increasing exports of one commodity while reducing those of another resulting in little net effect. At the same time, events that may impact the trade volume for one commodity may not have a statistically significant effect with respect to the aggregate category of consumer-oriented or high-value product exports.

All six events had statistically significant negative effects on US HVP exports including: (1) the drought in California in 1977; (2) US/world economic concerns and the drought in the United States in 1982; (3) the drought in the United States and the California Medfly issue in 1989; (4) EU hoof & mouth disease and Starlink in 2002; (5) BSE, US soybean aphid infestation, and US animal disease issues in 2004; and (6) the financial meltdown and recession in 2009.

The estimated elasticities of the goodwill variable (GHVP) in equation (4) indicate that total USDA Export Market Development Programs HVP export promotion spending had a statistically significant and positive effect on those exports over time. The promotion elasticity, normally referred to as the long-run promotion elasticity, is estimated at 0.11801 and is calculated as the sum of the elasticities in the current and two past periods (see Exhibit 10). The promotion elasticity for HVP exports is roughly 1.34 times the promotion elasticity of BULK exports and more than two and a half times the HVP promotion elasticity estimated in the previous study. The HVP promotion elasticity estimated in this study relative to that for Bulk/intermediate exports is consistent with *a priori* expectations.

Also, the estimated long-run promotion elasticity for US HVP exports is consistent with such elasticities estimated for other export demand promotion programs. This long-run elasticity is a *static* measure of promotion impact and assumes that all else is held constant. As such, if total USDA Export Market Development Programs promotion were to increase by 10%, then US consumer-oriented/high-value exports would increase by nearly 1.2%. Further, if total USDA Export Market Development Programs promotion were to double (tantamount to a 100% increase), then US consumer-oriented or high-value exports would rise by 11.8%. Again, it is critical to note that this measure of the effect of promotion on exports assumes that the export price remains unchanged with changes in promotion. Any price effects caused by promotion, which would also affect the level of exports, are ignored. This issue is discussed in more detail in a subsequent section of this report.

Given the presence of the lag in the dependent variable, a *dynamic* long-run elasticity assuming no change in export price also can be calculated by dividing the *static* long-run promotion elasticity by one minus the estimated coefficient of the lagged consumer-oriented/high-value product exports. The result was a *dynamic* long-run elasticity of 0.5191, much larger than the long-run elasticity of 0.1774 in the previous report[9].

To test the robustness of the estimated export demand promotion elasticity for consumer-oriented/high-value product exports, we conducted a sensitivity analysis in conformance with OMB guidelines for conducting benefit-cost analyses (OMB 1992). Confidence intervals at the five percent level (the industry standard) were computed for the consumer-oriented/high-value product long-run market development/promotion elasticity. This is the interval over which true promotion elasticity would be expected to fall 95% of the time. The 95% confidence interval for the consumer-oriented/high-value product *static* long-run elasticity ranges from 0.0851 to 0.1510.

Historical Simulation Analysis

To investigate the effectiveness of USDA export promotion programs, we postulate a simple three-equation conceptual model for USDA bulk/intermediate exports and for HVP agricultural exports:

(5) $XD_{it} = XD_i(PX_{it}, G_{it}, ZD_{it})$

(6) $XS_{it} = XS_i(PX_{it}, ZS_{it})$

(7) $XS_{it} = XD_{it}$

where XD is the foreign demand for US agricultural exports; XS is the export supply of US agricultural exports; PX is the average price paid for US agricultural exports; G is the “goodwill” or stock variable representing export promotion expenditures (Nerlove and Arrow 1962); ZD is a matrix of all other demand shift variables, including income (GDP) measures for importing countries, exchange rates relative to the US dollar countries, inflation, foreign production of goods in competition with U.S agricultural exports; numerous qualitative events that have impacted US agricultural exports over the period of 1977 through 2019; ZS is an equivalent matrix of supply shift variables; i = bulk/intermediate and HVP; and t = time period.

Equation (5) represents both bulk/intermediate (BULK) and high-value product (HVP) exports which are represented by the two econometric equations discussed in the previous section of the report. Equation (6) represents the responses of US BULK exports and of HVP agricultural exports to changes in price which is represented in each model by the corresponding export supply elasticity implied from the work of

[9] Consequently, the impacts reported represent lower bounds and hence are conservative.

Williams et al. (2016) of 1.66 for US BULK export supply and 1.56 for US HVP export supply. Equation (7) requires that the demand for US agricultural exports equal the US supply of agricultural exports. XD_i, XS_i, and PX_i are the endogenous variables in the model.

The models for US BULK and for HVP agricultural exports were used to simulate the effects of the USDA Export Market Development Programs on total US agricultural export revenue over the historical period (1977-2019). Two scenarios were simulated with the models over that period: (1) a scenario *with* USDA Export Market Development Programs promotion spending (the "*with* scenario") and (2) a scenario *without* USDA Export Market Development Programs promotion spending (the "*without* scenario"). The *with* scenario represents actual history, that is, the levels of BULK and HVP export prices, volume, and revenue that existed over time as generated by the corresponding model which includes any effects on exports and prices from the export promotion spending. The *without* scenario represents the level of BULK and HVP exports, prices, and revenue that would have existed over time if the USDA Export Market Development Programs had not existed or, in other words, if the export promotion spending had not been done over time.

The *with* scenario analysis over the 1977-2019 period represents the baseline historical scenario of the endogenous variables in the model, including US BULK and HVP agricultural prices, volume, and revenue. The *without* scenario was then conducted as a counterfactual analysis in which the USDA Export Market Development Programs for both BULK and HVP exports were assumed to have never existed so that the government FMD/MAP expenditures and cooperator contributions were not made over the period of analysis. This assumption effectively eliminated the effects of the program on US agricultural exports and prices over that period. The result was lower simulated levels of BULK and HVP agricultural export prices, volumes, and revenue than actually occurred. Because the changes in the endogenous model variables in the *without* scenario were generated by changing only the level of promotion spending, they represent the levels of those variables that would have existed over time *if there had been no USDA Export Market Development Programs*.

Differences in the simulated levels of total US agricultural exports (BULK and HVP), prices, and revenue in the *with* scenario from those in the *without* scenario are taken as direct measures of the effects of the USDA Export Market Development Programs over time. Those differences are often referred to as the "lift" provided by a promotion program over the period of promotion. In this case, the "lift" achieved by the USDA Export Market Development Programs is the addition to total BULK and HVP export volume, price, and revenue as a result of the promotion, that is, how much higher those three measures were over time than they would have been if the promotion had not been conducted. Because no other exogenous variable in the models (e.g., levels of inflation, exchange rates, income levels, agricultural and trade policies, etc.) other than promotion spending is allowed to change in either scenario in either model, this process effectively isolates the effects of the USDA Export Market Development Programs on total US agricultural exports and prices. Thus, the simulated differences between the levels of US BULK and HVP agricultural exports and prices and, therefore, US BULK and HVP agricultural export revenue in the *with* promotion spending scenario and in the *without* promotion spending scenario is the "lift achieved by the promotion. The "lift" provides a direct measure of the historical impacts of the export promotion spending under the USDA Export Market Development Programs (and only those expenditures) on US BULK and HVP, and therefore, on total agricultural export revenue.

Exhibit 11 shows both the level and percentage "lift" achieved by the U.S Export Market Development Programs over the 1977-2019 period of analysis for total US agricultural exports, prices and revenue as an aggregation over the results from the BULK and HVP simulations. Recall that the number of exported commodities and corresponding promotion spending included in this study are substantially greater than was the case in the previous study by Williams et al. (2016).

Exhibit 11. Estimated Promotion Lift[1] for US Agricultural Export Volume, Price, and Revenue, 1977 - 2019

	Average Annual Lift[1]	Percent Lift[1]
US Agricultural Export Volume (million MT)	9.7	6.1
US Agricultural Average Export Price ($/MT)	30.66	7.2
US Agricultural Export Revenue ($ million)	9,622	13.7

1 The average annual addition to aggregate BULK/Intermediate and HVP export volume, weighted average aggregate export price (BULK/Intermediate and HVP), and the aggregate BULK/Intermediate and HVP export revenue as a result of the USDA Export Market Development Programs.

The results show that on average over that period, the USDA Export Market Development Programs increased total US agricultural export revenue (BULK and HVP) by 13.7% over what might otherwise have been the case. In other words, the USDA Export Market Development Programs has provided a "lift" of $9.6 billion or 19.7% to the value of total US agricultural exports over time. Again, the "lift" is defined as the average annual increase in some variable like export revenue due to promotion over the period of analysis (1977-2019 in this case)[10]. At the same time, the program has provided a lift to the volume of aggregate US agricultural exports (Bulk/Intermediate and HVP) of about 6.1% (9.7 million mt) and to the aggregate price of US agricultural exports of about 7.2% ($30.06/mt). Over the 1977-2019 time period, these "lifts" equated to a total of $413.7 billion in additional export revenues and a total of 417.7 million metric tons of additional export volume. Clearly, the USDA Export Market Development Programs have had a substantial and statistically significant impact on US agricultural exports.

Benefit-Cost Analysis of USDA Export Market Development Programs

As the discussion in the previous section of the report clearly demonstrates, the USDA Export Market Development Programs have had a substantial impact on US agricultural exports, export price, and export revenue. A critical question, however, is whether these "benefits" of the program have outweighed the costs. The standard method of determining if export promotion has been beneficial is to calculate a benefit-cost ratio (BCR) in terms of the additional "benefits" that the promotion program has generated per promotion dollar spent over time. In evaluations of export promotion programs, a common measurement of the "benefit" of the program used in BCR analyses is the additional export revenue generated. Another common, and arguably more appropriate, measure of the "benefit" of export promotion relies on standard economic welfare analysis (consumer and producer surplus concepts) in which the calculated net changes to economic welfare (which approximates the economic profit) as a result of the promotion program are considered to be the "benefits" of the promotion program. The cost of the program is the total amount of funds invested in the promotion program.

a) Calculating Export Promotion BCR Measures

Exhibit 12 illustrates the expected export revenue "benefits" of export promotion in general. The objective of export demand promotion is to shift out the export demand curve (a shift of ED_R out to ED_R' in Exhibit 12) and, thereby, increase the export price (P_x to P_x') on a higher volume of export sales over time (Q_x^{us} to $Q_x^{us\prime}$). The result is an increase in export revenue represented in Exhibit 12 as the sum of the dark and light red areas in the right-hand panel of that figure. The increase in export revenue generated by the USDA Export Market Development Programs was measured through historical simulation as discussed in the previous section of the report.

[10] Lift is defined with respect to the level of a variable (the value of exports in this case) in the absence of the promotion program over the period of analysis (1977-2019 in this case).

The simulated change in export revenue induced by the USDA Export Market Development Programs over time can be used as the export revenue “benefits” of the program for the benefit-cost analysis. Several export revenue BCRs are often computed. The Gross Revenue BCR (GRBCR) is calculated as the additional export revenue generated over the period of promotion (R) per dollar of promotion spent (E) over that period:

$$(8)\quad GRBCR = \frac{\sum_{t=1}^{T} R_t}{\sum_{t=1}^{T} E_t}$$

where t represents a given year and T represents the last year of the promotion period.

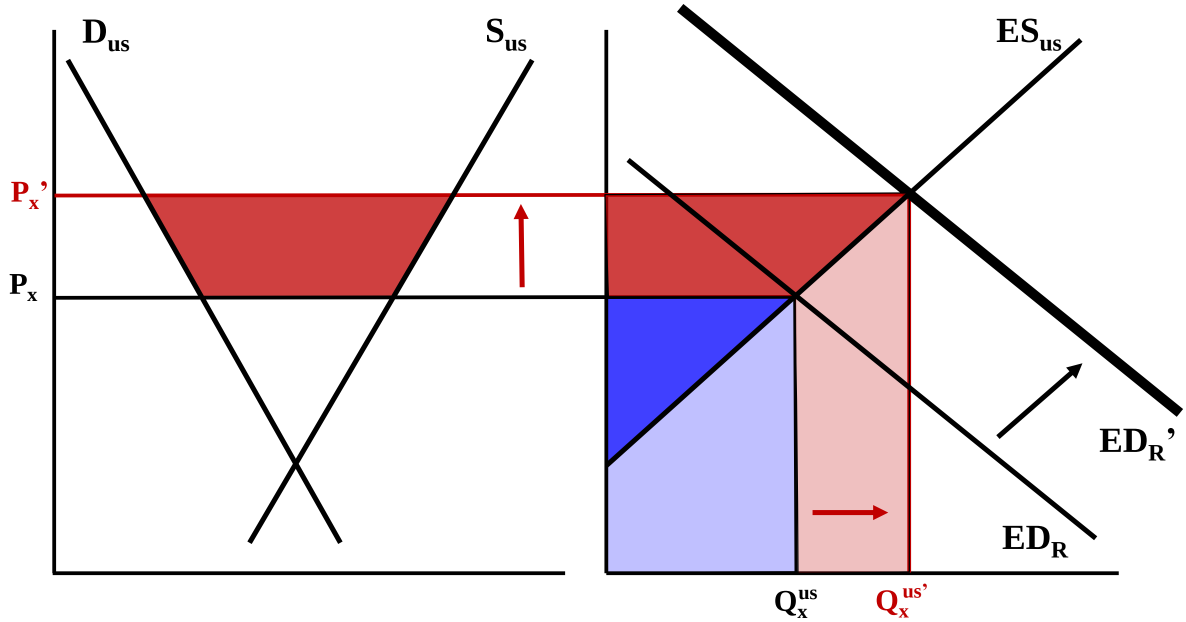
Because the promotion represents a cost of generating the additional export revenue, the promotion spending in each year must be netted out of the additional export revenue generated (R_t) in each corresponding year to arrive at the *net* export revenue BCR:

$$(9)\quad NRBCR = \frac{\sum_{t=1}^{T} R_t - E_t}{\sum_{t=1}^{T} E_t}$$

To comply with the Office of Management and Budget (OMB) guidelines for conducting benefit-cost analyses (OMB Circular A-94 1992), the time value of money must be accounted for by discounting the net export revenue BCR to generate a *discounted* export revenue benefit-cost ratio:

$$(10)\quad DRBCR = \frac{\sum_{t=1}^{T} (R_t - E_t)/(1+i)^t}{\sum_{t=1}^{T} E_t}$$

Exhibit 12. Export Revenue and Economic Surplus Effect of Export Promotion



where i is the interest rate chosen to discount the additional export revenue flows to present value. To be compliant with the OMB guidelines for conducting benefit-cost analyses, we use "discount rates for cost-effectiveness, lease purchase, and related analyses" required for such analyses by the OMB which are essentially the Treasury interest rates (Appendix C of OMB Circular A-94, Revised November 2020 in Vought, 2020).

