AN ANALYSIS OF THE EFFECTS OF THE AMERICAN PISTACHIO GROWERS PROGRAM TO REDUCE/ELIMINATE TARIFFS ON U.S. PISTACHIOS

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EXECUTIVE SUMMARY

Introduction

In April 2019, the American Pistachio Growers (hereafter "APG") retained The Tootelian Company (hereafter "consultant") to assist it in conducting a study to assess the effects of APG's actions to reduce or eliminate tariffs placed on pistachios grown in the United States by other countries and/or eliminate various trade barriers to create a more competitive marketplace for U.S. pistachios. The objective of APG's program was to expand the marketplace for U.S. growers by eliminating barriers to their shipping pistachios to foreign markets. This study sought to quantify some of the results of APG's efforts on behalf of American pistachio growers and processors in five geographic areas: Israel, Mexico, China, Hong Kong, and the European Union (E.U.).

The specific issues addressed in this study were:

- What would shipments in pounds of U.S. pistachios have been to Israel, Mexico, China and Hong Kong, and the European Union (E.U.) if the tariffs had not been reduced/eliminated, and how do those compare to actual shipments after the tariffs were reduced/eliminated?

- What would the dollar value of shipments of U.S. pistachios have been to Israel, Mexico, China and Hong Kong, and the European Union (E.U.) if the tariffs had not been reduced/eliminated, and how do those compare to actual dollar values of shipments after the tariffs were reduced/eliminated?

- How much extra U.S. and World supply of U.S. pistachios, if any, would there have been if the tariffs remained?

- How much do shipments of U.S. pistachios increase for every percent reduction of tariff imposed by geographic areas? How much does the dollar value of those shipments increase for every percent decline in the tariff imposed by geographic areas?

- How sensitive is demand to changes in prices of U.S. pistachios?

- To what extent could an increase in the U.S. supply of pistachios impact prices of U.S. pistachios?

Background

American Pistachio Growers (APG) is the United States' pistachio industry's generic trade association. It has more than 865 contributing members, and represents the interests of its growers and member processors located in California, Arizona and New Mexico.

APG was initially established as the Western Pistachio Association in 2007 as a voluntary trade association, following the dissolution of the California Pistachio Commission which was a mandated commodity marketing order. The name of the organization was changed to American Pistachio Growers in 2011.

Since the impact of generic agricultural activities are sometimes viewed as nebulous, APG commissioned a study to quantify the results of the actions taken by the industry's generic body. The purpose was to weigh the impact those actions have had on the industry at large and, in particular, its growers, and to provide data that would allow the members of the association to assess the direct benefits they receive.

While APG engages in multiple activities on behalf of the industry, a primary focus is on government relations that seek to reduce/eliminate tariffs and generic marketing designed to increase demand for pistachios and U.S. share of the market in export markets prioritized by the Board of Directors. This report will refer to the actions of the California Pistachio Commission, Western Pistachio Association, and American Pistachio Growers by the current association's name, American Pistachio Growers.

Methodology

Data for these analyses came from APG and other published sources. Analyses were made through 2017 since that was the most current data available. In addition, issues associated with U.S. and World production and supply were limited to 2007 through 2017 because that was the most credible information available. Furthermore, many of the analyses centered on the time frame from 2009 through 2017 since that was a period in which tariffs were reduced in all five geographic areas.

Summary and Conclusions

The analyses related to the reduction/elimination of tariffs in these geographic areas indicate that:

- Actual total shipments for the years after which the tariffs were reduced/eliminated for each country were more than 2.3 billion pounds (nearly 1.1 million metric tons) greater than what would have been expected if the tariffs remained in place.

- The average increase in actual shipments over projected shipments if tariffs remained just from 2009 through 2017 when all geographic areas had tariff reductions/eliminations was nearly 187.6 million pounds (more than 85,000 metric tons) per year.

- The actual total dollar value of the shipments for the years after which the tariffs were reduced/eliminated for each country was nearly $3.0 billion greater than what would have been expected if the tariffs remained in place. On an inflation-adjusted basis, this was more than $2.7 billion greater than what would have been expected if the tariffs remained in place. If the significant price fluctuations in Hong Kong and China were eliminated, the total dollar value of the shipments would have been nearly $4.5 billion greater (more than $4.4 billion on an inflation-adjusted basis).

  For an average year between 2009 and 2017 when all of the geographic areas had tariff reductions/eliminations, the average dollar value of shipments was nearly $172.5 million per year greater than projected dollar values if tariffs remained. On an inflation-adjusted basis, the average actual dollar value was nearly $158.2 million more per year. If the price fluctuations of Hong Kong and China were eliminated from this analysis, the average increase in the dollar value of shipments would have been nearly $355.5 million per year (nearly $354.7 million per year on an inflation-adjusted basis).

- The additional pounds of U.S. pistachios that would have gone into U.S. and World Storage per year if the tariffs remained and the pistachios were not diverted to other global markets ranged from a low of nearly 93.8 million pounds (42,500 metric tons) in 2015 to a high of nearly 285.2 million pounds (nearly 129,350 metric tons) in 2017. It is unlikely that growers would have wanted to build this much inventory in storage, so diversion to other markets at possibly lower prices might have been a necessary option.

- For the years in which all of the geographic areas had reduced/eliminated tariffs (i.e., 2009 through 2017), more than 1.7 billion pounds (nearly 785,000 metric tons) of U.S. pistachios would have gone into Storage if they were not diverted to other markets. This is an average of more than 192.0 million pounds (more than 87,000 metric tons) per year. As indicated above, it is unlikely that growers would have wanted to build this much inventory in storage, so diversion to other markets at possibly lower prices might have been a necessary option.

- U.S. Storage of pistachios would have increased annually from a low of a 52.5% (2015) to a high of a 451.2% (2010) if the tariffs remained in place. World Storage would have increased annually from a low of a 44.8% (2015) to a high of 268.3% (2010).

- The results of this analysis indicate that there was an increase in the tons shipped per 1% tariff reduction in Israel, China, and the E.U. This increase ranged from a low of nearly 317,250 pounds (143.9 metric tons) shipped per 1% tariff reduction in Israel to a high of more than 43.8 million pounds (19,890 metric tons) shipped per 1% tariff reduction in the E.U. The dollar value of the shipments per 1% reduction in tariffs ranged from a low of more than $1.0 million in Israel to a high of more than $126.2 million in the E.U. Finally, the dollar value per pound shipped per 1% reduction shipped ranged from a low of -$0.53 in China to a high of $0.56 per 1% reduction shipped in tariffs in the E.U. As previously indicated, China had significant price-per-ton fluctuations which suggests its results should be used with caution.

The analyses related to the relationship between the price of and demand for U.S. pistachios indicate that:

- Demand for U.S. pistachios is somewhat price sensitive. On an overall basis, and using all data points, the slope of the best fit trend line implies that a $1,000 increase in the price of U.S. pistachios resulted in a decline of 261.8 metric tons shipped—or 577.3 pounds for every $1.00 price increase. When the E.U., with its upward sloping demand curve was removed, it appears that a $1,000 increase in the price of U.S. pistachios resulted in a decline of 156.0 metric tons shipped—or 344.0 pounds for every $1.00 price increase. However, varying degrees of elasticity were found, and in only just over half of the data points did shipments decline with higher prices. This suggests that factors other than price, such as perceived better quality, safer due to better farming methods, more nutritious, etc. may influence demand for U.S. pistachios. This is further described as the last summary point.

- It was assumed that for every additional metric ton of U.S. pistachios available, the price would need to decline in order for it to be absorbed in the global marketplace. Based on the slopes of this analysis using shipments as the independent variable and prices as the dependent variable, the slopes ranged from a positive $0.0638 for the E.U. to a negative $0.6948 for China. If the E.U. is not included because of its upward-sloping demand curve, price declines ranging from $0.14 (Mexico) to $0.32 (China) would be needed per additional 1,000 pounds available.

  Based on the additional total supply from 2009 through 2017 that would have been available if U.S. pistachios were not shipped due to tariffs remaining in place, prices may have needed to decline as much as 196.2% (Hong Kong) to as little as 5.3% (China) excluding E.U. with its upward sloping curve. Using a weighted average based on excess demand in each geographic area, average prices for all geographic areas may have to decline 15.3% on an annual basis to absorb the additional supply available.

