
# An Economic Analysis of Market Impacts of the National Watermelon Promotion Board: 2017-2021

**December 2022**


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## Executive Summary

The National Watermelon Promotion Board (NWPB) was founded in 1989 with a mission focused on increasing consumer demand for watermelon through promotion, research, and educational programs. Funded by assessments on the growers and handlers of domestic watermelons and the importers of watermelon, the NWPB raises approximately $3.53 million annually (2021 year-end) with $2.195 million specifically earmarked for promotional activities (communications, marketing, and foodservice) and educational efforts to provide information to consumers to enhance demand. Research investments of $312,455 and $1,336,734 in other operating expenses account for the remainder of the 2021 budget.

The Federal Agriculture Improvement and Reform Act of 1996 (FAIR Act) requires Research and Promotion (R&P) boards to conduct independent evaluations of program effectiveness at least every five years. Therefore, the purpose of this study is to determine the impact of the NWPB's activities on the demand for watermelon and the return on investment (ROI) from the NWPB's activities. Utilizing advanced modeling techniques, this study shows the NWPB generated a return on investment (ROI) of nearly 19:1.

This five-year study update includes analysis of the impacts from the Coronavirus pandemic that began in 2020. Much of the data collected was capped through the end of 2021, at a time when the global economy was still in recovery mode from the pandemic. Impacts on production, input costs, and distribution were noted in several data sets; industry patterns showed definite breaks in long-term trends, which were likely temporary.

The USDA National Agricultural Statistics Service (NASS) is a key data provider used in the analysis throughout this report. Since 2015, the NASS report began excluding important production data from five producer states, resulting in a loss of 5% of market reporting. In 2019,

three more states were dropped from data collection, resulting in a total loss of 12% of the producer market data. As a result, total supply data and per capita watermelon consumption is likely understated compared to data collected prior to 2016. Per capita consumption of watermelon decreased from 15.0 pounds in 2001 to 14.4 pounds in 2021 according to NASS, which represents a 4.0% decline. Over the past five years, per capita consumption is down 11%, and was likely affected by the loss of producer data in the NASS dataset.

Total supply of watermelon dropped from 5.6 billion pounds in 2017 to 5.2 billion pounds by the end of 2021, again largely due to changes related to data collection in the NASS data and pandemic related challenges.

Watermelon grower revenues during the period from 2017 to 2021 dropped slightly, in nominal dollars, from $826.7 million in 2017 to $820.1 million in 2021. Growers also received a lower inflation-adjusted price per hundredweight (cwt) over that period; the price per cwt declined from $13.64 in 2017 to $13.42 in 2021, a slight decrease of 1.6%. Over the longer-term, inflation-adjusted watermelon grower revenues are 6.2% higher than they were a decade ago and 58.7% higher than they were in 2001. Retailers experienced a 31.6% increase in total revenues for watermelon between 2017 and 2021, with revenues at the end of 2021 totaling $2.131 billion.

As the research shows, there is a strong relationship between promotional activities and grower revenues. To understand the impact of domestic marketing by the NWPB and isolate those activities from other demand factors, statistical models are used to focus on those real market relationships.

The study examines retail prices using IRI scan data from regions across the country along with the NWPB monthly promotional expenditure data to create a model for retail watermelon demand. Additionally, the quantity of watermelons, cantaloupe and honeydew are considered for inclusion into the model. The model shows that the NWPB's promotional activities have a statistically significant, positive impact on the retail price of watermelon. The quantity of watermelon proves extremely significant in determining retail watermelon prices. The quantities of neither cantaloupe nor honeydew are proven significant. The region in which watermelon is sold is a major contributor to retail prices.

Two scenarios are examined to demonstrate the overall impact of the NWPB's activities:

1. Setting the NWPB monthly expenditure levels to their actual values for the period 2017-2021.
2. Setting all the NWPB monthly expenditure levels to the lowest value ever experienced from 2017-2021: $87,830 in February of 2017.

The simulation results of the two scenarios show that the NWPB's activities increase the retail price of watermelon by 4.5%. Similarly, the NWPB's activities increase farm price by 3.5% which results in an increase of $225.19 million in sales, representing an 18.8:1 return on investment.

Total domestic production of watermelons in 2021 was 3.37 billion pounds (aside from 2014 this was the lowest total output since 1991). Like many other industries, as supply chain continuity returns, labor availability improves, and distribution costs reduce, production is showing a tendency to return to pre-pandemic norms.

As in prior studies (Kaiser 2012 and 2017), current analysis shows that there is a broader impact from the NWPB's activities on the macroeconomic environment. A combination of contributions to the broader economy enhances the overall impact of the NWPB's investments.

The results indicate that spending on promotion by the NWPB potentially increased employment in the industry by 4,234 jobs (incremental grower income / median fruit and vegetable worker salary). Using economic multipliers from the USDA Economic Research Service for the melon segment of agricultural output, the total effect of the NWPB spending likely increased broader economic output in the nation by $160 million. Without the NWPB, the pandemic would have had a significantly higher impact on the industry.

The main findings of this study are that the watermelon industry continues to get a very high return from the domestic promotion efforts of the NWPB, and that these promotion programs have a significant impact on the general economy. The modeled ROI of 18.8:1 indicates that it would be profitable and prudent from an industry standpoint to continue to increase the level of domestic promotion of watermelons.

# An Economic Analysis of Market Impacts of the National Watermelon Promotion Board

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Christopher Kuehl, Armada Corporate Intelligence
Keith Prather, Armada Corporate Intelligence

## Introduction

The National Watermelon Promotion Board (NWPB) was founded in 1989 with a mission focused on increasing consumer demand for watermelon through promotion, research, and educational programs. Funded by assessments on the growers and handlers of domestic watermelons and the importers of watermelon, the NWPB raises approximately $3.53 million annually (2021 year-end) with $2.195 million specifically earmarked for promotional activities (communications, marketing, and foodservice) and educational efforts to provide information to consumers to enhance demand. Research investments of $312,455 and $1,336,734 in other operating expenses account for the remainder of the 2021 budget.