A shortcoming of the export revenue BCR measures is that they account for the additional export revenue associated with additional exports but do not subtract the additional costs required to generate the additional exports. Such costs include the additional production costs, inland transport costs, freight, and insurance costs and so on associated with an increase in exports. To account for those costs, we calculate a measure referred to as the export "economic surplus". This measure is the difference between the amount that exporters receive for their exports and the minimum amount they would be willing to accept to just cover their costs. In Exhibit 12, the US export supply curve (ES_{us}) shows the prices that exporters would be willing to accept for each additional unit of export sales to just cover costs. Thus, the area under ES_{us} (the US export supply curve) at Q_x^{us} where the excess demand curve ED_R crosses ES_{us} (the light blue area in Exhibit Y) is a measure of the minimum total amount exporters would be willing to accept for the level of exports demanded in the market. Of course, however, producers do not sell each additional quantity of exports at the price that would just cover their costs. Rather, they sell all units of exports at the export market price of P_x. Thus, their export revenue for selling Q_x^{us} units of exports is the sum of the dark and light blue areas. The dark blue area then is the "export surplus" of export revenue over and above the costs of exporting that export volume. Although not precisely the same thing, "export surplus" can be thought of as a measure of exporters' profit from exporting.

When promotion shifts export demand out to ED_R' in Exhibit 12, export revenue increases by the amount represented by the sum of the dark and light red areas in the right-hand graph in Exhibit 12, but the light red represents the additional costs of that additional level of exports. Thus, the dark red area on the right side of the exhibit represents the additional "export surplus" (profit) to exporters for the additional exports up to $Q_x^{us\prime}$. That area is equal to the difference between what economists call the additional "producers surplus" and the additional "consumer surplus" in the domestic market (the dark red area in the left-hand panel of Exhibit 12. Because the ES_{us} curve is just the difference between the domestic supply curve (S_{us}) and the domestic demand curve (D_{us}) in the left-hand panel of Exhibit 12, the red area in that panel is equal to the red area in the right-hand panel. Thus, the "export surplus" is a measure of the net change in economic welfare as a result of exporting. Because Exhibit 12 represents the US aggregate agricultural export sector, the red area (in both panels) represents the net additional economic welfare to the US agricultural economy and to the overall US economy resulting from agricultural export promotion.

The export surplus or net additional welfare from export promotion is calculated through the same simulation scenario process used to calculate the additional export revenue from export promotion over time described above. In the process, however, the additional export surplus portion of the additional export revenue is calculated using simple formulas. Then the additional export surplus (call it "S") is used as the measure of the "benefit" of export promotion in place of export revenue (R) in equations (8), (9), and (10) to calculate a Gross Export Surplus BCR (GSBCR), a Net Export Surplus BCR (NSBCR), and a Discounted Export Surplus BCR (DSBCR), respectively.

b) Export Promotion Benefit-Cost Analysis Results

Based on equations (8), (9), and (10), we calculated the BCRs for the USDA Export Market Development Programs over the entire 1977-2019 period of analysis (Exhibit 13). These calculated returns to the USDA Export Market Development Programs are higher than most average returns calculated for individual commodity export promotion programs as reported by Williams et al. (2016) but somewhat lower than found for the USDA Export Promotion Programs by Williams et al. (2016) for a less extensive set of exports than included in this analysis. A BCR that is greater than 1 is interpreted as meaning that the program has more than paid for itself. Otherwise, the program would be considered to have created an economic loss because the revenue generated would be less than the cost of the program.

The net export revenue benefit-cost ratio (NRBCR) of the USDA Export Market Development Programs (including both MAP/FMD expenditures and cooperator contributions) over the entire 1977-2019 period of the program is calculated as 24.5 (Exhibit 13). That is, for every dollar of export promotion expenditure, the net return in additional export revenue, net of the promotion spending, is $24.5. The net economic surplus BCR (NSBCR) is calculated at 12.2 indicating a net addition to US economic welfare of $12.2 per dollar spent on export promotion through the USDA Export Market Development Programs (Exhibit 13). This measure is necessarily smaller than the NRBCR because additional economic costs have been netted out of the additional export revenue to calculate the additional export surplus generated by the program.

The BCRs calculated in this study are somewhat lower than those reported by the previous analysis of the effectiveness of USDA Export Promotion Programs by Williams et al. (2016). However, the BCRs in the two studies are not strictly comparable given that this analysis is based on econometric results generated from extensively revised historical data for most variables and includes a much larger set of commodities that are promoted by USDA than considered in the 2016 report. Also, with the greater number of commodities and higher level of funding used in this analysis, a lower BCR would be expected relative to the previous report consistent with the principle of diminishing returns. A common error is to assume that the level of a BCR indicates the impact of a program so that a high BCR implies a high impact and a low BCR implies a low impact of a program. Such is not the case, however. For example, the BCR for a $1 investment that returns $5 is the same (5 to 1) as the BCR for a $1 billion investment that returns $5 billion. Obviously the more that is spent, the bigger the impact on exports. As spending increases, however, each additional dollar spent has a declining effect so that the total additional revenue achieved increases at a declining rate. Thus, the ratio between additional revenue and additional funding (the BCR) declines as funding increases. That is the law of diminishing returns. Thus, just because the BCR is somewhat lower in this study than in the 2016 study does not mean that the program is now less effective. The lower BCR may simply reflect the larger level of expenditures in this analysis. In fact, if the calculated BCR did not decrease with the larger USDA Export Development Program funding in this study relative to the 2016 study, the results would be suspect and inconsistent with the law of diminishing returns.

Consistent with the Office of Management and Budget (OMB) guidelines for conducting benefit-cost analyses (OMB Circular A-94 1992, revised November 2020 (Vought (2020)), a discounted net export revenue BCR (DRBCR) of 17.4 was calculated based on equation (10) using the 10-year maturity nominal Treasury interest rate[11] (Exhibit 13). The discounted NSBCR (DSBCR) was calculated to be 8.5.

Exhibit 13. Estimated Export Revenue and Surplus Benefit-Cost Ratios for the USDA Export Market Development Programs, 1977-2019

Benefit-Cost Measures	Non-Discounted BCR	Discounted BCR[a]
Net Export Revenue Benefit-Cost Ratios (NRBCR and DRBCR)	24.5	17.4
Net Export Surplus Benefit-Cost Ratios (NSBCR and DSBCR)	12.2	8.6

[a] Discounted using the 10-year maturity nominal Treasury interest rate (Appendix C of OMB Circular A-94, Revised November 2020 (Vought, 2020)).

Numerous studies of commodity export checkoff programs have noted that a high BCR indicates that a promotion program is underfunded (see Williams et al, 2016). For example, the non-discounted NRBCR of 24.5 indicates that for every dollar in additional funding NOT allocated to the USDA Export Market Development Programs, the US agricultural sector loses an average of $24.5 in additional export revenue. That is, $24.5 in additional agricultural export revenue is forfeited for every dollar not allocated to the USDA Export Market Development Programs. Of course, increases in promotion spending are accompanied by a reduction in the corresponding BCR. With such a high estimated BCR, however, spending on agricultural export promotion could be increased substantially before the BCR would decline to the $10 average over recent analyses of agricultural export promotion programs (see Williams et al, 2016). Indeed, a BCR of 1 to 1 would indicate that spending has increased to such a level that every additional dollar spent would generate only an additional dollar in export revenue. Given the net export revenue BCR of 24.5 to 1, the USDA Export Market Development Programs have been highly underfunded over the period of 1977 through 2019.

[11] Given that the nominal rather than the real Treasury interest rate is used, the calculated discounted BCRs represent upper bounds.

Analysis of Alternative Future Funding Scenarios for USDA Export Market Development Programs

This section considers the likely US agricultural export revenue impacts of several future USDA Export Market Development Programs funding scenarios over the 10-year period following the end of the historical data (2019). The effects of the various scenarios are measured against a Flat Funding or Baseline Scenario of future USDA Export Market Development Programs spending over that period:

- *Flat Funding (Baseline) Scenario*: Budgeted annual funding for MAP and FMD is assumed to remain at the current level (a total of $235.5 million) over the full 10-year period (2020 to 2029) (Exhibit 14). Spending of these funds is referred to as MAP/FMD "expenditures." The ATP funds of $200 million awarded in 2018 and of $100 million in 2019 were only begun to be spent in 2019 ($25 million) and 2020 ($75 million). In this scenario, the remaining $200 million in ATP funds are planned to be spent in roughly equal amounts each year from 2021 through 2024. Over the period of 2019-2024, the ATP funds awarded average about 18.6% of total expenditures (Exhibit 14). Cooperator contributions associated with MAP/FMD funding ($639.5 million in 2020) are assumed to grow at a historic annual rate of about 2.5% from 2021 through 2029. Because ATP provides cost-share promotion assistance to exporting US agricultural industries, those industries also provided promotion funds ("contributions") of an estimated $7.5 million in 2019 and $22.5 million in 2020 in connection with the ATP funding in those years. From 2021 through 2024, cooperators are assumed to provide associated contributions each year as ATP funds are spent from 2021 through 2024 amounting to a total of $60 million. Thus, total ATP funds awarded, and associated cooperator funds spent in 2019 and 2020 and planned to be spent in 2021 through 2024 amount to $390 million. Exhibit 15 shows the TOTAL USDA Export Market Development Programs spending (MAP/FMD and ATP expenditures and associated cooperator contributions) in 2019 and 2020 and assumed to be spent in each year from 2021 through 2029 in this Flat Funding (Baseline) Scenario. The ATP funds awarded plus the associated cooperator funds account for about 6.8% of TOTAL Export Market Development Funds spent and assumed to spent (expenditures plus contributions) over 2019 through 2024. The ATP share of TOTAL funds spent is substantially lower than the ATP share of just expenditures (18.6% compared to 6.8%) because of the large share of TOTAL funds spent accounted for by cooperator contributions. Over the full baseline period of 2019 through 2029, MAP/FMD and ATP expenditures together account for 26% of TOTAL Export Market Development funds spent and assumed to be spent (expenditures plus contributions). Consequently, cooperator contributions associated with MAP/FMD and ATP over the 2019 through 2029 baseline period account for the remaining 74% of TOTAL Export Market Development Programs funds spent (expenditures plus contributions).