- While tariff reductions/eliminations have positively impacted shipments, price does not appear to be the sole determinant of the volume shipped. Shipments and prices per ton rose after the tariffs have been reduced/eliminated, and computed elasticities of demand show that there are many individual price-shipment points where prices and shipments rose together. Possible reasons for this are that APG's marketing education efforts have caused consumers to view U.S. pistachios as being a good value proposition for superior quality, safety, and being healthy and nutritious. Other factors could be that consumers view pistachios more of a necessity for good nutrition than a luxury, consider the prices comparable to competing items which makes U.S. pistachios more desirable, and the realization that purchases of U.S. pistachios are not a major expense in relation to total household purchases. Overall, it is important to emphasize that it appears APG's efforts to reduce/eliminate tariffs resulted in increased shipments of U.S. pistachios to these five geographic areas. However, it also is likely that price was not the only relevant factor in this growth in shipments. APR's efforts to market the U.S. pistachio brand appears to have been a contributing factor to the increase in shipments.

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INTRODUCTION

In April 2019, the American Pistachio Growers (hereafter "APG") retained The Tootelian Company (hereafter "consultant") to assist it in conducting a study to assess the effects of APG's actions to reduce or eliminate tariffs placed on pistachios grown in the United States by other countries and/or eliminate various trade barriers to create a more competitive marketplace for U.S. pistachios. Hereafter in this Summary Report, for ease of reading all of these efforts by APG will be referred to as "reducing/eliminating tariffs."

The objective of APG's program was to expand the marketplace for U.S. growers by eliminating barriers to their shipping pistachios to foreign markets. APG's efforts in various parts of the world resulted in changes in shipment patterns and the dollar values of those shipments. This study sought to quantify some of the results of APG's efforts on behalf of American pistachio growers and processors in five geographic areas: Israel, Mexico, China, Hong Kong, and the European Union (E.U.).

Background

American Pistachio Growers (APG) is the United States' pistachio industry's generic trade association. It has more than 865 contributing members, and represents the interests of its growers and member processors located in California, Arizona and New Mexico.

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Since the impact of generic agricultural activities are sometimes viewed as nebulous, APG commissioned a study to quantify the results of the actions taken by the industry's generic body. The purpose was to weigh the impact those actions have had on the industry at large and, in particular, its growers, and to provide data that would allow the members of the association to assess the direct benefits they receive.

While APG engages in multiple activities on behalf of the industry, a primary focus is on government relations that seek to reduce/eliminate tariffs and generic marketing designed to increase demand for pistachios and U.S. share of the market in export markets prioritized by the Board of Directors. This report will refer to the actions of the California Pistachio Commission, Western Pistachio Association, and American Pistachio Growers by the current association's name, American Pistachio Growers.

Particular attention in this study was given to these five geographic areas because of the availability of data to make the analyses. A brief description of APG's efforts is presented below:

- ***Israel***: Even though Israel had an embargo against Iran, the only pistachios imported by Israel were Iranian pistachios. APG representatives worked with the U.S. Department of State, USDA, and members of Congress to address the trade with Iran. These efforts proved to be instrumental because in the closing months of 2008, the Israeli government issued a trade order stating that all imported pistachios except those of U.S. origin would be charged a 23 percent tariff.

- ***NAFTA (Mexico)***: APG testified before the U.S. House Committee on Ways and Means' Trade Subcommittee in support of NAFTA while the other specialty crop witnesses opposed the trade agreement. Upon NAFTA's implementation on January 1, 1994, U.S. raw pistachios received zero duty going into Mexico. The duty on imports from non-member pistachio exporting nations remained at 20 percent.

- ***China***: China joined the World Trade Organization in 2011. Prior to accession, APG consulted with the Office of the U.S. Trade Representative, Department of Commerce officials, USDA agency officials, and members of Congress in support of a reduction in China's tariffs on U.S. pistachios. As a part of the terms for its inclusion, China agreed to take concrete steps to remove trade barriers and open its markets to foreign exports. China ultimately reduced tariffs on pistachios from 40 to 10 percent and then to 5 percent in preparation for the 2008 Olympic Games.

- ***Hong Kong***: Most of the product shipped to Hong Kong is later re-exported to China, so for all practical purposes, China and Hong Kong can be viewed as a single market. Industry experts also have found that significant quantities of pistachios are transshipped through Vietnam from Hong Kong or directly from the U.S. Hong Kong charges no duty on U.S. pistachios.

- ***European Union (hereafter "E.U.")***: In 1997, the E.U. embargoed Iranian pistachios after the detection of high levels of aflatoxin in pistachios imported from Iran. The California Pistachio Commission and APG immediately lobbied the European Commission to recognize the U.S. pistachio export program that required all exports to be tested in California before being exported to Europe. When the Uruguay Round was being negotiated, APG lobbied to receive the lowest possible European tariff, and it received a 50 percent reduction to 1.6 percent in 1995. Since Iranian pistachios receive zero duty under the Generalized System of Preferences, this tariff reduction allowed U.S. pistachios to be more competitive against Iranian pistachios in Europe.

Issues of the Study

The specific issues addressed in this study were:

- What would shipments in pounds of U.S. pistachios have been to Israel, Mexico, China and Hong Kong, and the European Union (E.U.) if the tariffs had not been reduced/eliminated, and how do those compare to actual shipments after the tariffs were reduced/eliminated?

- What would the dollar value of shipments of U.S. pistachios have been to Israel, Mexico, China and Hong Kong, and the European Union (E.U.) if the tariffs had not been reduced/eliminated, and how do those compare to actual dollar values of shipments after the tariffs were reduced/eliminated?

- How much extra U.S. and World supply of U.S. pistachios, if any, would there have been if the tariffs remained?

- How much do shipments of U.S. pistachios increase for every percent reduction of tariff imposed by geographic areas? How much does the dollar value of those shipments increase for every percent decline in the tariff imposed by geographic areas?

- How sensitive is demand to changes in prices of U.S. pistachios?

- To what extent could an increase in the U.S. supply of pistachios impact prices of U.S. pistachios?

Consultant

The Tootelian Company is a Sacramento, California-based marketing and management consulting firm. It specializes in performing economic impact studies, conducting market research, and assisting its clients with their business and marketing plans. The consultant was Dennis H. Tootelian, Ph.D.

Dr. Tootelian is an Emeritus Professor of Marketing in the College of Business at California State University, Sacramento, and the former Director of the CSUS Center for Small Business which he developed into one of the largest of its kind in the United States. Dennis received his Ph.D. in Marketing from Arizona State University, with minor fields in Accounting and Management.

Dennis has published approximately one hundred articles dealing with all facets of business, and has co-authored six texts on marketing and small business management. His academic research has appeared as peer-reviewed articles (i.e., reviewed by academicians for quality of research methodology) in such journals as the Journal of Marketing, Journal of Retailing, Journal of Business Research, Journal of Food Products Marketing, Journal of Health Care Marketing, and Journal of Professional Services Marketing. Results of some of his applied research and writing have appeared in The Congressional Record, The Wall Street Journal, Forbes, The Kiplinger Report, USA Today, ABC National News website, and even The National Enquirer.

Dennis has worked in a consulting capacity with businesses that are Fortune 500 companies (e.g., Merck, Johnson & Johnson, McKesson Corporation, 3M, Nestles U.S.A.), medium sized businesses (e.g., E & J Gallo Winery, PCS Health Systems, John Asquaga's Nugget), professional and trade associations (e.g., California Pharmacists Association, California Dental Association), not-for-profit entities (e.g., Chicago 2016 Olympics Committee, Dignity Health), and federal and state governmental agencies (e.g., California Department of Food and Agriculture, Centers for Disease Control, California Environmental Protection Agency, California Department of Parks and Recreation).

Caveats

The results of any research should be used with caution and at the reader's own discretion. Every study, no matter how well constructed, contains the possibility of some degree of error and areas in which experts may disagree. Accordingly, the reader assumes sole responsibility for the use of this information.