The Federal Agriculture Improvement and Reform Act of 1996 (FAIR Act) requires Research and Promotion (R&P) boards to conduct independent evaluations of program effectiveness at least every five years. Therefore, the purpose of this study is to determine the impact of the NWPB's activities on the demand for watermelon and consequently, what the return on investment (ROI) is for the NWPB's activities. Utilizing advanced modeling techniques, this study shows the NWPB generated a return on investment (ROI) of nearly 19:1.

This five-year study update includes analysis of the impacts from the Coronavirus pandemic that began in 2020. Much of the data collected was capped through the end of 2021, at a time when the global economy was still in recovery mode from the pandemic. Impacts on production, input costs, and distribution were noted in several data sets; industry patterns showed definite breaks in long-term trends and are likely temporary.

## Researcher's Credentials

This independent evaluation is carried out by Armada Corporate Intelligence, Inc. (Armada) in collaboration with Morris, Nelson and Associates, LLC (MNA).

**John Nelson – Principal Analyst**

The principal analyst is Mr. John J. Nelson of MNA. Mr. Nelson is the CEO and Sr. Analyst at MNA. After retiring from military service in 2007, he has led numerous analytical and organizational improvement projects for a diverse client base of private sector, government, and military organizations. For several years, he developed analytical approaches, simulations, models, and strategies for federal, state, and local law enforcement agencies and non-profit organizations fighting Transnational Organized Crime. For the past three years, he has partnered with Armada Corporate Intelligence to develop economic forecasting models for U.S. industrial production, rail, trucking, intermodal transportation, and private construction.

Mr. Nelson has presented at numerous conferences including the Interservice/Industry Training, Simulation and Education Conference, Military Operations Society Symposium and has co-written several research publications.

A Certified Lean Six Sigma Master Black Belt, Mr. Nelson is a graduate of the United States Military Academy at West Point. He holds Master of Science degrees from the University of Central Florida in both Training Simulations and Engineering Management, and formerly served as an Assistant Professor at West Point.

**Dr. Chris Kuehl – Economist**

Dr. Chris Kuehl is a Managing Director for Armada Corporate Intelligence and one of its founders. Prior to Armada he was a professor of economics and finance for 15 years - teaching in the US, Russia, Estonia, Hungary, Taiwan and Singapore. His advanced degrees are in Soviet Studies (MA), East Asian Studies (MA) and Political Economics (PhD).

For the last 25 years he has been a keynote speaker for hundreds of meetings and conferences (averaging 125 presentations a year). These groups have ranged considerably including manufacturing, finance, agriculture, accounting, and others. He has spoken as keynote for the Georgia Watermelon Association in 2022 and will repeat in 2023. He has also been a frequent keynote for agricultural organizations and companies in Kansas, Missouri, North Dakota, Tennessee, Texas, Kentucky, Nebraska, Illinois, North Carolina, Florida and others.

He is co-writer and editor for the *Flagship* (publication from Armada) as well as the *Strategic Intelligence System* (also from Armada). He writes several industry publications for organizations as diverse as the American Supply Association, Chemical Coaters Association International and Fabricators and Manufacturers.

His focus has been on communicating complex economic issues to a broad audience through presentations, publications, and other interactions. The collection and evaluation of data is key to understanding an industry but the important next step is communicating these findings so they can be related to and acted upon.

**Keith Prather - Analyst**

Mr. Keith Prather has served as President and a Managing Director of Armada Corporate Intelligence for 22 years. As a well-known analyst, Mr. Prather provides more than 50 keynotes and presentations a year on economic forecasting and organizational updates on the global operating environment for corporations and associations. As an author, Keith writes an intelligence briefing called the *Flagship: An Executive Intelligence Briefing*, currently read by more than 18,000 business executives three times a week and publishes 12 additional reports per month for large corporations and business associations.

Mr. Prather was a co-creator with Mr. Nelson of a predictive modeling system known for its accuracy in predicting manufacturing output for general manufacturing of both durable and nondurable goods, machinery manufacturing in agriculture and transportation, aerospace, automotive, computers and electronics, electrical equipment and appliances, and fabricated metal products. These advanced models are used in the finance and manufacturing industry to understand output activity up to 18 months in advance.

In addition, Mr. Prather developed several indexes used in the private sector including the Transportation Demand Index that has been used for 15 years in the transportation and logistics sector; the NCM Automotive Demand Index; the Logistics Pulse Global Logistics Index; the National Association of Electrical Distributors Construction Potential Index and others.

Mr. Prather has a Master's in Business Administration from Baker University with an emphasis in finance and wrote his thesis on running a Competitive Intelligence Firm in Modern Corporate Environments. He is also a former Chief Financial Officer and was a frequent volunteer for the Kauffman Foundation and the Center for Transitional Leadership, an organization that counsels retiring Military staff as they begin entrepreneurial pursuits in post-service careers.

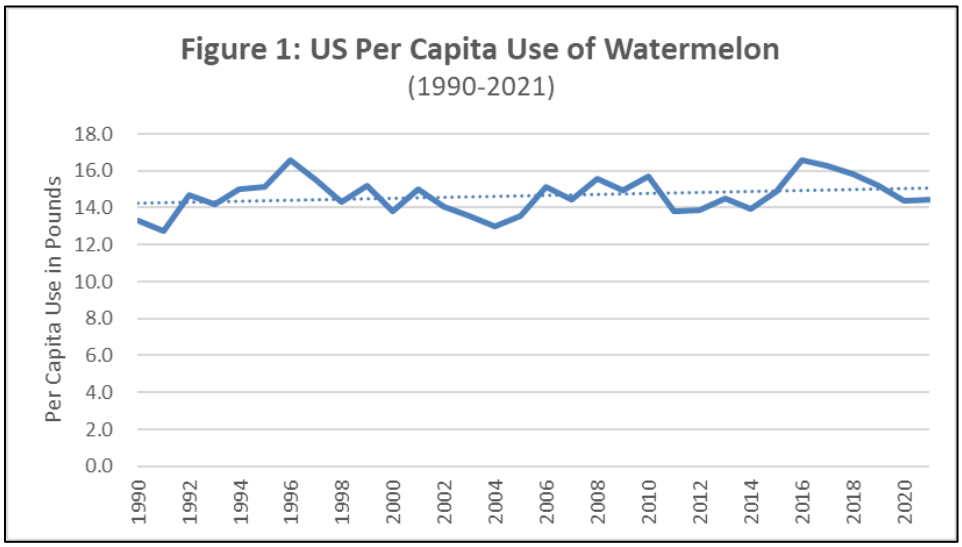
## Trends in Watermelon Consumption and Sales