Exhibit 14: Flat Funding (Baseline) Scenario: Current and Future, MAP, FMD, and ATP Expenditures, 2019-2029

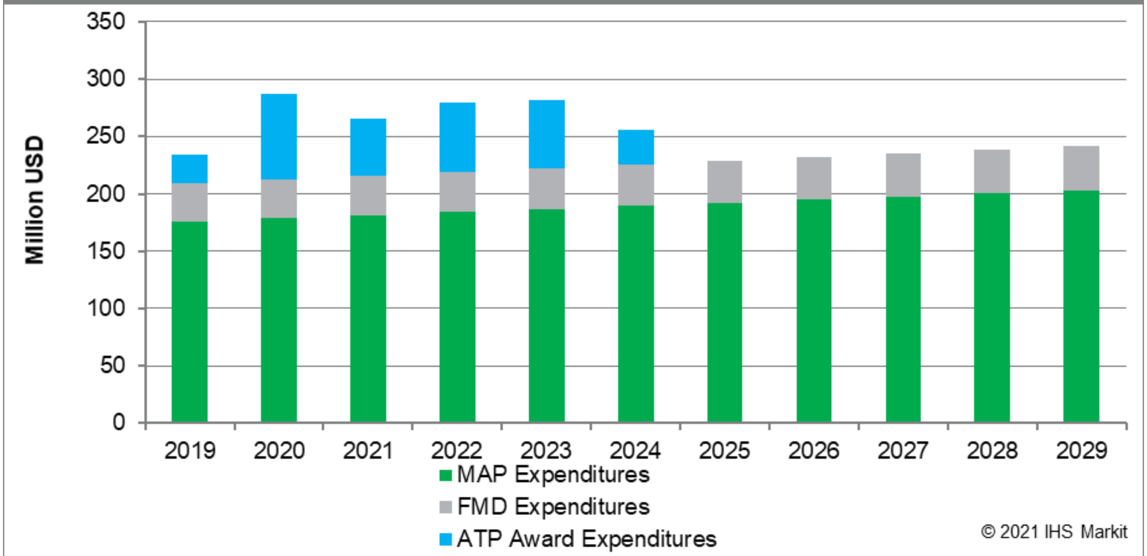
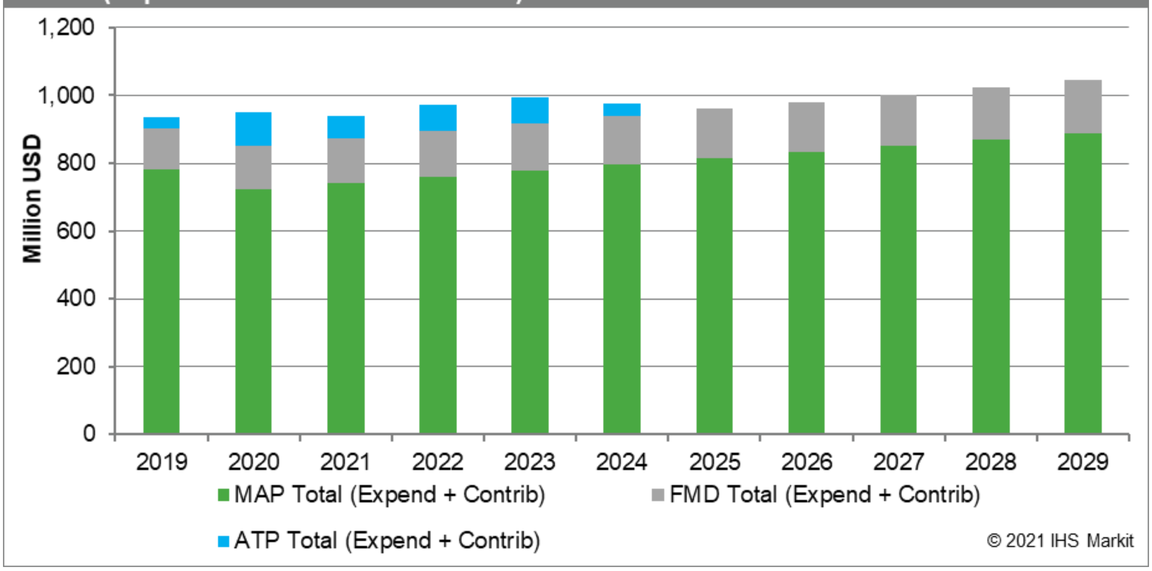


Exhibit 15: Flat Funding (Baseline) Scenario: Current and Future Total MAP, FMD, and ATP Funds (Expenditures Plus Contributions) 2019-2029



The first future scenario considered is the effects of spending the ATP funds awarded in 2018 and 2019 and associated cooperator contributions on US agricultural exports over 2019 through 2023.

- *ATP Effects Scenario*: In this scenario, the US export revenue effects of adding the Agricultural Trade Promotion funds to the USDA Export Market Development

Programs from 2019 through 2024 are considered. The $200 million of ATP funds awarded in 2018 and the additional $100 million awarded in 2019 were not spent all at once in those years. In fact, $25 million were spent in 2019 and $75 million in 2020 along with $30 million in associated cooperator contributions ($7.5 million in 2019 and $22.5 million in 2020). The remaining $200 million are assumed to be spent in roughly equal amounts in 2021 through 2024 along with an estimated $60 in associated cooperator contributions. The total amount of ATP funds assumed to be spent over 2019 through 2024 is $390 million, including $300 million in awarded funds and $90 in associated cooperator contributions. This scenario considers the contribution of the TOTAL ATP funds (awarded and cooperator contributions) to the past and future (baseline) level of US agricultural exports. The scenario process is referred to as "counterfactual simulation" in which the ATP funds are removed from the model over 2019 through 2024 to see what their contribution to the past and future baseline forecast of the value of US agricultural exports is likely to be. The difference in the value of exports over 2019 through 2029 in the Flat Funding (Baseline) Scenario from that level when ATP funding is removed from the baseline over 2019 through 2024 is a measure of the effects of ATP funding on US agricultural exports. In this scenario, nothing but the level of ATP funding changes over the 2019 through 2029 period.

Once the additional export market development funds provided by ATP are exhausted in 2024, an important question is what will be the level of funds available to the USDA Export Market Development Programs in the subsequent six years (2024-2029) of the 10-year forecast period (2020-2029). And what will be the likely effects of that funding on US agricultural exports over that period? To explore the answer to these questions, we analyze the US agricultural export effects of alternative future funding scenarios for USDA Export Market Development Programs over the last six years of the 10-year forecast period (2024-2029) when ATP funds are no longer available:

- *MAP/FMD Funding Doubles Scenario*: Combined MAP and FMD funding remains at the current authorized level for the first four years though 2023 but then is assumed to double to $469 million per year beginning in 2024. Associated Cooperator contributions are assumed to grow at the same historic rate as the baseline scenario of about 2.5% from 2020 through 2023. Because MAP and FMD funding is assumed to increase after 2024, however, associated Cooperator contributions are assumed to increase by about 10% in 2023 and then grow from that level at the historic rate of about 2.5% through 2029. ATP funds (awarded and contributions) are assumed to be spent in 2019 through 2024 as in the Flat Funding Scenario.

- *MAP Funding Increases by 50% Scenario*: MAP and FMD funding is assumed to remain at the current authorized level through 2023 but then MAP funding is assumed to increase by 50% ($100 million) beginning in 2024. FMD funding is assumed to remain at the current budgeted level of $34.5 million for the entire period of 2020 through 2029. Because MAP funding is assumed to increase beginning in 2024, MAP Cooperator contributions are assumed to increase by 3% in 2023 and then grow from that level at the historic rate of 2.5% through the end of the 10-year forecast period (2029). ATP funds (awarded and contributions) are assumed to be spent in 2019 through 2024 as in the Flat Funding Scenario.

- *MAP/FMD Funding Eliminated Scenario*: MAP and FMD funding is assumed to remain at the current authorized level through 2023 but then funding for both programs is assumed to be completely eliminated beginning in 2024. Because MAP and FMD funding is eliminated, associated Cooperator contributions are assumed to be reduced by 50% during the last six years of the 10-year forecast period. ATP funds (awarded and contributions) are assumed to be spent in 2019 through 2024 as in the Flat Funding Scenario.

a) Flat Funding (Baseline) Scenario

The *Flat Funding (Baseline) Scenario* analysis essentially was the process of establishing a forecast baseline using the flat funding scenario assumptions for USDA Market Development Programs funding over the 10-year period of 2020 through 2029. The results of the three alternative future scenarios (MAP/FMD Doubles scenario, MAP Funding Increases by 50% scenario, and MAP/FMD Funding Eliminated scenario) over the last six years of the 10-year forecast period (2024-2029) when ATP funds are exhausted are compared to those of the Flat Funding (Baseline) scenario to provide measures of the likely effects of the alternative future funding scenarios on US agricultural export revenue over that period. The results of ATP Effects Scenario for US agricultural export value are also measured against those of the Flat Funding (Baseline Scenario).

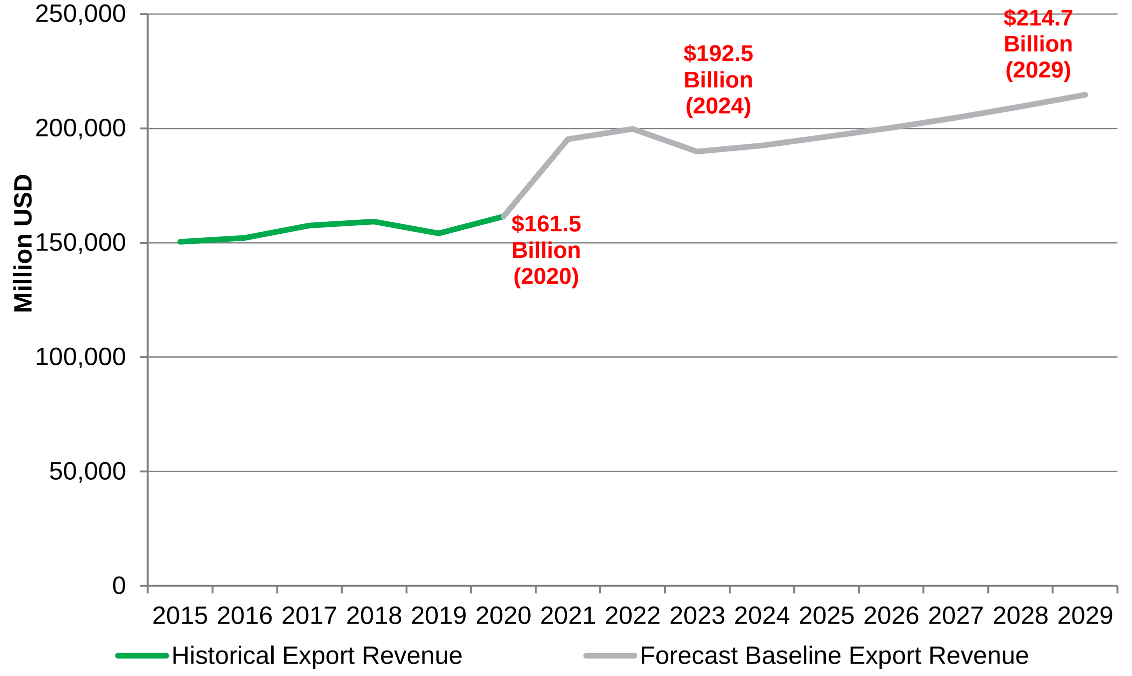
Setting the flat funding forecast baseline involved simulating the models for US Bulk/Intermediate agricultural exports and for US HVP agricultural exports as shown in equations (5) through (7) given values for the exogenous variable levels in the models and the flat funding scenario assumptions for USDA Market Development Programs spending over the 2020 through 2029 period. The forecasts of the exogenous variables (such as real GDP of non-US countries, the agricultural trade weighted US exchange rate, the world GDP deflator, and population of non-US countries) were based on the baseline projections provided by the USDA International Macroeconomic Dataset (USDA 2021). Forecasts of the foreign production of both bulk/intermediate and HVP commodities were provided by IHS Markit using a linear trend analysis (Somers 2021). The assumed levels of USDA Export Market Development Programs funding (expenditures plus contributions) were provided by USDA.

The baseline (flat funding) forecast begins in 2020, the first year beyond the data used for the econometric analysis of Bulk/Intermediate and HVP exports as discussed in an earlier section of the report. Consistent with actual export value for calendar year 2020, the forecast baseline export value increases about 6% to $161.5.1 billion from $154.1 billion in 2019 and then jumps 21% in 2021 with a conservative increase of about 2% in 2022 consistent with the current USDA forecast of US agricultural exports (Kenner, Jiang, and Russell 2021) (Exhibit 16). Following a slight decline of 5% in 2023 back to a level more consistent with the longer-term trend, the forecast annual growth of US total (BULK and HVP) agricultural export value averages between about 1.5% and 2.5% from 2024 through 2029.

b) ATP Effects Scenario Results

In this scenario, the value of US agricultural exports over 2019 through 2029 is measured *with* and *without* spending from total ATP funds (expenditures plus contributions). The value of US agricultural exports over that period *with* total ATP spending is provided by the Flat Funding Scenario. The *without* total ATP funding value of US agricultural exports over that period is simulated following the same process previously discussed for setting the baseline (Flat Funding Scenario) except that, in this case, spending from ATP funds is assumed to be zero. That is, the *without* simulation assumes that funds from the ATP have not been and will not be spent. The difference between the value of US agricultural exports in the *with* and *without* spending from ATP funds scenarios is a measure of the effects of the ATP on US agricultural exports. As Exhibit 15 previously showed, the $390 million in ATP funding (expenditures and contributions), some of which was spent in 2019 and 2020 and the remainder to be spent over 2021 through 2024, accounts for only 6.8% of the $5.77 billion in TOTAL funding spent and planned to be spent over that same period (including both expenditures and contributions) under MAP, FMD, and ATP.