METHODOLOGY

Data for these analyses came from APG and other published sources. These included the following:

- United States Department of Food and Agriculture, "Pistachio Summary," (https://apps.fas.usda.gov/psdonline/circulars/TreeNuts.pdf)

- United States Department of Agriculture, Foreign Agricultural Services, Office of Global Analysis, "Tree Nuts: World Production and Trade." (https://apps.fas.usda.gov/psdonline/circulars/TreeNuts.pdf)

- American Farm Bureau Federation: "In-Shell Pistachio Tariff Profile" November 7, 2018 (https://www.fb.org/market-intel/in-shell-pistachio-tariff-profile)

- Population figures from The World Bank (https://databank.worldbank.org/data/indicator/SP.POP.TOTL/1ff4a498/Popular-Indicators)

- Inflation figures from:
  - Inflation.eu: https://www.inflation.eu/
  - RI: RateInflation: https://www.rateinflation.com/inflation-rate/
  - Inflation.eu: www.inflation.eu/inflation-rates/cpi-inflation-2018.aspx
  - The Balance: US Inflation Rate by Year from 1929 to 2020 (www.thebalance.com/u-s-inflation-rate-history-by-year-and-forecast-3306093)

- Industry data from APG based on data from the United States International Trade Commission: https://www.usitc.gov/
  - Israel: United States International Trade Commission
  - NAFTA: *NOTE: Statistics were provided by the Islamic Republic of Iran Customs Administration. Source: Data for the U.S. was provided by the United States International Trade Commission. Statistics for Iran were retrieved from the United Nations Comtrade Database showing Mexico pistachio imports from Iran.
  - China: Source: U.S. Export data retrieved from the United States International Trade Commission. Iranian export data retrieved from the United Nation's Comtrade Database.
  - E.U.: United States International Trade Commission

- Data on Crop Production and World Supply from APG: "Data for Inventory and Country Comparisons."

- Tariffs: From "Impact of APG's Government Efforts to Remove Trade Barriers," Draft: February 12, 2019.

- Tariffs: From an email from APG: "China Tariff Rate" from WTO database.

Analyses were made through 2017 since that was the most current data available. In addition, issues associated with U.S. and World production and supply were limited to 2007 through 2017 because that was the most credible information available. Furthermore, many of the analyses centered on the time frame from 2009 through 2017 since that was a period in which tariffs were reduced in all five geographic areas.

Since each issue addressed in this study required a different set of analytical methods, they are explained with the results of each analysis.

RESULTS OF THE ANALYSES

Presented below are the specific issues identified by the APG for study, a description of the analyses made, and the results of those analyses. Some of the analyses were initially conducted in metric tons, and then the results were converted to pounds (i.e., 2,204.62 pounds per metric ton).

Impact on Pounds Shipped

Issue. What would shipments in pounds of U.S. pistachios have been to such geographic areas as Israel, Mexico, China and Hong Kong, and the European Union (E.U.) if the tariffs had not been reduced/eliminated, and how do those compare to actual shipments after the tariffs were reduced/eliminated?

Analysis. An analysis was made of shipments of U.S. pistachios to these geographic areas before and after the tariffs were reduced/eliminated. It was assumed that shipment trends prior to the tariffs being reduced/eliminated would have continued through 2017 if the tariffs remained. Those projected shipment volumes were then compared to actual shipment volumes after the tariffs were reduced/eliminated.

Results. The results for these geographic areas show that ***the reduction/elimination of tariffs created significant increases in metric ton shipments of U.S. pistachios compared to what would have been shipped if the tariffs had not been reduced/eliminated.*** Presented below are the supporting statistics:

- ***The annual compounded growth rates in shipments before the tariffs were reduced/eliminated were considerably lower than the growth rates from the year before the tariffs were reduced/eliminated and 2017 in all geographic areas except China.*** If the growth rates of the five geographic areas were simply averaged, the growth rate with tariffs was 3.3% and the growth rate after the tariffs were reduced/eliminated was 9.3%. The annual compounded growth rates in shipments before and after the tariffs were reduced/eliminated in the geographic areas were:

Geographic Area:	Shipment Growth Rate with Tariffs in Place	Shipment Growth Rate After Tariffs Reduced/Eliminated
Hong Kong (2003-2006 vs. 2007 to 2017)	7.8%	26.3%
European Union (1993 to 1994 vs. 1995 to 2017	9.4%	11.7%
Israel (2005/6/7 to 2008 vs. 2009 to 2017)	-15.9%	7.0%
Mexico (2002 to 2007 vs. 2008 to 2017)	6.3%	0.9%
China (2003 to 2006 vs. 2007 to 2017)	8.9%	0.8%
SIMPLE AVERAGE:	3.3%	9.3%

- ***Actual total shipments for the years after which the tariffs were reduced/eliminated were 2,330,872,541 pounds (1,057,266 metric tons) greater than what would have been expected if the tariffs remained in place.*** The increase in actual shipments over projected shipments if tariffs remained by geographic area were:

    - European Union (1995-2017): 1,278,229,858 pounds (total increase).
    - Hong Kong (2007-2017): 913,080,852 pounds (total increase).
    - Israel (2009-2017): 61,319,301 pounds (total increase).
    - Mexico (2008-2017): 46,671,405 pounds (total increase).
    - China (2007-2017): 31,567,954 pounds (total increase).

- Since tariff changes in the geographic areas were made in different years, the average annual change in metric tons shipped was computed and converted to pounds based on the number of years after the tariffs were reduced/eliminated. ***The combined average increase in actual shipments over projected shipments if tariffs remained for these five geographic areas just from 2009 through 2017 when all had reduced/eliminated tariffs was 187,591,116 pounds (85,090 metric tons) per year***. Average annual increases in pounds shipped by geographic area from the year tariffs were reduced/eliminated to 2017 were:

    - Hong Kong (2007-2017): 83,008,352 pounds increase per year.
    - European Union (1995-2017): 55,576,266 pounds increase per year.
    - Israel (2009-2017): 6,812,276 pounds increase per year.
    - Mexico (2008-2017): 4,667,181 pounds increase per year.
    - China (2007-2017): 2,870,415 pounds increase per year.

Impact on Dollar Value of Shipments

Issue. What would the dollar value of shipments of U.S. pistachios have been to such geographic areas as Israel, Mexico, China and Hong Kong, and the European Union (E.U.) if the tariffs had not been reduced/eliminated, and how do those compare to actual dollar values of shipments after the tariffs were reduced/eliminated?

Analysis. An analysis was made of the dollar value of shipments of U.S. pistachios to these geographic areas before and after the tariffs were reduced/eliminated. For each geographic area, the average dollar value per ton in years prior to the reduction/elimination of tariffs was computed and that dollar value per ton was applied to the estimated number of metric tons that would have been shipped in each successive year through 2017 (i.e., the average price remained constant). A constant average price was used instead of applying growth trends to the average because either no trends were discernable or the trends were negative and would have unreasonably skewed future price projections. For example, as shown below, prices per metric ton in China declined an average of 36.4% per year prior to the reduction/elimination of tariffs, and it would not be realistic to expect such a trend to continue to 2017.

Actual dollar values of the shipments were then subtracted from the estimated dollar values of shipments if the tariffs remained to measure the change in total dollar values. The projected dollar

values per ton if the tariffs remained also were adjusted for inflation in each geographic area to account for possible growth in future prices. Actual dollar values were subtracted from these adjusted estimated values to examine the change on an inflation-adjusted basis.

Results. The results for just these geographic areas show that **reducing/eliminating the tariffs significantly increased the total dollar values of shipments of U.S. pistachios compared to what values would have been generated if the tariffs had not been reduced/eliminated**. Presented below are the supporting statistics:

- ***Compounded growth rates in price-per-ton were higher in four of the five geographic areas after tariffs were reduced/eliminated when compared to growth rates while the tariffs were in place.*** These are shown below for each geographic area, but were not used in this analysis for reasons noted above. Nevertheless, it is important to note that price growth occurred in all markets other than Hong Kong after tariffs were reduced/eliminated.