The USDA National Agricultural Statistics Service (NASS) is a key data provider used in industry analysis and throughout this report. Since 2015, the NASS report began excluding important production data from five producer states, resulting in a loss of 5% of market reporting. In 2019, three more states were dropped from data collection, resulting in a total loss of 12% of the producer market data. As a result, total supply data and per capita watermelon consumption is likely understated compared to data collected prior to 2016.

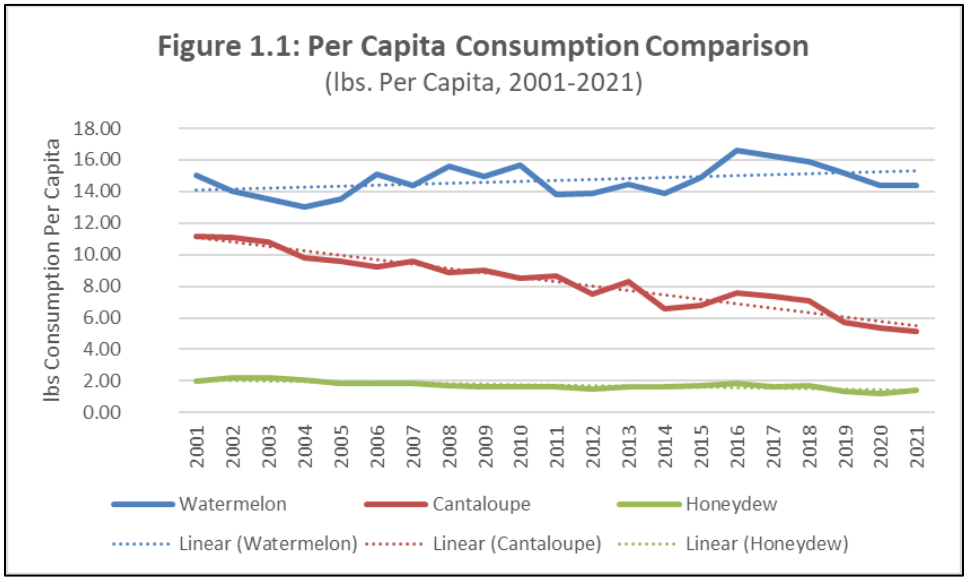
Total supply of watermelon dropped from 5.6 billion pounds in 2017 to 5.2 billion pounds by the end of 2021, again largely due to changes related to data collection in the NASS data and likely some pandemic related challenges.

For comparison, honeydew production in 2021 was the lowest in USDA recordkeeping dating back to 1970 and cantaloupe domestic production had the lowest level of output since 1976. Again, both categories were also impacted by the change in NASS data collection.

Per capita consumption of watermelon decreased from 15.0 pounds in 2001 to 14.4 pounds in 2021, which represents a 4.0% decline per NASS data. Over the past five years, per capita consumption is down 11%, and was likely affected by the loss of producer data in the NASS dataset. However, per capita use of watermelon (consumption) has generally been stable for the past 30 years. Figure 1 shows the long term trendline (dotted blue line) showing a slight increase in consumption over the longer term.

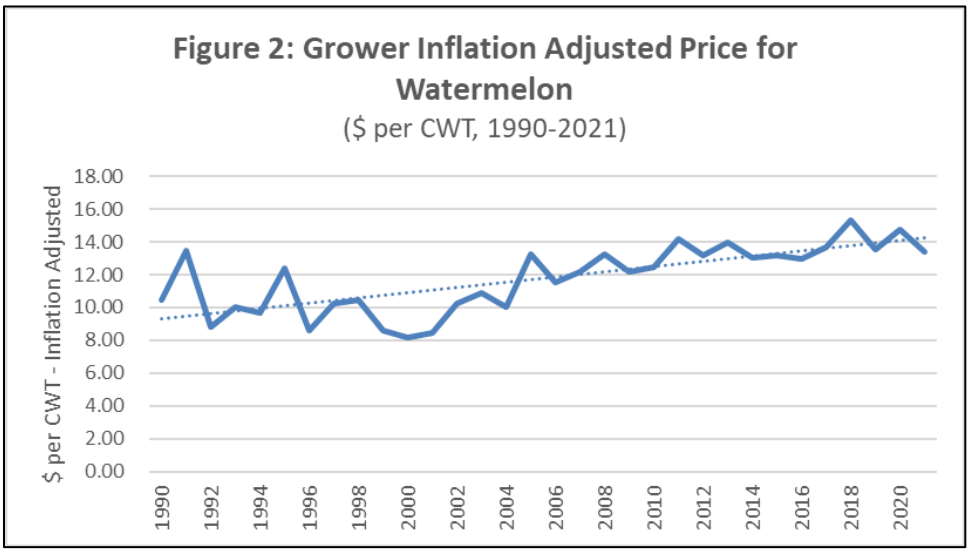


Per capita consumption of products across watermelon, cantaloupe, and honeydew categories show that watermelon was the only category showing positive trends in consumption over the past 20 years. Figure 1.1 shows the comparison of the three commodity lines.