Exhibit 16: Historical and Baseline Forecast US Agricultural Exports, 2015-2029



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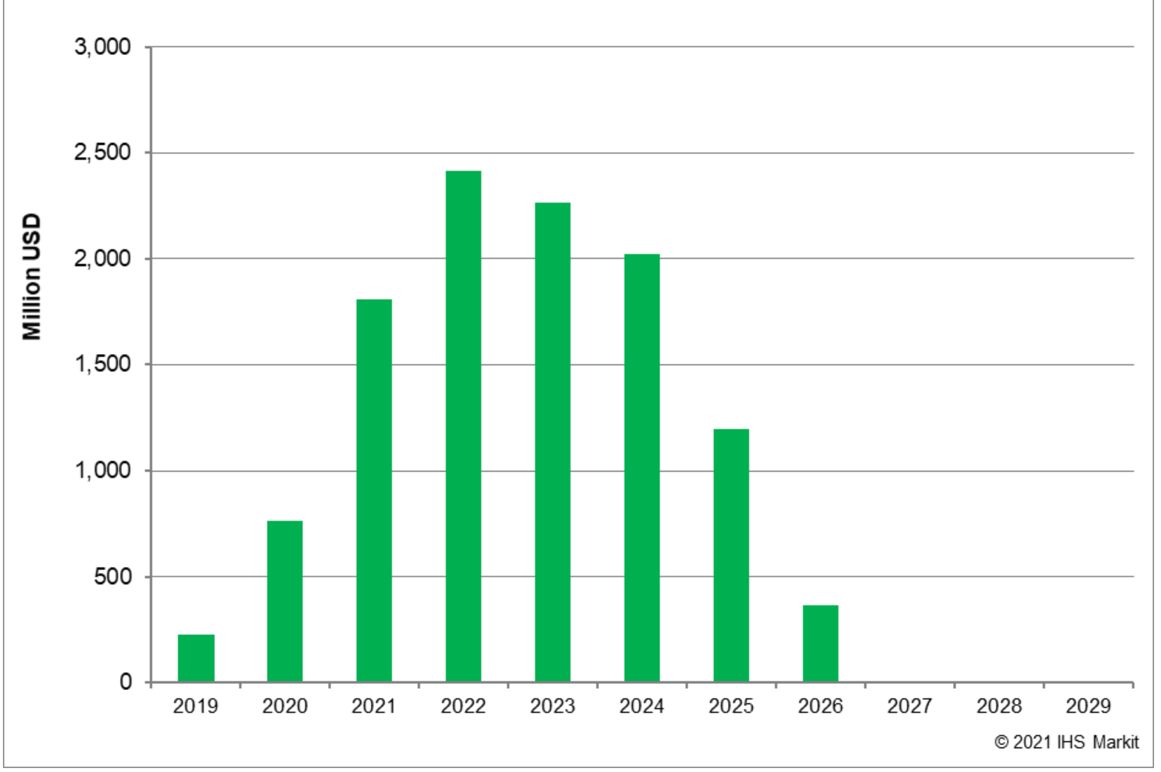
The scenario results indicate that the $390 million in ATP funding already and planned to be spent from 2019 through 2024 will generate a total of $11.1 billion in additional agricultural export revenue over that period (Exhibit 17). Thus, without the promotion spending from ATP funds, $11.1 billion in export revenue will never materialize. With a cost of $390 million and a forecast return of $11.1 billion, the ATP is forecast to generate a Gross Export Revenue BCR of about 28.4 to 1. That is, spending from ATP funds, assumed to occur as discussed in connection with Exhibit 14, are forecast to generate $28.4 in additional export revenue for every dollar of ATP funds spent.

Note from Exhibit 17 that the impact of spending ATP funds on US agricultural export revenue initially grows not only because the level of annual spending from TOTAL ATP funds increases from the low level of 2019 ($32.5 million) but also because of the lagged effect of promotion on US export sales. As demonstrated in the previous section of this report, export promotion spending under the USDA Export Market Development Programs affects exports not only in the year of spending but also over the next two years. That is the reason that the effects of ATP persist through 2026 even though the last of the ATP funds are assumed to be spent in 2024.

The ATP future funding scenario was not included in the previous study because ATP funding was allocated in 2019.

Exhibit 17: Additional US Agricultural Export Revenue Made Possible by ATP Funding, 2019-2029



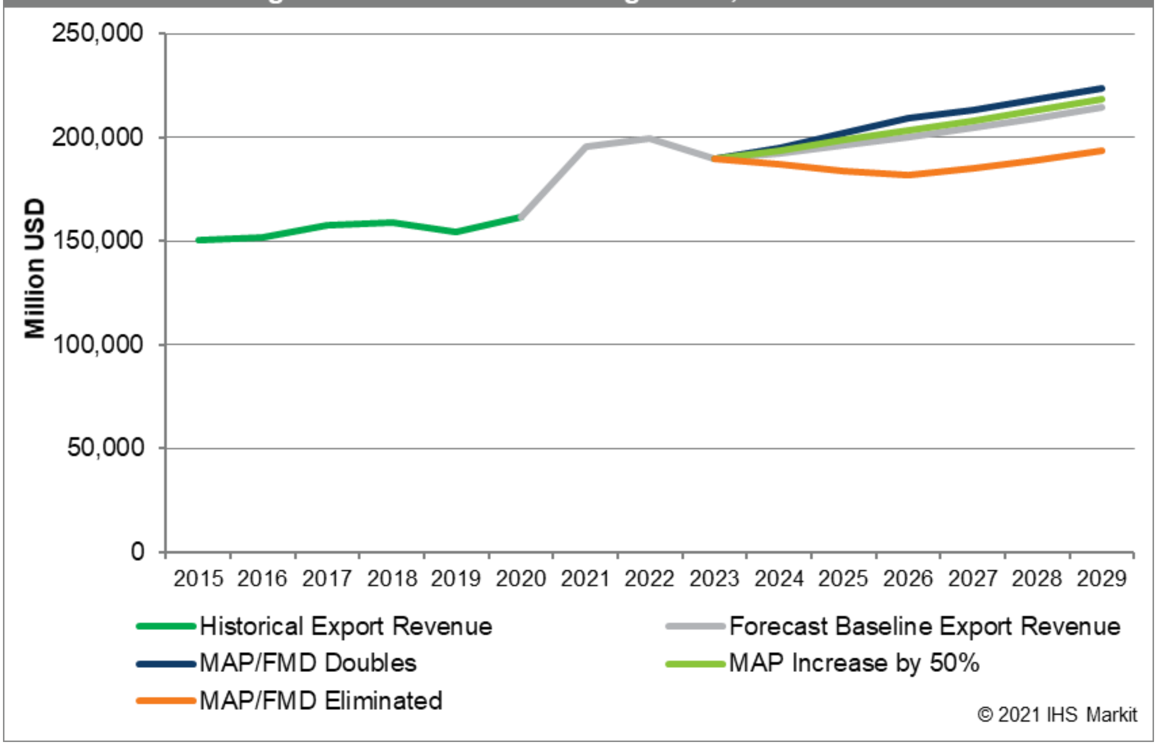
c) MAP/FMD Funding Doubles Scenario

The *MAP/FMD Doubles Scenario* analysis was conducted following the same process as the Flat Funding Scenario. In this scenario, however, combined MAP and FMD funding remains at the current budgeted level of $234.5 million in the first four years through 2023 but then is assumed to double to $469 million in the last six years of the 10-year forecast period (2024-2029). Cooperator MAP and FMD contributions are assumed to grow at the same historic rate of about 2.5% from 2020 through 2023 as in the *Flat Funding Scenario*. Because MAP and FMD funding is assumed to increase beginning in 2024, however, cooperator contributions are assumed to increase by about 10% in 2023 and then grow at the historic rate of about 2.5% through the end of the 10-year forecast period (2029). Based on their interviews with cooperator groups, Williams et al. (2016) reported that nearly all would expand their market promotion activities if MAP/FMD program funding was increased. They also reported that some indicated that they might even expand the number of their overseas offices.

ATP funds (awarded and cooperator contributions) are assumed to be spent in this scenario as in the Flat Funding Scenario.

In this forecast simulation scenario, the value of US agricultural exports increases by $2.4 billion (1.3%) in 2024, $5.9 billion (3%) in 2025, and then by an annual average of $9.0 billion (4.3%) through 2029 (Exhibit 18). Thus, a doubling of MAP/FMD funding would generate an additional $44.4 billion in US agricultural exports over the entire 2024-2029 period (3.6%), an annual average addition of $7.4 billion over that period (Exhibit 19). The only difference between this scenario and *the Flat Funding scenario* is the assumed change in the level of export promotion funding. Note that the increase in export revenue (compared to the *Flat Funding Scenario*) is a sustained rather than a one-time event. The effects of promotion on export revenue does not happen all at once due to the lagged effect of promotion funding on the level of exports as demonstrated econometrically in a previous section of this report. Rather, the effect on export revenue occurs slowly as the increase in funding takes effect in the sixth year (2024) and builds through the tenth year (2029) as the doubling of MAP/FMD promotion expenditures is sustained.

Exhibit 18: Historical and Baseline Forecast US Agricultural Revenue with Three Alternative Funding Scenarios for 2024 through 2029, 2015-2029



In compliance with OMB guidelines for conducting benefit-cost analyses (OMB 1992), we conducted a sensitivity analysis of the results of this scenario relative to those of the Flat Funding Scenario by calculating two standard deviations of the scenario forecast (above and below the mean scenario forecast) relative to the corresponding two standard deviations of the flat funding scenario. The resulting mean increase in US agricultural export revenue varies from $2.3 billion to $2.6 billion in 2024 relative to the flat funding scenario and from $8.6 billion to $9.8 billion in 2029 relative to the flat funding scenario confidence interval for this forecast scenario (Exhibit 20). The resulting range of increased export revenue effects between 2024 and 2029 is indicated by the dotted blue lines in Exhibit 20. Over that entire period, the *MAP/FMD Funding Doubles Scenario* results in a total addition to US agricultural export revenue of between $41.5 billion and $47.3 billion, a range of about 6.6% above and below the mean forecast scenario results.

Exhibit 19. Changes in U.S. Agricultural Export Revenue from the Baseline Forecast Under Alternative USDA Export Market Development Programs Spending Scenarios, 2020-2029

	MAP/FMD Doubled		MAP increased by 50%		MAP/FMD Eliminated	
Year	$ million	% change	$ million	% change	$ million	% change
2020	0	0.0	0	0.0	0	0.0
2021	0	0.0	0	0.0	0	0.0
2022	0	0.0	0	0.0	0	0.0
2023	0	0.0	0	0.0	0	0.0
2024	2,449	1.3	934	0.5	-5,167	-2.7
2025	5,897	3.0	2,247	1.1	-12,453	-6.3
2026	8,717	4.4	3,303	1.6	-18,339	-9.2
2027	8,966	4.4	3,391	1.7	-19,398	-9.5
2028	9,106	4.3	3,444	1.6	-20,165	-9.6
2029	9,237	4.3	3,504	1.6	-21,009	-9.8
TOTAL	**44,373**	**3.6**	**16,823**	**1.4**	**-96,531**	**-7.8**

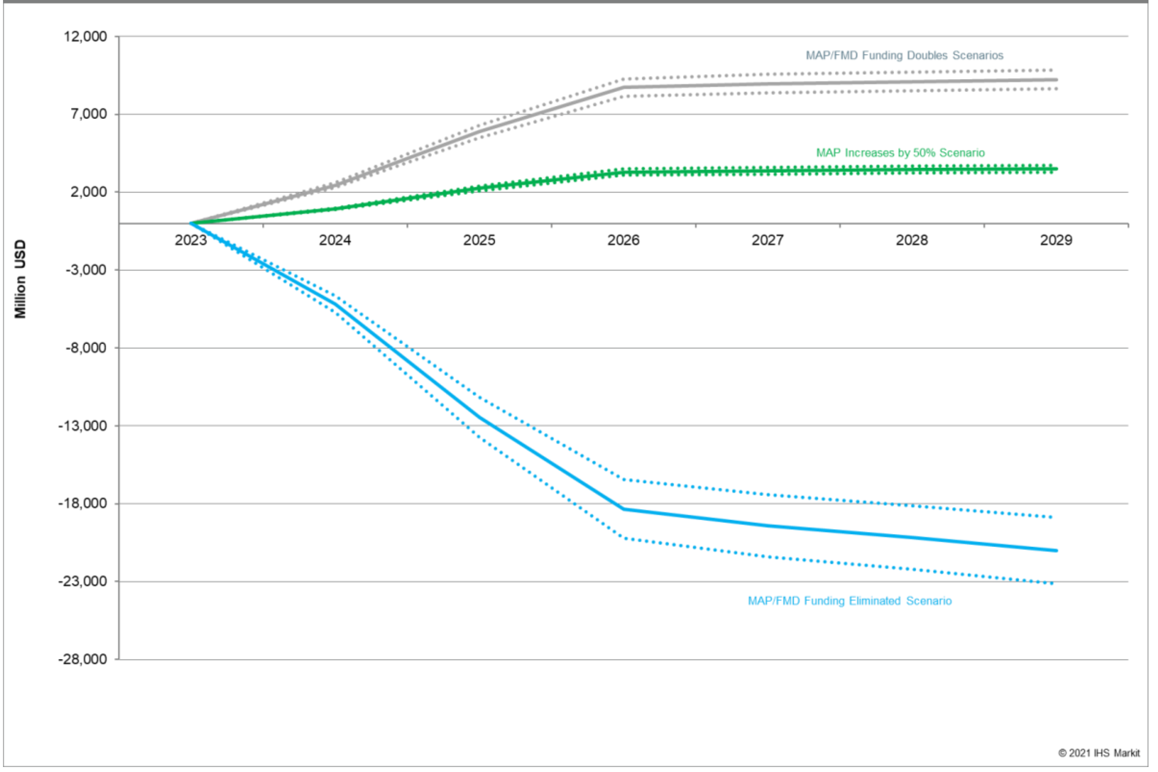
d) MAP/FMD Increases by 50% Scenario

In this scenario, MAP and FMD funding is assumed to remain at the current authorized level through the first four years of the 10-year forecast period ending in 2023. However, then ONLY MAP funding is assumed to increase by 50% ($100 million) beginning in 2024. This scenario is intended to provide a measure of the effects that a continuation of ATP funding might have on exports. FMD funding is assumed to remain at the current budgeted level of $34.5 million for the entire period of 2020 through 2029. Because MAP funding is assumed to increase beginning in 2024, MAP cooperator contributions are assumed increase by 3% in 2023 and then grow at the historic rate of 2.5% over the 2024 - 2029 period. Again, ATP funds are assumed to be spent in this scenario as in the Flat Funding Scenario.