Geographic Area:	Price Growth Rate with Tariff in Place	Price Growth Rate after Tariffs Reduced/Eliminated
Israel (2005 to 2008 vs. 2009 to 2017)	-12.3%	4.3%
Mexico (2002 to 2007 vs. 2008 to 2017)	10.3%	4.3%
European Union (1993 to 1994 vs. 1995 to 2017	-11.6%	4.1%
China (2003 to 2006 vs. 2007 to 2017)	-36.4%	2.8%
Hong Kong (2003 to 2006 vs. 2007 to 2017)	5.2%	-29.0%
SIMPLE AVERAGE	-9.0%	-2.8%
SIMPLE AVERAGE WITHOUT HONG KONG	-12.5%	3.9%

- ***The actual total dollar value of the shipments for the years after which the tariffs were reduced/eliminated was $2,955,404,453 greater than what would have been expected if the tariffs remained in place.*** In Hong Kong and China, significant price-per-ton fluctuations occurred in the years both before and after the tariff eliminations/reductions which resulted in total dollar values turning negative (i.e., the dollar values declined after the tariffs were reduced/eliminated). Accordingly, the estimates shown below for China and Hong Kong should be used with caution. *If China and Hong Kong were eliminated from this analysis, the total dollar value of the shipments for the years after which the tariffs were reduced/eliminated was $4,469,463,395 greater than what would have been expected if the tariffs remained in place*. The changes in the dollar value of actual shipments compared to projected dollar values if tariffs remained by geographic area were:

    - European Union (1995-2017): $4,119,596,405 (total increase).
    - Israel (2009-2017): $202,261,558 (total increase).
    - Mexico (2008-2017): $147,605,432 (total increase).
    - China (2007-2017): -$71,383,560 (total decrease).
    - Hong Kong (2007-2017): -$1,442,675,382 (total decrease).

- The computed dollar values per ton for the years prior to the tariff reductions/elimination were adjusted for annual inflation in each geographic area to illustrate possible normalized price increases during those time periods. ***On an inflation-adjusted basis, the actual total dollar value of the shipments for the years after which the tariffs were reduced/eliminated was $2,741,338,146 greater than what would have been expected if the tariffs remained in place.*** *If China and Hong Kong were eliminated from this analysis for reasons cited above, the inflation-adjusted total dollar value of the shipments for the years after which the tariffs were reduced/eliminated was $4,405,437,936 greater than what would have been expected if the tariffs remained in place*. The changes in the dollar value of actual shipments compared to projected inflation-adjusted dollar values if tariffs remained by geographic area were:

    - European Union (1995-2017): $4,058,020,104 (total increase).
    - Israel (2009-2017): $202,089,363 (total increase).
    - Mexico (2008-2017): $145,328,469 (total increase).
    - China (2007-2017): -$87,364,251 (total decrease).
    - Hong Kong (2007-2017): -$1,576,735,540 (total decrease).

- Since tariff changes in the geographic areas were made in different years, the average annual change in dollar values was computed based on the number of years after the tariffs were reduced/eliminated. ***The average increase in actual dollar values over projected dollar values if tariffs remained for these five geographic areas just from 2009 through 2017 when all had reduced/eliminated tariffs was nearly $172.5 million per year.*** Average annual dollar values increased in three of the five geographic areas, and as previously noted, China and Hong Kong had significant price-per-ton fluctuations which suggests their results should be used with caution. *If China and Hong Kong were removed from this, the combined average increase in actual dollar values over projected dollar values if tariffs remained for these five geographic areas just from 2009 through 2017 when all had reduced/eliminated tariffs was nearly $355.5 million per year*. Changes by geographic area from the year tariffs were reduced/eliminated to 2017 were:

    - European Union (2009-2017): $317,792,617 increase per year.
    - Israel (2009-2017): $22,473,506 increase per year.
    - Mexico (2009-2017): $15,208,508 increase per year.
    - China (2009-2017): -$174,161,979 decrease per year.
    - Hong Kong (2009-2017): -$8,816,705 decrease per year.

- ***On an inflation-adjusted basis, the combined average increase in actual dollar values over projected dollar values if tariffs remained for these five geographic areas just from 2009 through 2017 when all had reduced/eliminated tariffs was nearly $158.2 million per year.*** The same caution should be used with the results for China and Hong Kong as noted above. *If China and Hong Kong were removed from this, the combined average increase in actual dollar values over projected inflation-adjusted dollar values tariffs remained for these five geographic areas just from 2009 through 2017 when all had reduced/eliminated tariffs was nearly $354.7 million per year*. The average annual

increase in the dollar value of actual shipments over projected dollar shipment values if tariffs remained and adjusted for inflation for each geographic area were:

- European Union (1995-2017): $317,220,039 increase per year.
- Israel (2009-2017): $22,454,374 increase per year.
- Mexico (2008-2017): $14,984,862 increase per year.
- China (2007-2017): -$186,232,266 decrease per year.
- Hong Kong (2007-2017): -$10,382,390 decrease per year.

Impact on U.S. and World Supply of U.S. Pistachios

Issue. How much extra U.S. and World supply of U.S. pistachios, if any, would there have been if the tariffs remained?

Analysis. The supply of U.S. pistachios is a function of production and shipments. Supply grows when shipments of pistachios are less than production, and Storage grows if that supply is not diverted to other global markets. To make this analysis, the estimated shipments of U.S. pistachios in metric tons if the tariffs remained was subtracted from the actual shipments when the tariffs had been reduced/eliminated to assess how much more or less supply there would be in a given year. Then, this difference was added to current Storage to determine how much more or less there would be in total Storage. Metric tons were then converted to pounds. It was assumed throughout this particular analysis, that the added supply would not be diverted to other markets and therefore would increase amounts in Storage.

Results. The results for these geographic areas show that **if the tariffs were not reduced/eliminated, there would have been significant increases in both U.S. and World Storage** in each year between 2007 and 2017, assuming that the additional volume would not have been diverted to other global markets. Presented below are the supporting statistics:

- ***The additional pounds of U.S. pistachios that would have gone into U.S. and World Storage per year if the tariffs remained and the pistachios were not diverted to other global markets ranged from a low of 93,760,284 pounds (42,529 metric tons) in 2015 to a high of 285,165,392 pounds (129,349 metric tons) in 2017. For the years in which all of these geographic areas had reduced/eliminated tariffs (i.e., 2009 through 2017), a total of 1,728,263,347 pounds (783,928 metric tons) of U.S. pistachios would have gone into Storage if they were not diverted to other markets. This is an average of 192,029,016 pounds (87,103 metric tons) per year.*** The additional supply of U. S. pistachios going into U.S. and World Storage by geographic area and year are presented below (in pounds):

CONTRIBUTION TO U.S. & WORLD STORAGE BY YEAR	Israel	Mexico	China	Hong Kong	E.U.	TOTAL
2009	4,847,959	5,685,715	12,963,166	54,436,477	119,194,985	201,557,384
2010	9,528,368	4,290,191	5,008,897	56,570,549	95,239,584	175,068,874
2011	8,653,134	5,469,662	9,360,817	67,243,115	63,667,221	158,827,439
2012	6,673,385	6,199,391	20,443,441	122,449,004	72,053,595	232,254,512
2013	6,250,098	6,161,913	7,844,038	119,832,120	72,450,427	216,976,496
2014	8,794,229	5,577,689	-8,564,949	71,070,335	80,799,323	162,118,936
2015	3,906,587	3,337,795	-11,977,700	29,702,845	64,348,449	93,760,284
2016	4,823,709	2,400,831	-13,110,875	150,535,863	53,442,193	202,534,030
2017	7,841,833	3,251,815	-10,260,301	194,950,137	84,937,395	285,165,392
TOTAL	61,319,301	42,372,796	11,706,532	866,790,445	706,133,172	1,728,263,347

- The additional pounds of U.S. pistachios that would have gone into Storage per year if the tariffs remained would have significantly increased the amount held in U.S. Storage. ***The increase in U.S. Storage would have ranged from a low of a 52.5% increase (2015) to a high of a 451.2% increase (2010)***. How much each geographic area's tariffs would have contributed to this increase in U.S. Storage is shown below:

PERCENT INCREASE IN U.S. STORAGE BY YEAR	Israel	Mexico	China	Hong Kong	E.U.	TOTAL
2009	7.1%	8.3%	18.9%	79.4%	173.9%	294.0%
2010	24.6%	11.1%	12.9%	145.8%	245.5%	451.2%
2011	6.8%	4.3%	7.4%	53.2%	50.4%	125.7%
2012	7.4%	6.8%	22.5%	135.0%	79.5%	256.2%
2013	6.2%	6.1%	7.7%	118.2%	71.4%	214.0%
2014	13.8%	8.7%	-13.4%	111.2%	126.4%	253.6%
2015	2.2%	1.9%	-6.7%	16.6%	36.0%	52.5%
2016	4.7%	2.3%	-12.8%	146.8%	52.1%	197.4%
2017	3.1%	1.3%	-4.0%	76.6%	33.4%	112.0%

- The additional pounds of U.S. pistachios that would have gone into Storage per year if the tariffs remained would have significantly increased the amount held in World Storage. ***The increase in World Storage would have ranged from a low of a 44.8% increase (2015) to a high of a 268.3% increase (2010).*** How much each geographic area's tariffs would have contributed to this increase in World Storage is shown below:

PERCENT INCREASE IN WORLD STORAGE BY YEAR	Israel	Mexico	China	Hong Kong	E.U.	TOTAL
2009	3.8%	4.5%	10.2%	43.0%	94.2%	159.3%
2010	14.6%	6.6%	7.7%	86.7%	145.9%	268.3%
2011	4.5%	2.8%	4.8%	34.6%	32.8%	81.8%
2012	5.5%	5.1%	16.7%	100.2%	59.0%	190.1%
2013	2.2%	2.1%	2.7%	41.5%	25.1%	75.1%
2014	6.8%	4.3%	-6.6%	54.6%	62.1%	124.6%
2015	1.9%	1.6%	-5.7%	14.2%	30.7%	44.8%
2016	2.1%	1.1%	-5.7%	66.0%	23.4%	88.7%
2017	2.1%	0.9%	-2.8%	52.5%	22.9%	76.8%

Impact on Shipments per One Percent of Tariff

Issue. How much do shipments of U.S. pistachios increase for every percent reduction of tariff imposed by geographic areas? How much does the dollar value of those shipments increase for every percent decline in the tariff imposed by geographic areas?

Analysis. Analyses were made of the metric tons shipped and the dollar value of those shipments before and after the tariffs were reduced/eliminated. Then, the differences between the 4-year average metric tons shipped before the tariffs were reduced/eliminated and what was actually shipped were determined (2-year average for the E.U. since that was the only available data). Metric tons were then converted to pounds. This provided data on how much of an impact the reduction/elimination of tariffs had on the pounds shipped. That amount was divided by the tariff percentage to try to estimate how much each percent reduction in the tariff increased pounds shipped.

Some caution should be used with this analysis because the methodology assumed that there was a direct linear relationship between a percentage point reduction in the tariff and an amount of increase in pounds shipped. It is unknown if such a linear relationship exists. The purpose of this approach, however, was to provide some indication of how much of an impact a reduction in tariffs has on shipments. A similar approach was taken with regard to the dollar value of the pounds shipped and the dollar value per pound shipped.

Results. This analysis could only be made for Israel, China, and the European Union (E.U.). The "tariff" change in Mexico was to bring Iranian pistachios up to market value since the Mexican government determined that it was permitting the undervaluing of Iranian pistachios. And, for Hong Kong, there were no tariffs in place.

The results of this analysis indicate that there was an increase in the tons shipped per 1% tariff reduction in Israel, China, and the E.U. This increase ranged from a low of 143.9 tons shipped per 1% tariff reduction in Israel to a high of 19,890 tons shipped per 1% tariff reduction in the E.U. The dollar value of the shipments per 1% reduction in tariffs ranged from a low of more than $1.0 million in Israel to a high of more than $126.2 million in the E.U. Finally, the dollar value per pound shipped per 1% reduction ranged from a low of -$0.53 in China to a high of $0.56 per 1% reduction in tariffs in the E.U. As previously indicated, China had significant price-per-ton fluctuations which suggests its results should be used with caution.

Presented below are the supporting statistics. The second column indicates the average tons shipped and their dollar value per metric ton before the tariffs were reduced/eliminated. The third column shows the first year in which the tariffs were reduced/eliminated, and the fourth column shows the most recent year in which the tariffs were reduced/eliminated. The "Total" column represents the total difference in pounds shipped and dollar values from the first year the tariffs were reduced/eliminated to 2017. The "Average" column is the average per year difference for a 1% reduction in tariffs.

ISRAEL TARIFF	Last 4-Yr. Avg. with Tariffs	2009—1st year w/o or reduced tariff	2017	Total	Average
Pounds (1st Column = 2008)	429,901	5,335,180	9,160,196		
Value (1st Column = 2008)	$822,000	$14,088,000	$33,820,000		
Dollars per Pound (1st Column = 2008)	$1.91	$2.64	$3.69		
Four-Year Average before Tariff Reduction					
Pounds	358,802				
Dollar Value	$930,750				
Dollar Value per Pound	$2.65				
Tariff	23.0				
After Tariff Reduction					
Difference in Pounds		4,976,378	8,801,394	65,680,590	
Difference in Dollar Value		$13,157,250	$32,889,250	$214,021,250	
Difference in Average Dollar Value per Pound		$0.62			
Pounds per 1% of Tariff		216,364	382,669		317,298
Dollars per 1% of Tariff		$572,054	$1,429,967		$1,033,919
Dollar Value per Pound per 1% of Tariff					$0.03

CHINA	Last 4-Yr. Avg. with Tariffs	2007—1st year w/o or reduced tariff	2017	Total	Average
Pounds (1st Column = 2006)	9,157,991	12,103,364	13,119,694		
Value (1st Column = 2006)	$30,784,000	$41,025,000	$58,907,000		
Dollars per Pound (1st Column = 2006)	$3.36	$3.39	$4.49		
Four-Year Average before Tariff Reduction					
Pounds	8,556,681.4				
Dollar Value	$45,172,250				
Dollar Value per Pound	$5.99				
Tariff	5.0				
After Tariff Reduction					
Difference in Pounds		3,546,682	4,563,012	111,574,165	
Difference in Dollar Value		-$4,147,250	$13,734,750	$66,196,250	
Difference in Average Dollar Value per Pound		-$2.65			
Pounds per 1% of Tariff		709,336	912,602		2,028,621
Dollars per 1% of Tariff		-$829,450	$2,746,950		$1,203,568
Dollar Value per Pound per 1% of Tariff					-$0.53

E.U. TARIFF	Last 4-Yr. Avg. with Tariffs	1995—1st year w/o or reduced tariff	2017	Total	Average
Pounds (1st Column = 1994)	5,736,421	11,464,024	130,418,705		
Value (1st Column = 1994)	$8,435,000	$16,662,000	$461,614,000		
Dollars per Pound (1st Column = 1994)	$1.47	$1.45	$3.54		
Four-Year Average before Tariff Reduction					
Pounds	5,489,504				
Dollar Value	$8,577,500				
Dollar Value per Pound	$1.57				
Tariff	1.6				
After Tariff Reduction					
Difference in Pounds		5,974,520	124,929,202	1,613,653,972	
Difference in Dollar Value		$8,084,500	$453,036,500	$4,645,709,500	
Difference in Average Dollar Value per Pound		$0.89			
Pounds per 1% of Tariff		3,734,075	78,080,751		43,849,293
Dollars per 1% of Tariff		$5,052,813	$283,147,813		$126,242,106
Dollar Value per Pound per 1% of Tariff					$0.56

Sensitivity of Demand to Price of U.S. Pistachios

Issue. How sensitive is demand to changes in prices of U.S. pistachios?

Analysis. Analyses were made of the relationship between price per ton and metric tons shipped in total and for each of the geographic areas for the years since the tariffs were reduced/eliminated. Price-per-ton was computed by dividing the dollar value of the shipments of U.S. pistachios by the metric tons shipped. These results were then compared to the metric tons shipped to examine the price-quantity relationship (i.e., price per ton and metric tons shipped). Metric tons were then converted to pounds. Elasticity coefficients moving from one price-quantity relationship to another were computed. These coefficients varied greatly, from traditional downward-sloping demand curves (i.e., when price goes up, shipment volume goes down) to unusual upward-sloping demand curves (i.e., when price goes up, shipment volume goes up). In addition, the price-quantity data points were charted and "best fit" lines were computed to define the slope of the resultant demand curves. These slopes were then used to estimate how much demand changes with variations in prices.