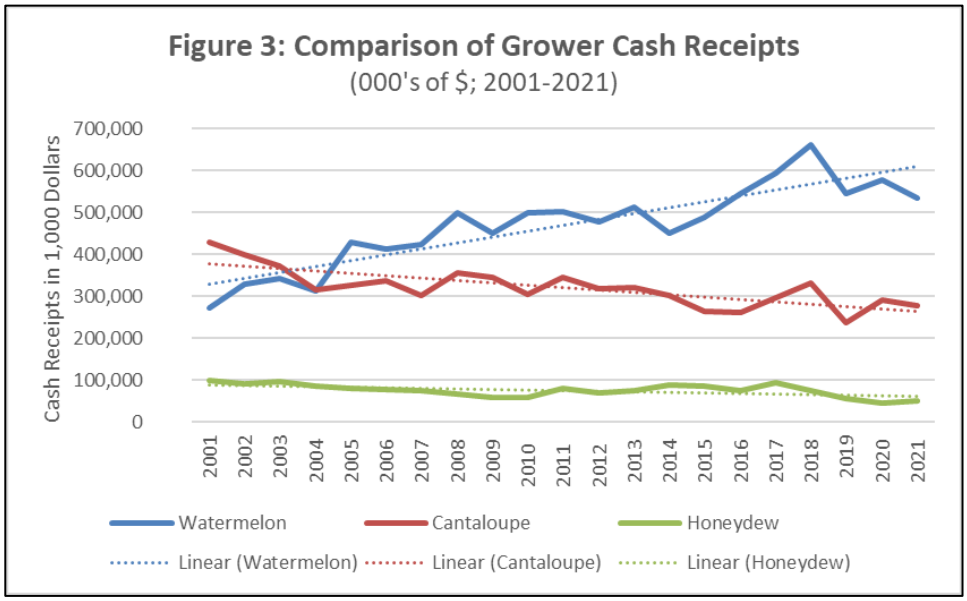



Watermelon grower revenues during the period from 2017 to 2021 dropped slightly, in nominal dollars, from $826.7 million in 2017 to $820.1 million in 2021 (again, acknowledging a loss of 12% of NASS market data during that period). Growers also received a lower inflation-adjusted price per hundredweight (cwt) over that period; the price per cwt declined from $13.64 in 2017 to $13.42 in 2021, a slight decrease of 1.6%.

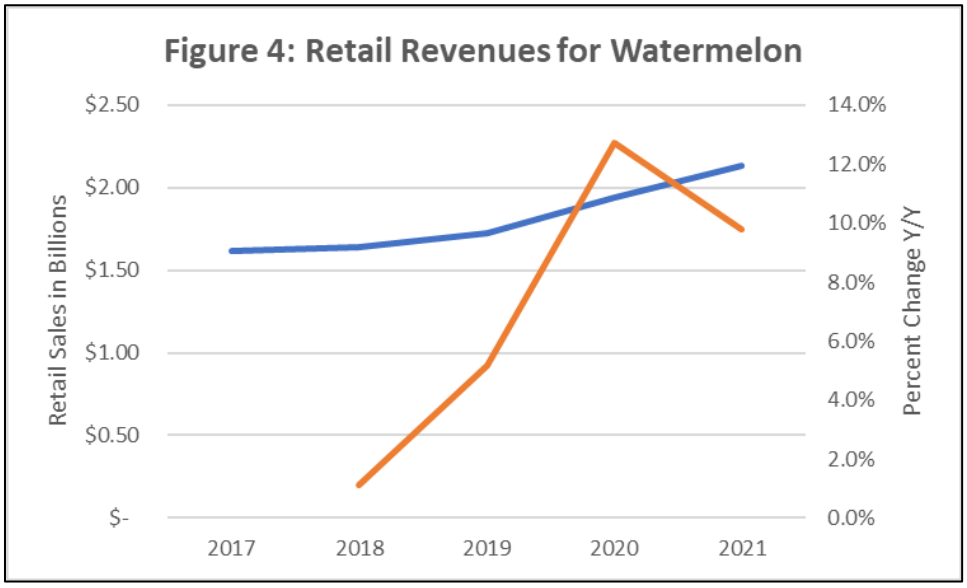
Over the longer-term, inflation-adjusted watermelon grower revenues are 6.2% higher than they were a decade ago and 58.7% higher than they were in 2001 (Figure 2). Retailers experienced a 31.6% increase in total revenues for watermelon between 2017 and 2021, with revenues at the end of 2021 totaling $2.131 billion.



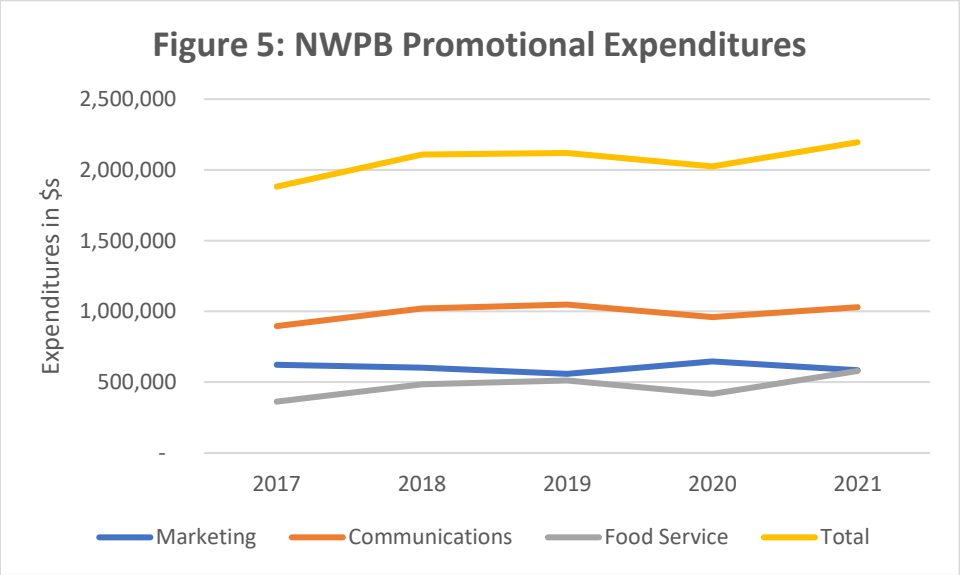

There is a considerable difference in the national sales cash receipts between the three competitive melon categories. Figure 3 shows the difference in grower cash receipts at a national level over the 20-year period between 2001 and 2021. Cash receipts for watermelon growers have increased from $273.4 million in 2001 to $533.7 million in 2021 (a 95.2% increase). Over the same period, cantaloupe experienced a drop of -35.4% and honeydew fell -50.8%. Over the past five years with the impact of the pandemic, watermelon grower cash receipts have dropped -2.4%, cantaloupe increased 6.5%, and honeydew was down -34.9%.