This scenario is similar to the *MAP/FMD Doubles Scenario,* but the magnitude of the effects is smaller (Exhibit 18). The simulation analysis shows that if MAP funding is increased by 50% over the last six years of the 10-year forecast period (2024-2029), the aggregate value of Bulk/Intermediate and HVP exports over that period would increase by a total of $16.8 billion (1.4%) compared to the baseline, an annual average addition of $2.8 billion (Exhibit 19). Again, the only difference between this scenario and *the Flat Funding scenario* is the assumed change in the level of export promotion funding. Note that the increase in export revenue in this scenario (compared to the *Flat Funding Scenario*) is a sustained rather than a one-time event. The effects of the increased promotion on exports does not happen all at once due to the lagged effect of promotion funding on the level of exports as demonstrated econometrically in a previous section of this report. Rather, the effect on export revenue occurs slowly as the increase in funding takes effect in 2024 and builds through the end of the 10-year forecast period (2029)2029 as the increase in funding in this scenario is sustained.

In compliance with OMB guidelines for conducting benefit-cost analyses (OMB 1992), we also conducted a sensitivity analysis of the results of this scenario relative to those of the Flat Funding Scenario by calculating two standard deviations of this scenario forecast (above and below the mean scenario forecast) relative to the corresponding two standard deviations of the flat funding scenario. The resulting mean range in the increase of US agricultural export revenue varies from $873 million to $995 million in 2024 relative to the flat funding scenario and from $3.3 billion to $3.7 billion in 2029 relative to the flat funding scenario (Exhibit 20). The resulting range of increased export revenue effects between 2024 and 2029 is indicated by the dotted green lines in Exhibit 20 which constitutes a 95% forecast confidence interval for this forecast scenario. Over that entire period, *the MAP Funding Increases by 50% Scenario* results in a total addition to US agricultural export revenue of between $15.7 billion and $17.9 billion, a range of about 6.5% above and below the mean forecast scenario results.

Exhibit 20: Sensitivity Analyses of the Alternative Funding Scenarios - Change in US Agricultural Export Revenue from the Flat Funding Level Given Two Standard Deviations of the Scenario Forecast Relative to the Coresponding Two Standard Deviations of the Flat Funding Scenario, 2024-2029



e) MAP/FMD Funding Eliminated Scenario

In this scenario, MAP and FMD funding is assumed to remain at the current budgeted level in the first four years of the 10-year forecast (2020-2023). Then when ATP funds are completely eliminated in the last six years of the 10-year forecast period (2024-2029). Because MAP and FMD funding is eliminated, cooperator contributions also are assumed to be reduced by 50% during that same period. Like the previous three scenarios, the analysis of this scenario was also conducted using equations (5) through (7) to forecast the levels of agricultural exports given the forecast values of the exogenous variable levels in the model except in this case, funding for MAP and FMD is assumed to be eliminated in 2024 through 2029. As in the previous scenarios, ATP funds (expenditures and contributions) are assumed to continue to be spent as in the Flat Funding Scenario.

The effect of eliminating MAP/FMD funding in 2024 through 2029 is a loss of $5.2 billion in US agricultural export revenue in 2024 (2.7%) which builds slowly each year to a loss of $21.0 billion in 2029 (9.8%) (Exhibit 18). The total loss in agricultural export revenue is $96.5 billion (7.9%) over the 2024-2029 period, an average annual loss of $16.1 billion (Exhibit 19). As is the case for the other scenarios, the reduction in export revenue (compared to the Flat Funding Scenario) does not happen all at once. Rather, as discussed earlier, promotion spending has a lagged effect on demand that builds over time as the drop in funding is sustained.

Again, the only difference between this scenario and *the Flat Funding scenario* is the assumed change in the level of export promotion funding. Note that the reduction in export revenue in this scenario (compared to the *Flat Funding Scenario*) is a sustained rather than a one-time event. The effects of the reduction in promotion on exports does not happen all at once due to the lagged effect of promotion funding on the level of exports as demonstrated econometrically in a previous section of this report. Rather, the effect on export revenue occurs slowly as the reduction in funding takes effect in 2024 and builds through 2029 as the reduction in funding in this scenario is sustained.

In compliance with OMB guidelines for conducting benefit-cost analyses (OMB 1992), we also conducted a sensitivity analysis of the results of this scenario relative to those of the Flat Funding Scenario by calculating two standard deviations of this scenario forecast (above and below the mean scenario forecast) relative to the corresponding two standard deviations of the flat funding scenario. The resulting mean loss in US agricultural export revenue varies from $4.6 billion to $5.7 billion in 2024 relative to the flat funding scenario and between $18.9 billion and $23.1 billion in 2029 relative to the flat funding scenario (Exhibit 20). The resulting range of loss in US agricultural export revenue in the last six years of the 10-year forecast period (2024-2029) is indicated by the dotted gold lines in Exhibit 20 which constitutes a 95% forecast confidence interval for this forecast scenario. Over that entire period, the MAP/FMD Funding Eliminated Scenario results in a total loss of US agricultural export revenue of between $86.6 billion and $106.4 billion, a range of about 10.4% above and below the mean forecast scenario results.

National Impact Analysis

a) Overview

The direct value of the additional agricultural export revenue generated is an important measure of the success of the USDA Export Market Development Programs. However, the additional direct revenue generated alone fails to capture the full economic contribution of the additional exports. When the agriculture industry makes an export sale, or any final demand sale, a portion of production expenses are paid to businesses' suppliers, and wages are paid to employees. These businesses and households in turn make purchases in the economy, stimulating additional economic activity. This multiplier effect recognizes that the total effect on output, employment, personal income, and government revenue is greater than the initial dollar value of the added exports.

The national economic analysis captures these broader, economy-wide impacts of the additional export revenue generated by the USDA Export Market Development Programs. Sensitivity analyses are conducted to test the stability of the models and to provide a measure of confidence regarding the results of the analysis.

The IMPLAN economic modeling tool and data (IMPLAN) were used to analyze the effects of the increase in agricultural exports generated by the USDA Export Market Development Programs under the assumption of less than full employment in the economy. The additional agricultural export revenues, or *direct effects*, result in two types of multiplier effects in this analysis: (1) *indirect effects* from the purchase of inputs among local industries and (2) *induced effects* from the expenditures of institutions such as households and governments benefitting from the increased activity among local businesses.

Multipliers were first developed for the increase in agricultural exports as measured in the export demand analysis, accounting for relationships between each of 544 industry sectors as well as private households and governments. As a less-than-full-employment input-output model, IMPLAN assumes constant prices and no resource constraints. The model calculates multipliers based on the purchasing patterns of industries and institutions in the regional economy. Each industry and region combination has a unique spending pattern and a unique multiplier.

To apply industry-specific multipliers accurately, the additional bulk/intermediate exports generated by the USDA Export Market Development Programs from the export demand analysis were proportioned according to IMPLAN sector sales across farm and processed agriculture sectors relevant to bulk commodities. Similarly, high value exports were proportioned across farm and processed agriculture sectors appropriate to high value products. This step approximated the breakdown of the additional export sales by industry, which was not done in previous analyses of the USDA Export Market Development Programs.

The resources needed to produce additional output (including labor, capital, and purchased inputs) are assumed to be readily available in the economy. That is, the model assumes that labor is available from the ranks of the unemployed and that other resources are likewise underutilized. Thus, increased demand for these inputs does not raise their prices and resources do not have to be diverted from other industries to meet higher export demand.

Four types of multiplier effects are reported in this analysis: (1) output or sales, (2) value-added (GDP)[12], (3) labor income or personal income, and (4) employment. The output or sales multipliers measure the effect of direct spending (or loss) on overall economic activity in the United States and sub-regions. The output multiplier provides the largest economic impact value and, therefore, is reported in many studies; however, the output multiplier says nothing about how the event affects the welfare of households or the profitability of businesses.

The labor income or personal income multiplier measures the effect of the additional exports on incomes of households in the nation or region and is appropriate for discerning the benefit to residents. The employment multiplier measures the effect of the increased exports on national employment in various economic sectors. Calculation of the employment multiplier assumes that existing employees are not all fully occupied and thus assumes that any increase in agricultural exports increases employment without increasing wages. Further, the model does not distinguish between full-time and part-time workers.

In this analysis, the simulation results of the impact of the USDA Export Market Development Programs on US agricultural export value are done over the historical period of 2002 to 2019[13] and used to measure the impacts of the program on the overall US economy. The analysis is conducted with the IMPLAN model and assumes that unemployment exists in the economy so that an increase in economic activity resulting from the additional exports generated through the USDA Export Market Development Programs can generate additional employment by drawing labor from the ranks of the unemployed at a constant wage. Historic data from ERS, USDA and the US Bureau of Economic Analysis form the basis of the analyses[14].

b) Agriculture Sector Impacts

The USDA Export Market Development Programs generated a positive lift[15] to the US agriculture sector, pushing up annual average US farm cash receipts in the range of $12.2 billion (3.4%) over the base average value for cash farm receipts for the 2002-

[12] Output (Industry Sales) is the summation of sales among businesses supported by the different spending patterns in an industry (in our case the agribusiness industry). GDP is the sum of value added at every stage of production (the intermediate stages) for all final goods and services produced within a region in a given period of time. In other words, GDP is the wealth created by industry activity. The difference between the two is gross domestic product is a measure of "value added" at the national level (that ag sector contributes to) while economic output measures the value of all sales of goods and services across the ag ind ustry.

[13] This analysis started in 2002 to match the start of the analysis in the 2016 report.

[14] USDA/ERS data that have been used to supplement the IMPLAN have been converted into 2010 dollars with a GDP deflator from USDA/ERS.

[15] Recall that "lift" is defined as an average annual increase in some variable like farm cash receipts due to promotion over some period of analysis (2002-2014 in this case). In this analysis, the lift is defined with respect to a "base value" representing the average annual level of the variable (cash receipts in this case) in the absence of the promotion program.

2019 period of analysis (Exhibit 21). Over the entire period, $219.8 billion was added to farm cash receipts as a result of the program. As with all economic variables shown in Exhibit 18, the standard deviations (measures of uncertainty around the means) for the lift in farm cash receipts under both assumptions is shown in parentheses in Exhibit 11 beneath the respective changes in farm cash receipts. The lift in US net cash farm income was $3.1 billion (4.8%) over the same period as a result of the USDA Export Market Development Programs. In total, the USDA Export Market Development Programs added between $55.8 billion on net farm income above the baseline. The annual lift in farm assets was $1.4 billion (0.6%) and over the entire period was $25.6 billion.

The UDSA Market Development Programs also generated a positive lift in employment across the entire agri-food sector, which includes food product processing as well as production agriculture, totaling 105,800 (1.8%) jobs over the 2002-2019 period (Exhibit 18). These jobs are full and part-time.

c) US Economy Effects

Across the overall US economy, the USDA Export Market Development Programs led to an average annual lift of total US economic output of $45 billion (Exhibit 21); adding $810.2 billion over the entire period. This total contribution to US output includes a contribution to US GDP of $22.3 billion adding $401.3 billion over the entire period – and a contribution to US labor income of $11.7 billion across the economy. Over the entire time period, USDA Export Market Development Programs generated $210.3 billion in additional labor income. Labor income is a component of value added, which is a component of output, so the corresponding numbers in Exhibit 20 cannot be summed. While substantial, the measured lifts of economic variables are not large in percentage terms. For example, the lift in GDP represents only 0.1% of the $20.6 trillion base value of GDP over the period.