Results. The results of the analyses show that there varying degrees of price sensitivity among geographic areas. It is important to note that different degrees of price sensitivity should be expected among geographic area due to socio-economic, cultural, etc. differences. Furthermore, it is not unusual to find some upward sloping data points (i.e., when price goes up, shipments go up) since buyers may execute purchase orders more quickly when they expect prices to rise. Presented below are the supporting statistics:

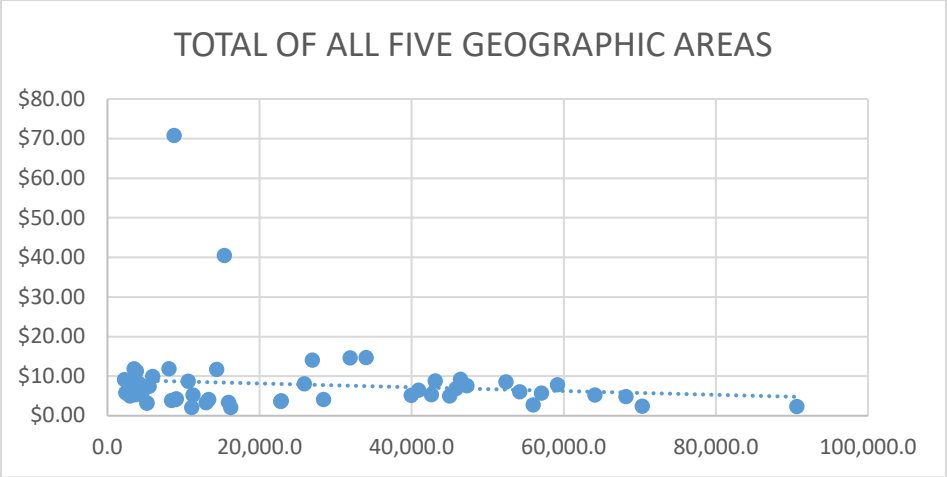
- In four of the five geographic areas, price increases appear to result in declines in the quantity of U.S. pistachios shipped. The only exception to this was in the E.U. where price-quantity relationships fluctuated greatly. ***On an overall basis, and using all data points, the slope of the best fit trend line was -0.2618, which implies that a $1,000 increase in the price of U.S. pistachios resulted in a decline of 261.8 metric tons shipped—or 577.3 pounds for every $1.00 price increase. When the E.U., with its upward sloping demand curve was removed, it appears that the best fit slope was -0.1560, so a $1,000 increase in the price of U.S. pistachios resulted in a decline of 156.0 metric tons shipped—or 344.0 pounds for every $1.00 price increase.*** The reason for this difference may be that the best-fit line is more precise when the upward-sloping data points found in the E.U. were omitted. When an analysis was made of the E.U. for only 2009 through 2017 when tariffs were reduced/eliminated in all geographic areas, the demand curve became more traditional in being downward sloping and having a best fit slope of -2.5 metric tons—or a decline of 5,484.5 pounds per $1.00 increase in price.

- Price sensitivities varied by geographic area as shown below based on the slope of the demand curve (i.e., price is the independent variable, and shipments is the dependent variable):

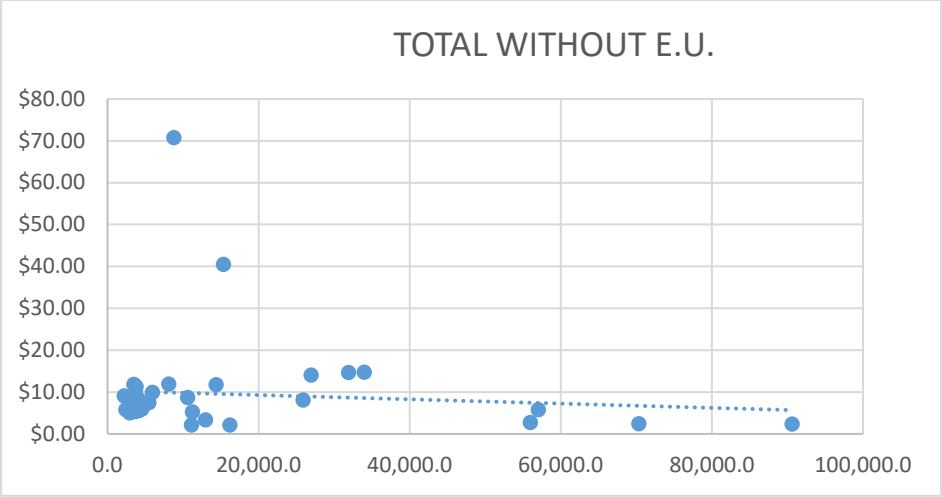
    - China: A $1.00 price increase reduced shipments by 1,942 pounds.
    - Hong Kong: A $1.00 price increase reduced shipments by 1,799 pounds.
    - Israel: A $1.00 price increase reduced shipments by 589 pounds.

- Mexico: A $1.00 price increase reduced shipments by 394 pounds.
- E.U.: A $1.00 price increase increased shipments by 15,792 pounds.
- E.U. (2009-17): A $1.00 price increase reduced shipments by 5,484 pounds.

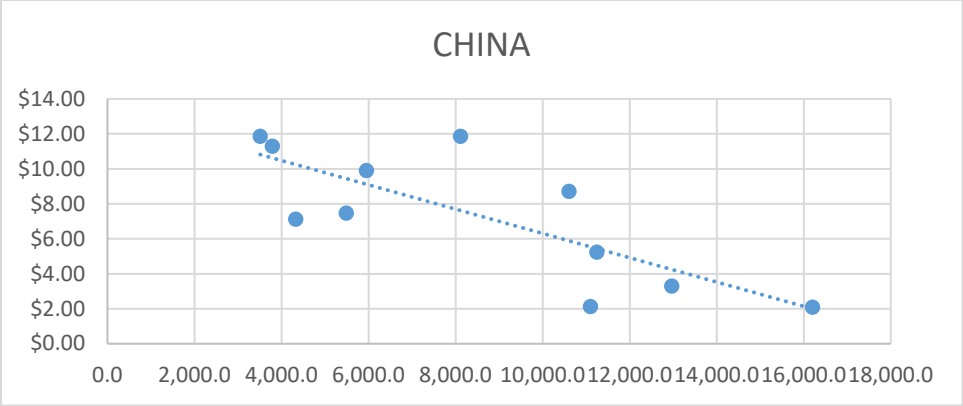
- Charts showing the trend lines of the data points in total and for each geographic area are presented below:



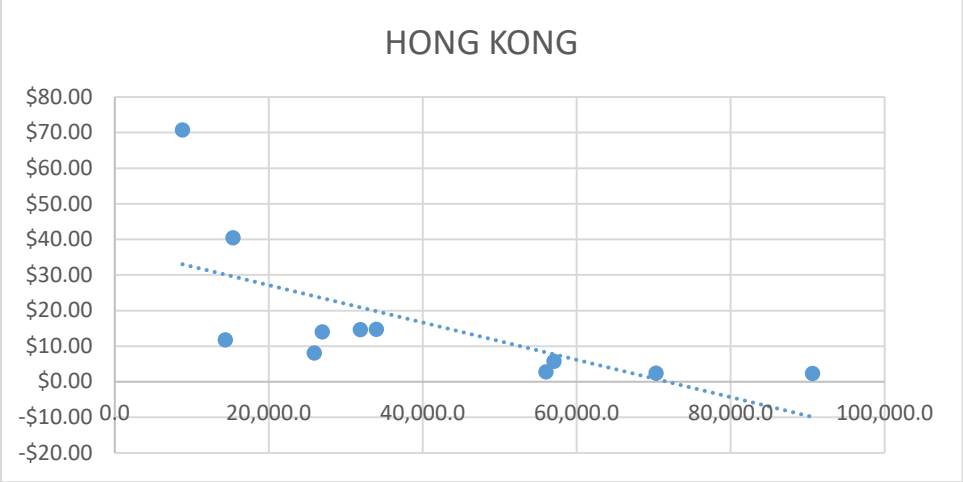
Slope: for every $1 increase in price, demand declines 577 pounds.