Retailer revenues have benefited during this five-year period. Between 2017 and 2021, retail watermelon revenues have increased 31.6% from $1.619 billion in 2017 to $2.131 billion in 2021. Figure 4 shows this trend over the five-year period (blue) and the annual percent change in retail sales for the subsequent four (orange).




The NWPB's annual expenditures on promotional activities continued to increase during the study period. Isolating marketing, communications, and foodservice promotional activities, expenditures have been modestly increasing over the past four years and hit $2.195 million in 2021, up slightly from $2.024 million in the pandemic year. Figure 5 shows the various spending categories since 2017 and the mild growth of each during that period. Total spending was up 16.7% over the five-year period.




In summary, spending on promotional activities likely contributed heavily to the growth in inflation-adjusted prices for watermelon growers as shown in Figure 2 above.

To verify this speculative conclusion in looking at secondary data and research, and isolate promotional activities from other factors like the pandemic and external impacts, a sophisticated modeling process was applied to this study to calculate the specific return-on-investment from the NWPB's promotional activities to the watermelon industry.

# Methodology

In this study, Armada analyzes how the promotional activities of the NWPB impact the U.S. demand for watermelon over the five-year period from 2017 through 2021. Established statistical econometric methods are used to account for the various factors that can influence the demand for watermelon.

This study assumes that a good proxy for the demand for watermelon is retail price. Accordingly, a statistical model is developed with retail price, adjusted for inflation, as its dependent variable. While it is anticipated that the NWPB's promotional activities have an impact on the demand for watermelon, several other factors also impact the demand for watermelon and are included in the study's statistical analysis. Based on the theory of supply and demand, it follows that the quantity of watermelon available impacts demand – the greater the supply the lower the price. Watermelon shares the retail market with honeydew and cantaloupe; the supply and demand for both could influence the demand for watermelon. The impact of the season of the year on prices is also included in the analysis.

Since retail prices can vary significantly from market to market, the analysis incorporates watermelon pricing data from eight separate regions of the country including California, Great Lakes, Mid-South, Northeast, Plains, South Central, Southeast, and West. This approach enables an understanding of how regional market conditions influence the demand for watermelon.

In the simplest terms, we can say that the demand for watermelon is dependent on the:

- supply of watermelon;
- supply of cantaloupe;
- supply of honeydew;
- activity of the NWPB;
- season of the year; and
- retail region.

Using the retail price of watermelon as a proxy for demand, the demand for watermelon can be expressed mathematically as:

$$PW_{it}/CPI_t = \beta_0 + \beta_1(QtyWm_{it}) + \beta_2(QtyCant_{it}) + \beta_3(QtyHD_{it}) + \beta_4(NWPB_{t-n}/CPI_t) + \beta_5(SEAS_t) + \sum_{j-1}^{7} \beta_j REG_i$$

Where:

- $PW_{it}$ is the retail price of watermelon in retail region *i* during month *t*.
- $CPI_t$ is the Total Consumer Price Index during month *t.*
- $QtyWM_{it}$ is the quantity of watermelon in retail region *i* during month *t.*
- $QtyCant_{it}$ is the quantity of cantaloupe in retail region *i* during month *t.*
- $QtyHD_{it}$ is the quantity of honeydew in retail region *i* during month *t.*
- $NWPB_{t-n}$ are the promotional expenditures of the National Watermelon Promotion Board for months *t* through *n*.
- $SEAS_t$ is a seasonal dummy variable; 1 for a five-month summer period (May through September) and 0 for a seven-month winter period (October through April)
- $REG_i$ is a regional dummy variable for each of the retail regions.

Both the retail price for watermelon and the expenditures of the NWPB are divided by the Consumer Price Index (CPI) to account for inflation over time allowing for comparisons in constant dollars.

## Econometric Results

The demand model is developed using ordinary least squares, multiple regression analysis. The dependent variable, the retail price of watermelon, and the independent variables - the quantities of watermelon, cantaloupe, and honeydew as well as the expenditures of the NWPB – are taken in their natural logarithmic form. To account for the regional differences in retail price, dummy variables are included for 7 of the 8 regions: California, Great Lakes, Mid-South, Plains, South Central, Southeast, and West. Having the highest average retail price for watermelon during the study period, the Northeast region is selected as the reference region.

An autoregressive term (AR1), representing the previous month's retail price of watermelon, is added to the model to correct for autocorrelation. Residual analysis of the initial model reveals errors trending positively in 2021. Therefore, a final term is added to the model, the consumer price index for food which accounts for the significantly higher inflation that occurred toward the end of the study period and corrects the residual error imbalances.