Exhibit 21. Average Annual Impacts of USDA Export Market Development Programs on the US Farm and Overall US Economy - 2002-2019[a]

Variable	Base Avg Value[b] (2002-2019)	Average Annual Change		Cumulative Change 2002-2019
Agriculture Sector	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
Farm Cash receipts	359.9	12.2	3.4	219.8
	(38)	(2.2)	(0.001)	
Net Cash Farm Income	64.1	3.1	4.8	55.8
	(16)	(0.6)	(1.5)	
Farm Assets	2,543.9	1.4	0.06	25.6
	(309)	(0.3)	(0.01)	
	1,000 jobs	**1,000 jobs**		
Employment in agri-food sector[c]	5,879	105.8	1.8	
US Economy	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
US Output (Gross Sales)	36,684.7	45.0	0.12	810.2
		(7.8)	(0.02)	
US GDP	20,580.2	22.3	0.1	401.3
		(3.9)	(0.02)	
US Labor Income	12,530.1	11.7	0.09	210.3
		(2.2)	(0.02)	
	1,000 jobs	**1,000 jobs**		
US Employment	198,964	226	0.11	

a Numbers in parentheses are standard deviations based on 18 observations using 2015 deflated values.
b The "base value" for a variable is the average annual level of that variable in the absence of the promotion program.
c The base employment value is measured as actual 2015 jobs as reported in IMPLAN.

Source: IHS Markit © 2021 IHS Markit

d) Benefit-Cost Measures from the National Economic Analysis

The national economic analysis of the impacts of the USDA Export Market Development Programs presented earlier demonstrate that the effects of the program go well beyond generating additional agricultural exports (Exhibit 21). Those effects can be considered to be broad measures of "benefits" of the program to the US agricultural sector and the overall US economy. Comparing those benefits to the amount of funds that have been invested in the USDA Export Market Development Programs yields broad BCR measures of the program.

In the agriculture sector, the farm cash receipt BCR was calculated to be 18.0 (Exhibit 22). In other words, over the 2002-2019 time period, $18 in additional farm cash receipts were generated for every dollar spent on agricultural export promotion through the USDA Export Market Development Programs. To comply with the Office of Management and Budget (OMB) guidelines for conducting benefit-cost analyses (OMB Circular A-94 Revised November 2020), the time value of money was accounted for by discounting the farm cash receipt BCR by the Treasury interest rate. A discounted BCR depends critically on the discount chosen. Consequently, the farm cash receipt BCR was discounted by nominal Treasury interest rates of maturities of 10 years. The resulting discounted farm cash receipt BCRs was 15.6 (Exhibit 21). Thus, the program generated many times more dollars in farm cash receipts then the cost of the program over the 2002-2019 period of analysis.

The net cash farm income BCR which nets out the additional cash costs from additional farm revenues generated by the USDA Export Market Development Programs is 3.8. The discounted net cash farm income BCR was 3.3. The farm asset BCR follows the same pattern as the net cash farm income BCR.

For the overall economy, the US GDP BCR (the GDP generated per dollar spent on agricultural export promotion) was 33.7. That is, every dollar spent on agricultural export promotion between 2002 and 2019 generated an annual average of $33.7 in additional US GDP. On a discounted basis, the US GDP BCR was 29.2.

Over both the agricultural sector and the general US economy, the BCRs are strong. Thus, although the effects of the USDA Export Market Development Programs on the US economy as a whole may be small in percentage terms, the program delivers a healthy return on investment and has large effects in absolute terms as well. Note that benefit-cost ratios based on economic impacts, particularly those calculated using economy-wide impacts such as GDP, should be interpreted with caution.

Exhibit 22. Farm Sector and National Economy Benefit Cost Ratios for the USDA Market Development Programs - 2002-2019

Variable	Non-Discounted BCR	Discounted BCR[a]
Agriculture Sector	**$ Benefit per $ Spent on Ag Export Promotion[b]**	
Farm Cash receipts	18.0	15.6
Net Cash Farm Income	3.8	3.3
Farm Assets	1.2	1.1
	Jobs created per $Million Spent	
Employment in agri-food sector	163.5	
US Economy		
US Output (Gross Sales)	69.0	59.8
US GDP	33.7	29.2
US Labor Income	17.2	14.9
	Jobs created per $1.0 Million Spent	
US Employment	350.0	

a Appendix C of OMB Circular A-94 (Revised 2020)

b Includes government expenditures and cooperator contributions

Source: IHS Markit © 2021 IHS Markit

National Economic Analysis of the Effects of the Future Funding Scenarios

This section considers the likely US farm and general economy impacts of several future USDA Export Market Development Programs funding scenarios. The effects of the various scenarios are measured against a Flat Funding or Baseline Scenario of future USDA Export Market Development Programs spending:

a) Flat Funding (Baseline) Scenario

The Flat Funding (Baseline) Scenario analysis, as discussed earlier, was the process of establishing a forecast baseline using the flat funding scenario assumptions for USDA Market Development Programs funding over the period of 2020 through 2029. The results of the subsequent three scenarios (MAP/FMD Doubles scenario, MAP Funding Increases by 50% scenario, and MAP/FMD Funding Eliminated scenario) are compared to those of the Flat Funding (Baseline) scenario to provide measures of the likely effects of those three future funding scenarios on US agricultural export revenue over the period of 2024-2029. The results of ATP Effects Scenario for US agricultural export value are also measured against those of the Flat Funding (Baseline Scenario).

b) ATP Scenario

The impacts of the ATP funding scenario on key economic variables over the 2019-2026 time period are shown in Exhibit 23 as changes from the respective flat funding scenario (base) values. ATP funds were first used in 2019 and are expected to be spent through 2024. However, because of the lag effect the impacts from ATP are expected through 2026. The impacts of the ATP scenario on key farm and economic variables over the 2019-2026 time period are shown in Exhibit 20 as changes from the flat funding scenario (base values).

The scenario results indicate that the $390 million in ATP funding already and planned to be spent from 2019 through 2024, with lag impacts through 2026, would have been $6.44 billion less in farm cash receipts without ATP funding over the period 2019 to 2026. Net cash farm income would also have been $1.05 billion less over the period. Farm assets would also have been $700 million less during the same time period. US employment would be 4,310 jobs lower without ATP funding.

The ATP funding also benefited the overall economy. The scenario results indicate that GDP would be $11.21 billion less without ATP funding over the 2019-2026 period. US output would also be $22.56 billion less over the same time period. US labor income would be $6.56 billion less during the same time period. US employment annually would be 14,780 jobs lower.

Exhibit 23. Farm and General Economy Impacts of the ATP Scenario Relative to the Flat Funding Scenario, 2019-2026[a]

Variable	Flat Funding Base Value[b]	Average Annual Change - Added benefits from ATP		Cumulative Change 2019-2026
Agriculture Sector	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
Farm Cash receipts	377.4	-0.81	-0.21	-6.44
		(0.47)	(0.002)	
Net Cash Farm Income	61.6	-0.13	-0.21	-1.05
		(0.08)	(0.0003)	
Farm Assets	2,880.0	-0.09	0.00	-0.70
		(0.05)	(0.000002)	
	1,000 jobs	**1,000 jobs**		
Employment in agri-food sector[c]	5,879	-4.31	0.07	0.0
US Economy	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
US Output (Gross Sales)	36,685	-2.82	-0.008	-22.56
		(1.65)	(0.004)	
US GDP	20,580	-1.40	-0.007	-11.21
		(.82)	(0.004)	
US Labor Income	12,530	-0.82	-0.007	-6.56
		(.48)	(0.004)	
	1,000 jobs	**1,000 jobs**		
US Employment	198,964	-14.78	-0.007	

a. Numbers in parentheses are standard deviations based on the 8 observations from 2019-2026.
b. The base value is for the year 2015. The “base value” is the average annual level of a variable in the absence of the promotion program.
c The base employment value is measured as actual 2015 jobs as reported in IMPLAN.
Source: IHS Markit © 2021 IHS Markit

c) MAP/FMD Funding Doubles Scenario

The impacts of the doubling of MAP/FMD funding scenario on key economic variables from 2024 to 2029 time period are shown in Exhibit 24 as changes from the respective flat funding scenario (base) values. In the agriculture sector, the increase in funding in this scenario extending from 2024 to 2029 would raise farm cash receipts annually by $3.75 billion and net cash farm income would be $0.63 billion higher annually. Over the entire 2020-2029 period, farm cash receipts would increase by $22.5 billion, net cash farm income by $3.76 billion and farm assets by $2.38 billion. The number of jobs in the agri-food sector would be 31,350 higher.

Exhibit 24. Farm and General Economy Impacts of the MAP/FMD Doubling Scenario Relative to the Flat Funding Scenario, 2024-2029[a]

Variable	Flat Funding Base Value[b]	Average Annual Change	Percent Change	Cumulative Change 2024-2029
Agriculture Sector	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
Farm Cash Reciepts	377.4	3.75	1.0%	22.50
		(1.15)	(0.000)	
Net Cash Farm Income	61.6	0.63	1.0%	3.76
		(0.19)	(0.001)	
Farm Assets	2,880.0	0.40	0.01%	2.38
		(0.12)	(0.00000)	
	1,000 jobs	**1,000 jobs**		
Employment in agri-food sector[c]	5,879	31.35	0.5%	
US Economy	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
US Output (Gross Sales)	36,685	12.64	0.03%	75.84
		(3.87)	(0.011)	
US GDP	20,580	6.27	0.03%	37.62
		(1.92)	(0.009)	
US Labor Income	12,530	3.64	0.03%	21.84
		(1.12)	(0.009)	
	1,000 jobs	**1,000 jobs**		
US Employment	198,964	64.52	0.03%	

a. Numbers in parentheses are standard deviations based on the 10 observations from 2020-2029.
b. The base value is for the year 2015. The "base value" is the average annual level of a variable in the absence of the promotion program.
c The base employment value is measured as actual 2015 jobs as reported in IMPLAN.

Source: IHS Markit © 2021 IHS Markit

Doubling MAP/FMD funding would also benefit the overall economy. The scenario results indicate that GDP would be $6.27 billion higher annually and $37.6 billion higher over the 2024-2029 period, US output would be $12.6 billion higher annually and $75.8 billion higher over the entire period. US labor income would also be $3.64 billion higher annually and $21.8 billion higher over the same time period. US employment annually would be 64,520 jobs higher.

d) MAP Funding Increases by 50% Scenario

The impacts of MAP funding increasing by 50% scenario on key economic variables over the 2024-2029 time period are shown in Exhibit 25 as changes from the respective flat funding scenario (base) values. In the agriculture sector, the increase in MAP funding by 50% from 2024 to 2029 would increase farm cash receipts, net cash farm income, farm assets, and employment. In monetary equivalent, farm cash receipts would increase by $1.35 billion annually and $8.1 billion over the 2024-2029 period. Net cash farm income would increase $220 million annually and $1.3 billion over the entire period. Farm assets would increase $150 million annually and $890 million over the entire period. The number of jobs in the agri-food sector would be 11,100 higher.

Exhibit 25. Farm and General Economy Impacts of MAP Increases by 50% Scenario Relative to the Flat Funding Scenario, 2024-2029[a]				
Variable	**Flat Funding Base Value[b]**	**Average Annual Change**	**Percent Change**	**Cumulative Change 2024-2029**
Agriculture Sector	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
Farm Cash Reciepts	377	1.35	0.36%	8.11
		(0.41)	(0.0002)	
Net Cash Farm Income	62	0.22	0.35%	1.31
		(0.07)	(0.0002)	
Farm Assets	2,880	0.15	0.01%	0.89
		(0.05)	(0.000002)	
	1,000 jobs	**1,000 jobs**		
Employment in agrifood sector[c]	5,879	11.10	0.19%	
US Economy	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
US Output (Gross Sales)	36,685	4.80	0.013%	28.82
		(1.46)	(0.004)	
US GDP	20,580	2.39	0.012%	14.34
		(0.73)	(0.003)	
US Labor Income	12,530	1.40	0.011%	8.41
		(0.43)	(0.003)	
	1,000 jobs	**1,000 jobs**		
US Employment	198,964	25.41	0.01%	

a. Numbers in parentheses are standard deviations based on the 10 observations from 2020-2029.
b. The base value is for the year 2015. The “base value” is the average annual level of a variable in the absence of the promotion program.
c The base employment value is measured as actual 2015 jobs as reported in IMPLAN.
Source: IHS Markit

Increasing MAP funding by 50% would also benefit the overall economy. The scenario results indicate that GDP would be $2.39 billion higher annually and $14.3 billion higher over the 2024-2029 period, US output would be $4.8 billion higher annually and $28.8 billion higher over the entire period. US labor income would also be $1.4 billion higher annually and $8.4 billion higher over the same time period. US employment annually would be 25,410 jobs higher.

e) Elimination of MAP/FMD Funding Scenario

The impacts of the elimination of MAP/FMD funding scenario on key economic variables over the 2024-2029 time period are shown in Exhibit 26 as changes from the respective flat funding scenario (base) values. In the agriculture sector, the elimination of MAP/FMD funding in this scenario extending 2024 to 2029 would reduce farm cash receipts, net cash farm income, farm assets, and employment. In monetary equivalent, farm cash receipts would decrease by $5.27 billion annually and $31.65 billion over the 2024-2029 period. Net cash farm income would decrease $990 million annually and $5.92 billion over the entire period. Farm assets would decrease $480 million annually and $2.9 billion over the entire period. The number of jobs in the agri-food sector would be 46,860 lower.