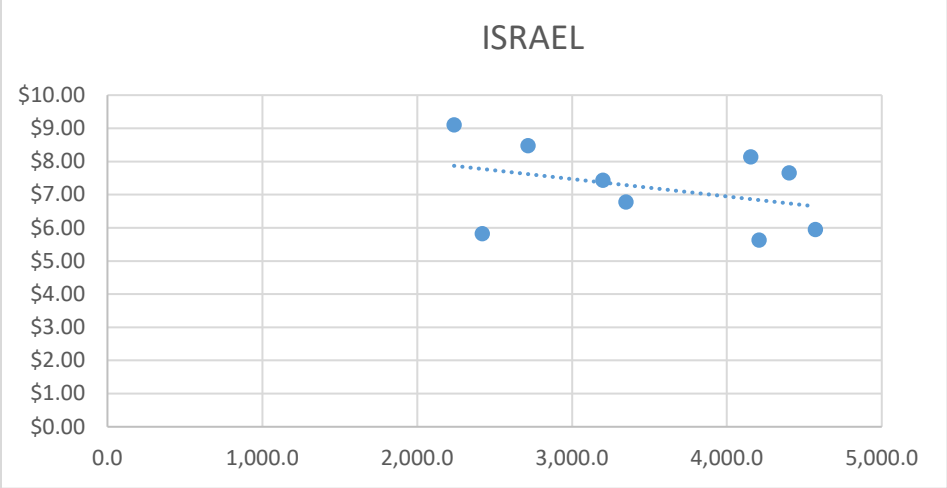
Slope: for every $1 increase in price, demand declines 344 pounds.



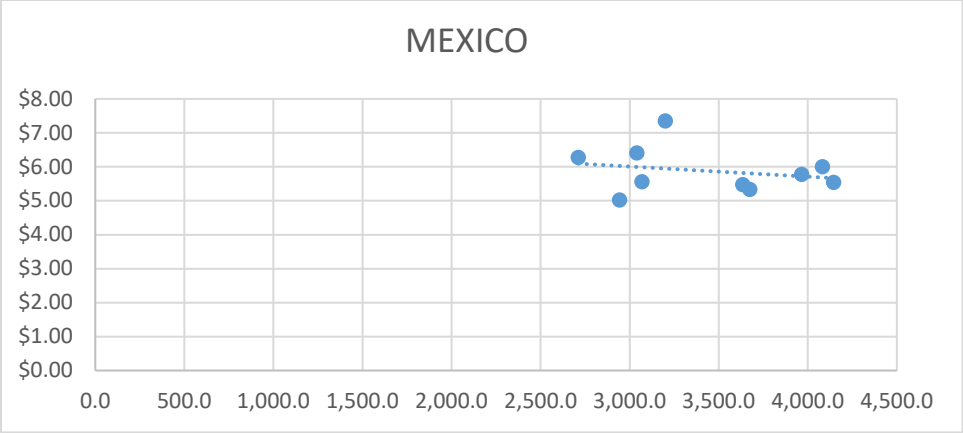
Slope: for every $1 increase in price, demand declines 1,942 pounds.



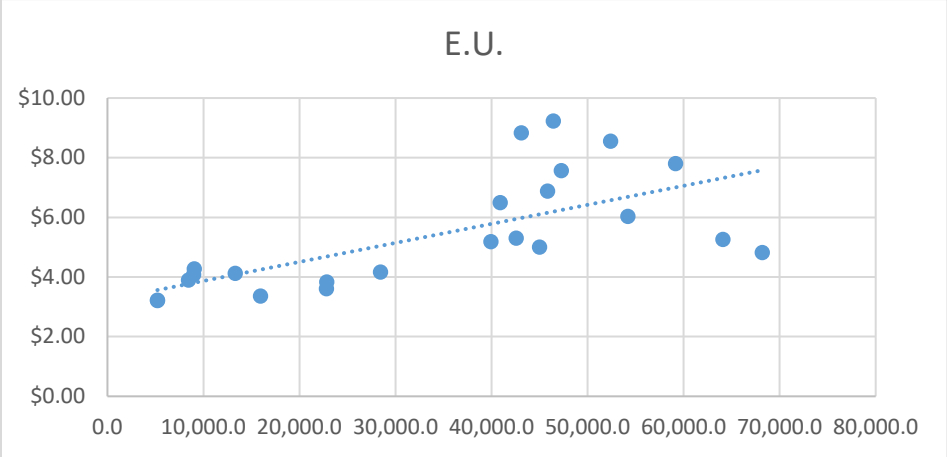
Slope: for every $1 increase in price, demand declines 1,799 pounds.



Slope: for every $1 increase in price, demand declines 589 pounds.



Slope: for every $1 increase in price, demand declines 394 pounds.



Slope: for every $1 increase in price, demand increases 1,579 pounds.

- ***While there were varying degrees of elasticity between small increases in price, overall, shipments declined with price increases for only just over half of the data points. This suggests that price is not the sole determinant of demand for U.S. pistachios.*** The individual elasticities for each geographic area and in total for each price-shipment (demand) movement from a lower to a higher price are shown below:

	Shipments in Pounds	Price per Pound	Price Elasticity
Israel			
	199,793,688	$1.05	
	155,028,878	$1.09	-$12.46
	123,421,241	$1.25	$39.05
	125,777,980	$2.62	-$1.93
	57,095,249	$3.66	-$0.46
	31,682,594	$5.33	$12.60
	59,436,555	$6.38	-$0.88
	70,331,787	$6.65	-$8.31
	74,939,443	$6.67	-$2.38

	Shipments in Pounds	Price per Pound	Price Elasticity
Mexico			
	6,488,197	$2.28	
	8,101,979	$2.42	$4.01
	8,013,794	$2.48	-$0.40
	9,138,150	$2.52	$11.21
	6,765,979	$2.52	-$136.29
	8,743,523	$2.62	$7.23
	8,999,259	$2.72	$0.76
	5,978,929	$2.85	-$7.33
	6,704,249	$2.91	$5.64
	7,056,989	$3.33	$0.36
China			
	35,712,639	$0.95	
	24,471,282	$0.96	-$17.76
	28,589,512	$1.50	$0.30
	24,788,747	$2.38	-$0.23
	9,541,595	$3.23	-$1.72
	12,103,364	$3.39	$5.31
	23,384,404	$3.96	$5.59
	13,119,694	$4.49	-$3.25
	8,359,919	$5.13	-$2.56
	7,740,421	$5.38	-$1.51
	17,886,082	$5.38	$2,117.30
Hong Kong			
	199,793,688	$1.05	
	155,028,878	$1.09	-$5.71
	123,421,241	$1.25	-$1.39
	125,777,980	$2.62	$0.02
	57,095,249	$3.66	-$1.36
	31,682,594	$5.33	-$0.98
	59,436,555	$6.38	$4.43
	70,331,787	$6.65	$4.29
	74,939,443	$6.67	$25.32
	33,871,782	$18.35	-$0.31
	19,363,177	$32.10	-$0.57

	Shipments in Pounds	Price per Pound	Price Elasticity
E.U.			
	11,464,024	$1.45	
	11,479,456	$1.46	$0.41
	35,135,029	$1.52	$46.55
	50,252,108	$1.63	$5.90
	50,357,930	$1.74	$0.03
	18,582,742	$1.77	-$35.90
	19,804,101	$1.85	$1.39
	29,332,469	$1.87	$51.97
	62,657,505	$1.89	$119.65
	19,969,448	$1.94	-$24.20
	150,299,969	$2.19	$51.05
	99,207,900	$2.27	-$9.12
	88,041,500	$2.35	-$3.15
	141,329,370	$2.38	$42.02
	93,859,492	$2.40	-$41.10
	119,459,539	$2.74	$1.96
	90,168,958	$2.94	-$3.22
E.U.			
	101,050,962	$3.12	$2.06
	104,179,318	$3.43	$0.31
	130,418,705	$3.54	$7.97
	115,517,679	$3.88	-$1.20
	95,008,099	$4.01	-$5.26
	102,336,256	$4.19	$1.72
Total			
	35,712,639	$0.95	
	24,471,282	$0.96	-$17.76
	199,793,688	$1.05	$82.96
	155,028,878	$1.09	-$5.71
	123,421,241	$1.25	-$1.39
	11,464,024	$1.45	-$5.52
	11,479,456	$1.46	$0.41
	28,589,512	$1.50	$53.63
	35,135,029	$1.52	$14.28
	50,252,108	$1.63	$5.90
	50,357,930	$1.74	$0.03
	18,582,742	$1.77	-$35.90
	19,804,101	$1.85	$1.39
	29,332,469	$1.87	$51.97
	62,657,505	$1.89	$119.65
	19,969,448	$1.94	-$24.20