The results of the econometric model (Table 1) show that over 96% of the variability in the retail price of watermelon across all regions during the study period is explained by the model (see the Adjusted R Square value of 0.96 in the OVERALL FIT section). The model results indicate that the NWPB has a statistically significant impact on watermelon price. As shown by its negative coefficient, the quantity of watermelon has an inverse relationship with the retail price - as the quantity of watermelon increases, the retail price decreases; Kaiser (2017) found a similar relationship is his previous study. Similar to Kaiser (2012) and Ward (2007), this study reveals there are significant differences in the retail prices of watermelon from region to region. Unlike previous studies, the season (summer or winter) did not have an impact on the retail price and was removed from the model; the quantity of watermelon available accounts for the impact of seasonal variations on price.

| OVERALL FIT | |
|---|---|
| Multiple R | 0.983848 |
| R Square | 0.967958 |
| Adjusted R Square | 0.9672 |
| Standard Error | 0.078279 |
| Observations | 477 |

| | |
|---|---|
| AIC | -2418.44 |
| AICc | -2417.65 |
| SBC | -2368.43 |

| ANOVA | | | | Alpha | 0.05 | |
|---|---|---|---|---|---|---|
| | *df* | *SS* | *MS* | *F* | *p-value* | *sig* |
| Regression | 11 | 86.07542 | 7.825038 | 1277 | 0 | yes |
| Residual | 465 | 2.849368 | 0.006128 | | | |
| Total | 476 | 88.92479 | | | | |

| | *coeff* | *std err* | *t stat* | *p-value* | *lower* | *upper* | *vif* |
|---|---|---|---|---|---|---|---|
| Intercept | -5.1187 | 0.512099 | -9.99553 | 1.94E-21 | -6.12501 | -4.11238 | |
| LN(QtyWm) | -0.31171 | 0.0058 | -53.7396 | 1.3E-201 | -0.3231 | -0.30031 | 3.619953 |
| LN(NWPB/CPI)-L7 | 0.030855 | 0.011129 | 2.772614 | 0.005784 | 0.008987 | 0.052724 | 1.090532 |
| Cal | -0.22146 | 0.014797 | -14.9666 | 1.28E-41 | -0.25054 | -0.19238 | 1.874172 |
| GrLakes | -0.16805 | 0.014671 | -11.4545 | 6.26E-27 | -0.19688 | -0.13922 | 1.816114 |
| MidSouth | -0.19966 | 0.014708 | -13.5747 | 1.36E-35 | -0.22856 | -0.17076 | 1.85179 |
| Plains | -0.469 | 0.016513 | -28.4012 | 1.2E-103 | -0.50145 | -0.43655 | 2.334216 |
| SoCentral | -0.2261 | 0.014841 | -15.2346 | 8.37E-43 | -0.25527 | -0.19694 | 1.885449 |
| SoEast | 0.133025 | 0.014636 | 9.089081 | 2.89E-18 | 0.104264 | 0.161785 | 1.780954 |
| West | -0.21887 | 0.014785 | -14.8031 | 6.7E-41 | -0.24792 | -0.18981 | 1.871236 |
| AR(1) | 0.142474 | 0.015457 | 9.217423 | 1.06E-18 | 0.1121 | 0.172848 | 3.540281 |
| LN(CPI-UF) | 1.083915 | 0.092213 | 11.75451 | 4.13E-28 | 0.902709 | 1.26512 | 1.017903 |

| Shapiro-Wilk Test | |
|---|---|
| W-stat | 0.997241 |
| p-value | 0.610534 |
| alpha | 0.05 |
| normal | yes |

| d'Agostino-Pearson | |
|---|---|
| DA-stat | 0.264487 |
| p-value | 0.876128 |
| alpha | 0.05 |
| normal | yes |

Table 1: Econometric model of retail demand for watermelon

The quantity of cantaloupe proved insignificant and was removed from the model. Although it initially proved significant, the quantity of honeydew was removed from the model as its inclusion caused multicollinearity issues with the quantity of watermelon; in other words, the quantities of watermelon and honeydew moved together – they are colinear. Multicollinearity makes estimates of individual variable coefficients difficult to interpret and unreliable. When honeydew is removed from the model, the Adjusted R Square of the resulting model remains very high (over 0.96) and close to when honeydew is included.

By using logarithmic transformations, price flexibility for the explanatory variables can be readily estimated. Price flexibilities represent the percent change in the dependent variable given a 1% change in an explanatory variable. From Table 1 above, the price flexibility

coefficient for the quantity of watermelon is -0.312 and for the 0.031 the NWPB's activities This means that a 10% increase in the quantity of watermelons available would result in approximately 3.12% decrease in the retail price of watermelon. Likewise, a 10% increase in expenditures on the NWPB's activities would result in a 0.31% increase in retail watermelon price. The price flexibility for the NWPB's activities found in this study is smaller than what Kaiser found in 2017 (0.056) indicating that retail demand is somewhat less responsive to the activities of the NWPB than during the previous study period, 2012-2016. Of note is that the lagged value of the NWPB in the model (*LN(NWPB/CPI)-L7*) shows that there is a seven-month time-period before the maximum benefit of the NWPB activities are felt on the retail price of watermelon. Previous studies also demonstrated how promotional activities had a residual effect over time.

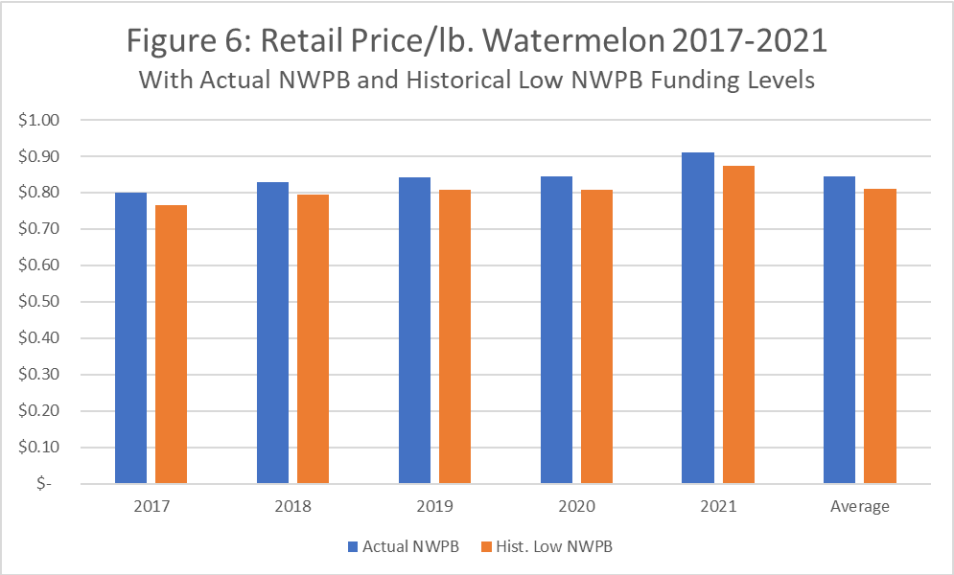
## Simulation Analysis

The retail demand model enables the development of a simulation that can depict the impact of differing market conditions, which in turn allows for a calculation of ROI for the NWPB's activities. For the study period of 2017-2021, two specific scenarios are simulated:

1. Setting the NWPB monthly expenditure levels to their actual values for the period.
2. Setting all the NWPB monthly expenditure levels to the lowest value ever experienced during the period - $87,830 in February of 2017.