Exhibit 26. Farm and General Economy Impacts of Eliminating MAP/FMD Scenario Relative to the Flat Funding Scenario, 2024-2029[a]				
Variable	Flat Funding Base Value[b]	Average Annual Change	Percent Change	Cumulative Change 2024-2029
Agriculture Sector	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
Farm Cash Reciepts	377	-5.27	-1.40%	-31.65
		(2.34)	(0.001)	
Net Cash Farm Income	62	-0.99	-1.60%	-5.92
		(0.37)	(0.001)	
Farm Assets	2,880	-0.48	-0.02%	-2.90
		(0.27)	(0.00001)	
	1,000 jobs	**1,000 jobs**		
Employment in agrifood sector[c]	5,879	-46.86	-0.8%	
US Economy	**US$ billions**	**US$ billions**	**Percent**	**US$ billions**
US Output (Gross Sales)	36,685	-27.55	-0.08%	-165.28
		(8.7)	(0.024)	
US GDP	20,580	-13.73	-0.07%	-82.36
		(4.3)	(0.021)	
US Labor Income	12,530	-8.11	-0.06%	-48.65
		(2.6)	(0.020)	
	1,000 jobs	**1,000 jobs**		
US Employment	198,964	-148.84	-0.07%	

a. Numbers in parentheses are standard deviations based on the 10 observations from 2020-2029.
b. The base value is for the year 2015. The "base value" is the average annual level of a variable in the absence of the promotion program.
c The base employment value is measured as actual 2015 jobs as reported in IMPLAN.

Source: IHS Markit © 2021 IHS Markit

The elimination of MAP/FMD funding would also adversely impact the overall economy. The scenario results indicate that GDP would be $13.7 billion lower annually and $82.4 billion lower over the 2024-2029 period, US output would also be $27.6 billion lower annually and $165.3 billion lower over the same time period. US labor income would be $8.1 billion lower annually and $48.65 billion lower over that time period. US employment annually would be 148,840 jobs lower.

Summary and Conclusions

Major conclusions from this report include:

- The results of this study support/corroborate the conclusions of previous studies that the USDA Export Market Development programs are highly effective at generating an extremely high return on investment and account for a high percentage of the level of U.S. agricultural exports despite the different analytical methods used, different time periods of the studies, and different data sets used in the various studies over the years.
- This study along with the previous study emphasizes the importance of using multiple measures to provide a comprehensive evaluation of USDA export market

development program effectiveness. While BCRs are commonly used to determine the effectiveness of programs, they do not consider the overall scale of a program's impact. Analyzing other measures, such as changes in export revenues, farm income, GDP, etc., in conjunction with BCRs provides a more comprehensive understanding of the full impact of market development programs.

- The results of the future funding scenarios demonstrate any reduction in funding of the USDA Export Market Development Programs would have substantial negative impacts on the US agricultural sector and on the growth of the US economy. Likewise, an increase in funding for the program would contribute substantially to the support of the farm sector and to the overall US economy.
- ATP funding also benefited exports, the farm economy and US economy at a time when the farm sector was adversely impacted by trade wars.

Specific takeaways related to each of the above conclusions include the following:

- The USDA Export Market Development Programs are effective in boosting US agricultural exports.
  - The USDA Export Market Development Programs provided an annual average lift of $9.6 billion to the value of US agricultural exports over the history of the program (1977 through 2019). Over the same period, the program provided an annual average lift to the volume of aggregate US agricultural exports of about 6.1% (9.7 million mt) and to the aggregate price of US agricultural exports of about 7.2% ($30.66/mt). Between 1977 and 2019, the USDA Export Market Development Programs generated a total of $413.7 billion in additional export value and 417.7 million metric tons of additional export volume.
  - The previous study added $8.15 billion annually to export value from 1977-2014.
- Impacts of the USDA Export Market Development Programs on the US farm economy.
  - Over the 2002-2019 time period (with a base value in 2015 dollars), the USDA Export Market Development Programs had a substantial impact on the US agricultural sector. Farm cash receipts were higher by an annual average of $12.2 billion while net cash farm income was $3.1 billion higher, farm asset value was higher by $1.4 billion and employment in the agri-food sector was higher by 105,800 jobs. These values over the entire period equate to $219.8 billion in higher farm cash receipts, $55.8 billion in additional net cash farm income, and $25.6 billion in higher farm asset values.

  - The previous study (2002-2014) (with a base value in 2010 dollars) found that $8.7 billion was added annually to farm cash receipts, $2.1 billion annually to net cash farm income and $1.1 billion annually to farm assets.
- The USDA Export Market Development Programs also had an important impact on the overall US economy.
  - The program increased US output (gross sales) by an annual average of $45.0 billion over the 2002-2019 time period. US GDP also increased by an average of $22.3 billion per year over that time period. The programs also added up to 226,000 jobs to the US economy over that period.
  - The previous study found that $39 billion was added annually in economic output, $16.9 billion annually in GDP and $9.8 billion in annually labor income. Jobs created in the previous study were 239,800.
- Return on Investment Achieved by the USDA Export Market Development Programs
  - The USDA Export Market Development Programs generated high benefit-to-cost ratios (BCRs) over history (1977-2019) which are in the range of those reported by other studies of various agricultural export promotion programs:
    - The undiscounted net export revenue BCR of the USDA Export Market Development Programs (including both USDA and cooperator export promotion expenditures) is calculated as 24.5. That is, for every dollar of export promotion expenditure, the undiscounted return in additional export revenue, net of the promotion expenditures, over the 1977 to 2019 period was $24.5. On a discounted basis, the export revenue BCR of the USDA Export Market Development Programs was $17.4.
    - In comparison, the previous study determined that US agricultural export value increased by $28 (1977-2014) for every dollar invested in export market development.
  - The USDA Export Market Development Programs also generated high returns in terms of their impact on the US farm sector and the overall US economy. Various BCRs reflecting the additional dollars generated for the farm sector per dollar spent on agricultural export promotion through the USDA Export Market Development Programs over the 2002-2019 period include the following:
    - Farm cash receipt BCR: 18 undiscounted (15.4 over the 2002-2014 period in the previous study) and 15.6 discounted.
    - Net cash farm income BCR: 3.8 undiscounted (3.8 over the 2002-2014 period in the previous study) and 3.3 discounted.

        - Farm asset value BCR: 1.2 undiscounted (2.0 over the 2002-2014 period in the previous study) and 1.1 discounted.
        - Also, the program generated 163.5 jobs in the agri-food sector per $US million spent on export promotion (176.3 in the previous study).
    - For the overall economy, various BCRs reflecting the contribution of the USDA Export Market Development Programs to the overall economy per dollar spent on agricultural export promotion over the 2002-2019 period include the following:
        - US GDP BCR 33.7 undiscounted (30,9 over the 2002-2014 period in the previous study) and 29.2 discounted.
        - US Output BCR 69.0 undiscounted and 59.8 discounted.
        - US labor income 17.2 BCR undiscounted and 14.9 discounted.
    - In addition, the USDA Export Market Development Programs generated 350 jobs per $US million spent on export promotion (450 in the previous study).
- Impacts of ATP funding scenario:
    - ATP funding will generate $11.1 billion in additional agricultural export revenue over that 2019-2026 period. Thus, without the promotion spending from ATP funds, $11.1 billion in export revenue will never materialize. The ATP is forecast to generate a Gross Export Revenue BCR of about 28.4 to 1. That is, spending from ATP funds, assumed to occur are forecast to generate $28.4 in additional export revenue for every dollar of ATP funding spent.
    - The results also show that ATP funding will benefit the farm economy. Adding $810 million annually and $6.44 billion over the 2019-2026 period to farm cash receipts. Net cash farm income would increase by $130 million annually and $1.05 billion over the 2019-2026 period. Farm assets would increase by $90 million annually and $700 million over the same time period.
    - The ATP funding will also benefit the overall economy. The scenario results indicate that GDP would be $11.2 billion higher with ATP funding over the 2019-2026 period. US output would also be $22.56 billion higher over the same time period. US labor income would be $6.56 billion higher during the same time period. US employment annually would be 14,780 jobs higher.
- Impacts of Future Funding Scenarios after ATP:
    - The effect of doubling MAP/FMD funding in 2024 through 2029:
        - The value of US agricultural exports would increase $2.4 billion (1.3%) in 2024, $5.9 billion (3%) in 2025, and then by an annual average of $9.0 billion (4.3%) through 2029. Thus, a doubling of MAP/FMD funding would generate an additional $44.4 billion in US agricultural exports over the entire 2024-2029 period, an annual average of $7.4 billion.

        - Farm cash receipts would increase annually by $3.75 billion and $22.5 billion over the 2024-2029 period. Net cash farm income would increase $630 million annually and $3.76 billion over the 2024-2029 period. Farm assets would increase $400 million annually and $2.38 billion over the same time period.
        - GDP would increase by $6.27 billion annually and $37.62 billion over the 2024-2029 period. US output would also be $12.64 billion higher annually and $75.84 billion over the 2024-2029 period. US labor income would be $3.64 billion more annually and $21.84 billion during the same time period. US employment annually would be 64,520 jobs higher.
    - The effect of eliminating MAP/FMD funding in 2024 through 2029:
        - Results in a loss of $5.2 billion in US agricultural export revenue in 2024 (2.7%) which builds slowly each year to a loss of $21.0 billion in 2029 (9.8%). The total loss in agricultural export revenue would be is $96.5 billion (7.9%) over the 2024-2029 period, an average annual loss of $16.1 billion. In the previous study agricultural exports would drop $14.7 billion annually from 2015-2030 period.
        - Farm cash receipts decrease annually by $5.27 billion and $31.65 billion over the 2024-2029 period. In the previous study farm cash receipts would fall $9.9 billion annually from 2015-2030 period.
        - Net cash farm income decreases $990 million annually and $5.9 billion over the 2024-2029 period. In the previous study net farm income would fall $2.5 billion annually from 2015-2030.
        - Farm assets decrease $480 million annually and $2.9 billion over the same time period. In the previous study farm assets would fall $1.3 billion annually from 2015-2030.
        - GDP decreases $13.7 billion annually and $82.4 billion over the 2024-2029 period. In the previous study GDP would decrease $19.5 billion annually from 2015-2030.
        - US output will be $27.6 billion lower annually and $165.3 billion over the 2024-2029 period. In the previous study output would decrease $45.3 billion annually from 2015-2030.
        - US labor income will be $8.1 billion less annually and $48.65 billion during the same time period. In the previous study labor income would decrease $11.3 billion annually and $180.8 billion over the 2015-2030 period.
        - US employment annually would be 148,840 jobs lower. In the previous study US employment would be 278,600 jobs lower.

- The effect of increasing MAP funding by 50% during the 2024 through 2029 period:
    - This scenario is intended to provide a measure of the effects that a continuation of the ATP funding might have on exports.
    - Exports over the 2024-2029 period would increase by $16.8 billion (1.4%) compared to the baseline, an annual average increase of $2.8 billion. The previous study increased both MAP and FMD funding by 50% over the 2015-2030 period and showed that exports over that period would increase by $3.5 billion annually.
    - The farm economy will benefit with farm cash receipts increasing annually by $1.35 billion and $8.1 billion over the 2024-2029 period. In the previous study farm cash receipts would increase $2.4 billion annually from 2015-2030.
    - Net cash farm income will increase $220 million annually and $1.3 billion over the 2024-2029 period. In the previous study net cash farm income would increase $600 million annually from 2015-2030.
    - Farm assets will increase $150 million annually and $890 million over the same time period. In the previous study farm assets would increase $300 million annually from 2015-2030 period.
    - The overall economy will also benefit with GDP increasing by $2.39 billion annually and $14.3 billion over the 2024-2029 period. US output would also be $4.8 billion higher annually and $28.8 billion over the 2024-2029 period. US labor income would be $1.4 billion more annually and $8.4 billion during the same time period. US employment annually would be 25,410 jobs higher.

Appendix

Appendix A: Export Commodity Groups Used in the Study

Bulk and Intermediate			Consumer Oriented			Excluded Products
Agave fibres nes	Forage and silage, alfalfa	Silk, raw	Almonds shelled	Garlic	Offals, edible, cattle	Cigarettes
Alfalfa meal and pellets	Forage and silage, clover	Silk-worm cocoons, reelable	Almonds, with shell	Ghee, buffalo milk	Offals, edible, goats	Cigars, cheroots
Bagasse	Forage and silage, grasses nes	Sisal	Anise, badian, fennel, coriander	Ghee, butteroil of cow milk	Offals, horses	Tobacco, products nes
Barley, pearled	Forage and silage, legumes	Skins, calve nes	Apples	Ginger	Offals, liver chicken	Tobacco, unmanufacture
Barley, pot	Forage and silage, maize	Skins, calve, dry salted	Apricots	Gooseberries	Offals, liver duck	
Bastfibres, other	Forage products	Skins, calve, wet salted	Apricots, dry	Grapefruit (inc. pomelos)	Offals, liver geese	
Beehives	Fructose and syrup, other	Skins, furs	Areca nuts	Grapes	Offals, other camelids	
Beeswax	Germ, maize	Skins, goat nes	Artichokes	Grapes, must	Offals, pigs, edible	
Beet pulp	Germ, wheat	Skins, goat, dry salted	Asparagus	Groundnuts, prepared	Offals, sheep,edible	
Beets for fodder	Glucose and dextrose	Skins, goat, fresh	Avocados	Groundnuts, shelled	Okra	
Biodiesel	Grapes, marc	Skins, goat, wet salted	Bacon and ham	Groundnuts, with shell	Olives	
Bran, barley	Grease incl. lanolin wool	Skins, karakul	Bambara beans	Hazelnuts, shelled	Olives preserved	
Bran, buckwheat	Gums, natural	Skins, pig nes	Bananas	Hazelnuts, with shell	Onions, dry	
Bran, cereals nes	Hair, carded/combed	Skins, pig, dry salted	Beans, dry	Ice cream and edible ice	Onions, shallots, green	
Bran, fonio	Hair, coarse nes	Skins, pig, wet salted	Beans, green	Juice, apple, concentrated	Oranges	
Bran, maize	Hair, fine	Skins, rabbit	Beer of barley	Juice, apple, single strength	Palm kernels	
Bran, millet	Hair, goat, coarse	Skins, sheep nes	Beer of sorghum	Juice, citrus, concentrated	Papayas	
Bran, mixed grains	Hair, goat, fine	Skins, sheep, dry salted	Berries nes	Juice, citrus, single strength	Peaches and nectarines	
Bran, oats	Hair, horse	Skins, sheep, fresh	Beverages, distilled alcoholic	Juice, fruit nes	Peanut butter	
Bran, pulses	Hay (clover, lucerne,etc)	Skins, sheep, wet salted	Beverages, fermented rice	Juice, grape	Pears	
Bran, rice	Hay (unspecified)	Skins, sheep, with wool	Beverages, non alcoholic	Juice, grapefruit	Peas, dry	
Bran, rye	Hay, non-leguminous	Spermaceti	Blueberries	Juice, grapefruit, concentrated	Peas, green	
Bran, sorghum	Hemp tow waste	Straw husks	Brazil nuts, shelled	Juice, lemon, concentrated	Pepper (piper spp.)	
Bran, wheat	Hides and skins nes, fresh	Sugar confectionery	Brazil nuts, with shell	Juice, lemon, single strength	Persimmons	
Bread	Hides nes	Sugar nes	Broad beans, horse beans, dry	Juice, mango	Pigeon peas	
Bulgur	Hides nes, dry salted	Sugar non-centrifugal	Butter and ghee, sheep milk	Juice, orange, concentrated	Pineapples	
Butter of karite nuts	Hides, buffalo, dry salted	Sugar Raw Centrifugal	Butter, cow milk	Juice, orange, single strength	Pineapples canned	
Cake, copra	Hides, buffalo, fresh	Sugar refined	Buttermilk, curdled, acidified milk	Juice, pineapple	Pistachios	
Cake, cottonseed	Hides, buffalo, wet salted	Swedes for fodder	Cabbages and other brassicas	Juice, pineapple, concentrated	Plantains and others	
Cake, groundnuts	Hides, camel nes	Tallow	Carobs	Juice, plum, concentrated	Plums and sloes	
Cake, hempseed	Hides, camel, wet salted	Total Fibre Furnish	Carrots and turnips	Juice, plum, single strength	Plums dried (prunes)	
Cake, kapok	Hides, cattle nes	Turnips for fodder	Cashew nuts, shelled	Juice, tangerine	Potatoes	
Cake, linseed	Hides, cattle, dry salted	Vegetable tallow	Cashew nuts, with shell	Juice, tomato	Potatoes, frozen	
Cake, maize	Hides, cattle, fresh	Vegetables and roots fodder	Cashewapple	Juice, tomato, concentrated	Pulses nes	
Cake, mustard	Hides, cattle, wet salted	Vetches	Cassava	Juice, vegetables nes	Pumpkins, squash and gourds	
Cake, oilseeds nes	Hides, horse nes	Vitamins	Cassava dried	Karite nuts (sheanuts)	Quinces	
Cake, palm kernel	Hides, horse, dry salted	Wafers	Cauliflowers and broccoli	Kiwi fruit	Raisins	
Cake, rapeseed	Hides, horse, wet salted	Waxes vegetable	Cheese, goat milk	Kola nuts	Raspberries	
Cake, rice bran	Hides, wet salted nes	Wood Chips, Particles and Residues	Cheese, processed	Leeks, other alliaceous vegetables	Roots and tubers dried	
Cake, safflower	Honey, natural	Wood Fuel	Cheese, sheep milk	Lemons and limes	Roots and tubers nes	
Cake, sesame seed	Hops	Wood Pellets and Other Agglomerates	Cheese, skimmed cow milk	Lentils	Soya curd	
Cake, soybeans	Infant food	Wool, degreased	Cheese, whole cow milk	Lettuce and chicory	Soya paste	
Cake, sunflower	Isoglucose	Wool, greasy	Cherries	Liver prep.	Soya sauce	
Cane tops	Jute	Wool, hair waste	Cherries, sour	Maize, green	Spices nes	
Cereal preparations nes	Kapok fibre	Wool, shoddy	Chestnut	Mango pulp	Spinach	
Cereals, breakfast	Lactose		Chick peas	Mangoes, mangosteens, guavas	Starch, cassava	
Cocoa, husks, shell	Lard		Chicory roots	Maté	Strawberries	
Cocoons, unreelable & waste	Lard stearine oil		Chillies and peppers, dry	Meat nes	String beans	
Coir	Leather used & waste		Chillies and peppers, green	Meat nes, preparations	Sugar beet	
Cotton lint	Lupins		Chocolate products nes	Meat, ass	Sugar cane	
Cotton linter	Macaroni		Cider etc	Meat, beef and veal sausages	Sugar crops nes	
Cotton waste	Malt		Cinnamon (cannella)	Meat, beef, dried, salted, smoked	Sweet corn frozen	
Cotton, carded, combed	Malt extract		Cloves	Meat, beef, preparations	Sweet corn prep or preserved	
Crude materials	Manila fibre (abaca)		Cocoa, beans	Meat, bird nes	Sweet potatoes	
Degras	Maple sugar and syrups		Cocoa, butter	Meat, buffalo	Tangerines	
Dregs from brewing, distillatio	Margarine, liquid		Cocoa, paste	Meat, camel	Tapioca, cassava	
Ethanol	Margarine, short		Cocoa, powder & cake	Meat, cattle	Tapioca, potatoes	
Fat nes, prepared	Meal, meat		Coconuts	Meat, cattle, boneless (beef & veal)	Taro (cocoyam)	
Fat, camels	Mixes and doughs		Coconuts, desiccated	Meat, chicken	Tea	
Fat, cattle	Molasses		Coffee, extracts	Meat, chicken, canned	Tea, mate extracts	
Fat, cattle butcher	Oats rolled		Coffee, green	Meat, dried nes	Tomatoes	
Fat, pig butcher	Oil, boiled etc		Coffee, husks and skins	Meat, duck	Tomatoes, paste	
Fat, pigs	Oil, castor beans		Coffee, roasted	Meat, extracts	Tomatoes, peeled	
Fat, poultry	Oil, coconut (copra)		Coffee, substitutes containing coffee	Meat, game	Tung nuts	
Fat, poultry, rendered	Oil, cottonseed		Cow peas, dry	Meat, goat	Vanilla	
Fat, sheep	Oil, groundnut		Cranberries	Meat, goose and guinea fowl	Vegetables in vinegar	
Fatty acids	Oil, hydrogenated		Cream fresh	Meat, homogenized preparations	Vegetables, dehydrated	
Fatty substance residues	Oil, jojoba		Crustaceans	Meat, horse	Vegetables, fresh nes	
Feed additives	Oil, kapok		Cucumbers and gherkins	Meat, pig	Vegetables, fresh or dried products nes	
Feed and meal, gluten	Oil, linseed		Currants	Meat, pig sausages	Vegetables, frozen	
Feed minerals	Oil, maize		Dates	Meat, pig, preparations	Vegetables, homogenized preparations	
Feed supplements	Oil, mustard		Eggplants (aubergines)	Meat, pork	Vegetables, leguminous nes	
Feed, compound nes	Oil, olive residues		Eggs, dried	Meat, rabbit	Vegetables, preserved nes	
Feed, compound, cattle	Oil, olive, virgin		Eggs, hen, in shell	Meat, sheep	Vegetables, preserved, frozen	
Feed, compound, pigs	Oil, palm		Eggs, liquid	Meat, turkey	Vegetables, temporarily preserved	
Feed, compound, poultry	Oil, palm kernel		Eggs, other bird, in shell	Melons, other (inc.cantaloupes)	Vermouths & similar	
Feed, food waste preparations	Oil, poppy		Fat, liver prepared (foie gras)	Melonseed	Walnuts, shelled	
Feed, other concentrates nes	Oil, rapeseed		Figs	Milk, dry buttermilk	Walnuts, with shell	
Feed, pulp of fruit	Oil, rice bran		Figs dried	Milk, products of natural constituen	Watermelons	
Feed, vegetable products nes	Oil, safflower		Fish	Milk, reconstituted	Waters,ice etc	
Fibre crops nes	Oil, sesame		Fish, crustaceans, molluscs , other aquati	Milk, skimmed condensed	Whey, cheese	
Fibreboard	Oil, soybean		Flour, cassava	Milk, skimmed cow	Whey, condensed	
Flax fibre and tow	Oil, sunflower		Flour, fruit	Milk, skimmed dried	Whey, dry	
Flax fibre raw	Oil, tung nuts		Flour, mustard	Milk, skimmed evaporated	Whey, fresh	
Flax tow waste	Oil, vegetable origin nes		Flour, potatoes	Milk, whole condensed	Wine	
Flour, barley and grits	Oils, fats of animal nes		Flour, pulses	Milk, whole dried	Yams	
Flour, buckwheat	Olive residues		Flour, roots and tubers nes	Milk, whole evaporated	Yautia (cocoyam)	
Flour, cereals	Pastry		Food prep nes	Milk, whole fresh cow	Yoghurt	
Flour, fonio	Pet food		Fruit, citrus nes	Milk, whole fresh sheep	Yoghurt, concentrated or not	
Flour, maize	Potato offals		Fruit, cooked, homogenized preparations	Molluscs, aquatic invertebrates		
Flour, millet	Pulpwood and Particles		Fruit, dried nes	Mushrooms and truffles		
Flour, mixed grain	Ramie		Fruit, fresh nes	Mushrooms, canned		
Flour, rice	Roundwood		Fruit, prepared nes	Mushrooms, dried		
Flour, rye	Rubber natural dry		Fruit, stone nes	Nutmeg, mace and cardamoms		
Flour, sorghum	Rubber, natural		Fruit, tropical dried nes	Nuts nes		
Food preparations, flour, malt	Sawlogs and Veneer Logs		Fruit, tropical fresh nes	Nuts, prepared (exc. groundnuts)		
Food wastes	Sawnwood		Fruits, nuts, peel, sugar preserved	Offals nes		

Appendix B: Indicator Variables of Potentially Key Events Impacting US Agricultural Exports Tested for Significance

Years	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975
Weather & Natural Events																																															
Hurricane Katrina																	x																														
Historic US flooding																													X																		
Russian Drought/Export Ban												X																																			
South America Drought (countries vary)					x	x	x	x		x	X		x			x	x	x							x						x	x	x									x					
Short Argentine crop forces Brazil to lower non-Mercosur import tax									x																																						
US Drought (locations vary)									x	x	x				x	x			x														x								x						
Back to back US & Australian drought for wheat															x	x																															
Japanese Earthquake											X																																				
EU Grain Shortage														x	x																																
Animal & Crop Disease Events																																															
Avian Influenza						x	x	x																																							
Swine Flu													x																																		
BSE																		x	x																												
PEDv								x	x																																						
US Soybean Aphid Infestion																		x																													
African Swine Fever outbreak in China				x																																											
Covid	x	x																																													
Trade Issues/Events																																															
China enters WTO																				x																											
WTO begins																											x																				
NAFTA begins																												x																			
Japanese Beef Agreement																																	x														
Starlinnk issue Impacts Corn trade																					X																										
Chinese ban corn exports																												X																			
Discovery of GMO wheat in Oregon									x																																						
USSR Embargo																																										X					
China's Slow Approval of MIR 162 & rejection of US Corn (2013)								x	x																																						
Russian Drought/Export Ban												x																																			
US China Trade Tensions	x	x	x	x																																											
Economic Events																																															
Financial Meltdown														x	x																																
Recession												x	x																																		
Euro Debt and 9/11											X																																				
US/World Economic concerns								X						X																											X	X					
Energy price run-up														X	X																																
Farm Policy Events																																															
Dairy Whole Herd Buyout																																				x											
Ethanol Program								X	X	X	X	X	X	X	X																																
PIK Program																																							x								
US Export Enhancement Program																										x	x	x	x	x	x	x	x	x	x	x											
Loss of Australian Wheat Board's single desk authority								x	x	x	x	x	x	x																																	
Loss of Canadian Wheat Board's single desk authority								x	x	x																																					
Lack of Packer Capacity Hogs																							x	x																							
EU CAP reform								x	x																																						
Political Events																																															
Ukraine/Russian situation								X																																							
Arab Spring Unrest in N. Africa											x																																				
Rise of FSU prod'n & export capability following the fall of the Soviet Union								x	x	x	x	x	x	x	x	x	x	x	x	x	x																										

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