The resulting difference between the average retail prices between the two scenarios in the simulation provides an estimation of the impact of the NWPB's activities. This approach is somewhat different than the approaches taken by Ward (2007) and Kaiser (2012, 2017) in previous studies. In each of those studies, scenarios with actual historical values were compared with scenarios that removed the NWPB activities from the model entirely as with Ward, or with expenditure levels set to 1% of their historical level as with Kaiser. These approaches require extrapolating a resultant dependent variable using independent variables that are outside of the known sample space, a "dangerous practice" (Scheaffer and McClave, 1995) as the linear relationships found during the model may not hold beyond the sample space.

Figure 6 below depicts the difference in the retail price of watermelon from the simulation using actual expenditures for the NWPB and setting those expenditures to their lowest level between 2017 and 2021. Depicted by the blue columns, the retail prices shown are the average retail prices for each year across all retail regions holding the NWPB expenditures at their actual historical levels. The orange columns depict the average retail price when the NWPB monthly expenditures are set to the lowest level experienced between 2017 and 2021. On average, the retail price between the two scenarios differed by approximately $0.04 per pound, approximately 4.5%, clearly showing the benefit of the NWPB to retailers.

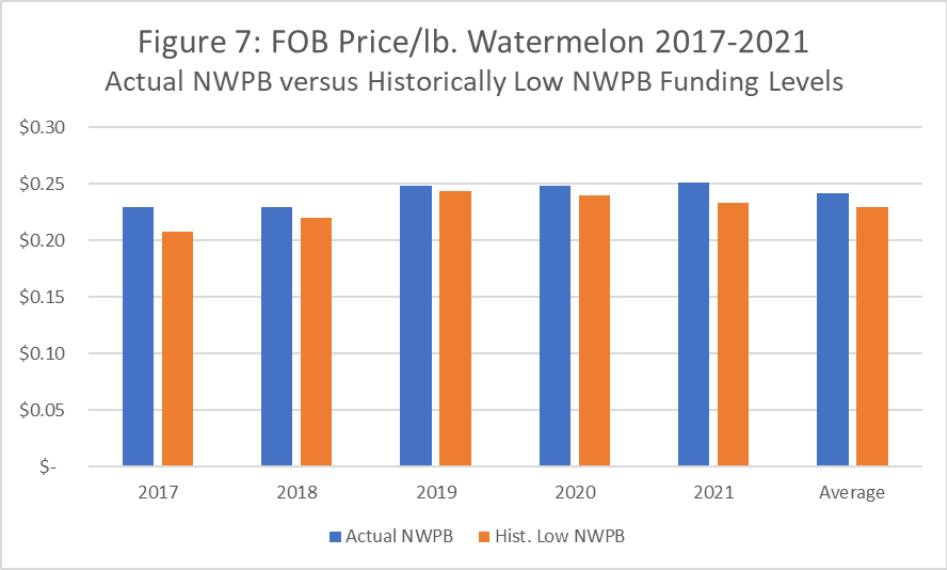



From the perspective of the NWPB, it is more important to know what impact it has on farm prices. Using available data, the study team developed a model to estimate the relationship between retail and farm price using the FOB (free on board) price as a proxy, as did Ward (2007) and Kaiser (2012 and 2017). Data available for FOB is more limited than it is for retail price. The resulting model had limited utility as it explained only slightly more than 63% of the variability in the FOB price. As a result, confidence intervals developed were exceptionally wide and not useful for constructing an accurate estimate of ROI.

Accordingly, this study employs a similar procedure to that used by Ward (2007) and Kaiser (2012 and 2017) linking price spreads between FOB and retail price. Between 2017 and 2021, on average the FOB price was approximately 28% of the retail price of watermelon. The FOB portion of the retail price is shown below for each year in the study period:

- 2017 – 27%
- 2018 – 28%
- 2019 – 30%
- 2020 – 30%
- 2021 – 27%

Applying these percentages to the average retail price for each year, an estimate is calculated for the corresponding FOB price. Figure 7 shows the difference between the average FOB price using the NWPB's actual expenditures and that when expenditures are set to their historically lowest level. On average, the difference between the annual FOB price for watermelon is $0.012 per pound, or 3.5%.




Taking the difference between the annual FOB price for watermelon between the two scenarios and multiplying it by the total domestic watermelon production during that same period provides an estimate of the increase in sales at the farm level. From 2017 to 2021, the domestic watermelon production was 18.3 billion pounds. Multiplying the $0.012 per pound FOB price difference by 18.3 billion pounds results in a $225.19 million increase in the value of sales. During the same five-year period, the total NWPB expenditures were $17.23 million. In the five-year study period, the lowest monthly NWPB expenditure level occurred during February 2017 where total expenditures were $87,830. If the expenditure levels for all months during the period are set to $87,830, the total NWPB expenditures are $5.27 million for the five-year period. The difference between the actual expenditures and the lowest expenditures scenario is $11.96 million. The rate of return on investment (ROI) for the NWPB's expenditures between the two scenarios is:

$$ROI = {}^{\$225.19\ mil.}/_{\$11.96\ mil.} = 18.8$$

This ROI shows that the NWPB has a significant impact on the farm price. Since statistical techniques have inherent error associated with them, a 99% confidence interval on the ROI is developed. The upper and lower bounds of the 99% confidence interval are 27.7 and 9.8 respectively. This means that we can be 99% confident that the true mean ROI for the NWPB's activities is a positive number between these two bounds. The ROI of 18.8:1 is lower than found by Kaiser in 2012 and 2017 study but above what Ward found in 2007. Table 2 below shows a comparison between the ROIs found during each study.

| Study | ROI |
|---|---|
| 2007 - Ward | 10.6 |
| 2012 - Kaiser | 27.73 |
| 2017 - Kaiser | 32.08 |
| 2022 - Armada | 18.8 |

Table 2: Comparison of ROI between the NWPB Economic Analysis Studies

## Broader Economy-wide Impacts

Aside from the health benefits that society enjoys from consumption of fresh produce, there are other measurable economic benefits from a strong watermelon production sector. Through promotion and education, economic growth across a broad range of industries can be realized using specific measuring techniques. Support industries ranging from those firms providing direct material inputs (fertilizers, seeds, pesticides, etc.) to the direct and indirect labor supporting the sector, there is a wide range of economic benefits that emerge from growth in an industry. When including the impacts to state and local tax income, transportation and logistics, the services sector (legal, accounting, etc.), a dollar spent on promotion in the industry yields significant returns (beyond the ROI calculated in the previous modeling discussion).

The use of input/output models and creating multipliers for commodity sectors helps understand the broader impact of a dollar of spending in a given sector and how that dollar multiplies across the economy.

The USDA provides a specific modeling value and isolates the melon sector, and it uses recent data to calculate those measures. Ironically, using multipliers to calculate economic benefit is supposed to help smooth out fluctuations in economic volatility, but the recent 100-year pandemic event has had an impact on some multiplier calculations. With the pandemic impact on many industries and datasets, it is difficult to get an accurate measure of the full impact of the industry on the current economic environment. For example, the current multiplier for contributions to total economic output and employment from the melon production sector shows just 0.71 using the USDA Economic Research Service (ERS) model calculations.

Using this economic multiplier from the ERS for the melon segment of agricultural output, and the incremental increase that the NWPB's marketing and promotion efforts generated on a dollar basis, the total effect of the NWPB's spending likely increased broader economic output in the nation by $160 million *(0.71 X $225.19 million)*. Despite being lower than the findings in the 2017 Kaiser report ($200 million in total impact), this was still substantial. And certainly, without the NWPB promotional efforts, the pandemic would likely have had a significantly greater negative impact on the industry.

A previous study conducted in 2019 by the Nevada Department of Agriculture found that the vegetable and melon industry had a multiplier of 1.6 using pre-pandemic data. Based on

those more optimistic findings, the NWPB could have contributed as much as $360 million to the broader economy based on the output of the current statistical model illustrated in the previous section. The Nevada data is slightly skewed because it is impossible to isolate just the melon sector in the data from a broader vegetable sector. But upon analyzing current USDA data in the ERS economic multiplier database, vegetables and melons both have the same multiplier quotient. The inference here is that even when using the Nevada data to illustrate pre-pandemic contributions of the sector to the broader economy, the ratio likely holds. In either case, the incremental increase in broader economic growth is significant given the low amount of dollars in total investment into the NWPB.

# Conclusions and Implications

The purpose of this study is to determine the impact of the NWPB activities on the demand for watermelon, and consequently, what the ROI is for investment in the NWPB activities. A model is developed that explains the retail demand for watermelon as it is explained by the quantity of watermelon, the monthly expenditures of the NWPB, and the retail region in which the watermelon is sold: California, Great Lakes, Mid-South, Northeast, Plains, South Central, Southeast, and West.

There are several key findings from this report. First, the activities of the NWPB have a significant positive impact on watermelon demand. The study shows that funding the NWPB's activities at their actual levels versus funding them at the lowest monthly level experienced results in a 4.5% increase in the retail price of watermelon. Based on the demand model developed, the price flexibility coefficient for the NWPB's expenditures is 0.031 meaning that a 10% increase in expenditures on the NWPB's promotional activities would result in a 0.31% increase in retail watermelon price.

The study also demonstrates that the NWPB's promotional activities have a positive impact on farm prices. On average there is a $0.012 per pound difference in farm price between when the NWPB's expenditures are set to their historically lowest level versus what was experienced using the actual expenditures. The result of this difference is a $225.19 million increase in farm sales. The resultant ROI for the NWPB's promotional activities is 18.8:1.

The results indicate that spending on promotion by the NWPB potentially increased employment in the industry by 4,234 jobs (incremental grower income / median fruit and vegetable worker salary). Using economic multipliers from the USDA Economic Research Service for the melon segment of agricultural output, the total effect of the NWPB's spending likely also increased broader economic output in the nation by $160 million.

The study, consistent with previous studies, clearly shows that the NWPB is having a significant positive impact on the watermelon industry. The nearly 19:1 ROI makes a strong case for increased funding to the NWPB.

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USDA Agricultural Marketing Service

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January 3, 2023

Mr. Mark Arney
Executive Director
National Watermelon Promotion Board
1321 Sundial Point
Winter Springs, FL 32708

Dear Mr. Arney:

I am writing this letter in regards to the National Watermelon Promotion Board's econometric evaluation that our office received on December 16, 2022.

Our office, the Market Development Division, reviewed the econometric evaluation titled "An Economic Analysis of Market Impacts of the National Watermelon Promotion Board: 2017-2021" written by John Nelson, Morris, Nelson & Associates, LLC, Christopher Kuehl, Armada Corporate Intelligence, and Keith Prather, Armada Corporate Intelligence, collectively from Armada Corporate Intelligence. The Market Development Division concurs with the evaluation conducted by Armada Corporate Intelligence.

Sincerely,

*Marlene M. Betts*

Marlene M. Betts
Marketing Specialist
Market Development Division
Specialty Crops Program