Shipments in Pounds	Price per Pound	Price Elasticity
150,299,969	$2.19	$51.05
99,207,900	$2.27	-$9.12
6,488,197	$2.28	-$222.21
88,041,500	$2.35	$400.72
24,788,747	$2.38	-$60.52
141,329,370	$2.38	$1,876.42
93,859,492	$2.40	-$41.10
8,101,979	$2.42	-$131.88
8,013,794	$2.48	-$0.40
9,138,150	$2.52	$11.21
6,765,979	$2.52	-$136.29
9,277,041	$2.55	$27.88
125,777,980	$2.62	$504.30
8,743,523	$2.62	-$514.74
5,335,180	$2.64	-$54.48
10,079,523	$2.70	$39.05
8,999,259	$2.72	-$13.26
119,459,539	$2.74	$2,457.36
5,978,929	$2.85	-$23.41
6,704,249	$2.91	$5.64
90,168,958	$2.94	$997.91
7,381,068	$3.08	-$20.67
101,050,962	$3.12	$944.11
9,541,595	$3.23	-$25.80
7,056,989	$3.33	-$7.94
7,052,579	$3.37	-$0.05
12,103,364	$3.39	$136.14
104,179,318	$3.43	$622.19
9,702,533	$3.47	-$75.17
130,418,705	$3.54	$644.00
57,095,249	$3.66	-$15.90
9,160,196	$3.69	-$112.02
5,987,748	$3.85	-$8.31
115,517,679	$3.88	$2,398.29
23,384,404	$3.96	-$38.75
95,008,099	$4.01	$237.20
4,933,940	$4.13	-$30.63
102,336,256	$4.19	$1,464.61
13,119,694	$4.49	-$12.00
8,359,919	$5.13	-$2.56
31,682,594	$5.33	$71.46
7,740,421	$5.38	-$77.05
17,886,082	$5.38	$2,117.30
59,436,555	$6.38	$12.53

	Shipments in Pounds	Price per Pound	Price Elasticity
	70,331,787	$6.65	$4.29
	74,939,443	$6.67	$25.32
	33,871,782	$18.35	-$0.31
	19,363,177	$32.10	-$0.57
Total w/o E.U.			
	35,712,639	$0.95	
	24,471,282	$0.96	-$17.76
	199,793,688	$1.05	$82.96
	155,028,878	$1.09	-$5.71
	123,421,241	$1.25	-$1.39
	28,589,512	$1.50	-$3.83
	6,488,197	$2.28	-$1.49
	24,788,747	$2.38	$64.68
	8,101,979	$2.42	-$38.03
	8,013,794	$2.48	-$0.40
	9,138,150	$2.52	$11.21
	6,765,979	$2.52	-$136.29
	9,277,041	$2.55	$27.88
	125,777,980	$2.62	$504.30
	8,743,523	$2.62	-$514.74
	5,335,180	$2.64	-$54.48
	10,079,523	$2.70	$39.05
	8,999,259	$2.72	-$13.26
	5,978,929	$2.85	-$7.33
	6,704,249	$2.91	$5.64
	7,381,068	$3.08	$1.76
	9,541,595	$3.23	$5.97
	7,056,989	$3.33	-$7.94
	7,052,579	$3.37	-$0.05
	12,103,364	$3.39	$136.14
	9,702,533	$3.47	-$8.12
	57,095,249	$3.66	$88.25
	9,160,196	$3.69	-$112.02
	5,987,748	$3.85	-$8.31
	23,384,404	$3.96	$102.43
	4,933,940	$4.13	-$17.83
	13,119,694	$4.49	$19.04
	8,359,919	$5.13	-$2.56
	31,682,594	$5.33	$71.46
	7,740,421	$5.38	-$77.05
	17,886,082	$5.38	$2,117.30
	59,436,555	$6.38	$12.53
	70,331,787	$6.65	$4.29

Shipments in Pounds	Price per Pound	Price Elasticity
74,939,443	$6.67	$25.32
33,871,782	$18.35	-$0.31
19,363,177	$32.10	-$0.57

How Increased Supply Could Impact Prices of U.S. Pistachios

Issue. To what extent could an increase in the U.S. supply of pistachios impact prices of U.S. pistachios?

Analysis. It is difficult to assess what would have happened to the price of U.S. pistachios if the tariffs remained in place and the difference between actual and projected quantities shipped would have gone into Storage. Most likely, of course, efforts would have been made to divert the excess supply to other global markets and/or attempt to sell the excess pistachios in markets with less price sensitivity (e.g., Mexico, Israel).

However, to consider a possible increase in available product that might have gone into storage, and try to decipher its impact on price based on the available data, two assumptions were made. First, it was assumed that if the supply of U.S. pistachios increases as would have existed if tariffs remained in place, the price per metric ton shipped would have to decline in some fashion in order for that supply to be absorbed in the global marketplace. This is not an unrealistic assumption and fits with conventional downward-sloping demand curves. Second, in an attempt to measure what impact such an increase in supply could mean to price, it was assumed that shipments was the independent variable and price per metric ton was the dependent variable—in effect, the quantity shipped determines the price. This second assumption, although of questionable validity, made it possible to estimate how much price would change based on the quantity shipped and it would thereby follow that if additional supply became available, it would adversely impact price in some manner. It must again be noted that this second assumption is open to question, but it was the only way available data could be used to provide some possible insights into this Issue.

Results. It was assumed that for every additional metric ton of U.S. pistachios available, the price would need to decline in order for it to be absorbed in the global marketplace. As shown in the price-shipment graphs for each geographic area, in nearly all cases as the price of U.S. pistachios rose, the shipments tended to decline. Based on the slopes of this analysis using shipments as the independent variable and prices as the dependent variable, the slopes ranged from a positive $0.0638 for the E.U. to a negative $0.6948 for China. If the E.U. is not included because of its upward-sloping demand curve, price declines ranging from $0.14 (Mexico) to $0.32 (China) would be needed per additional 1,000 pounds available. When an analysis was made of the E.U. for only 2009 through 2017 when tariffs were reduced/eliminated in all geographic areas, the demand curve became more traditional in being downward sloping. Presented below are the supporting statistics:

- The relationships for individual geographic areas varied, and the slopes of the best fit trend lines and the resultant price changes that may be needed to absorb an additional 1,000 pounds available are shown below:

- China: Price declines $0.32 per increase in 1,000 pounds available.
- Hong Kong: Price declines $0.23 per increase in 1,000 pounds available.
- Israel: Price declines $0.23 per increase in 1,000 pounds available.
- Mexico: Price declines $0.14 per increase in 1,000 pounds available.
- E.U.: Price increases $0.03 per increase in 1,000 pounds available.
- E.U. (2009-17): Price declines $0.03 per increase in 1,000 pounds available.

- Based on the additional total supply from 2009 through 2017 that would have been available if U.S. pistachios were not shipped due to tariffs remaining in place, and using the above slopes, prices may have needed to decline as much as 196.2% (Hong Kong) to as little as 5.3% (China) excluding E.U. with its upward sloping curve. Using a weighted average based on excess demand in each geographic area, average prices for all geographic areas may have to decline 15.3% on an annual basis to absorb the additional supply available. When an analysis was made of the E.U. for only 2009 through 2017 when tariffs were reduced/eliminated in all geographic areas, the demand curve became more traditional in being downward sloping. For individual geographic areas, and using the above slopes, the average change in price per average metric ton needed to absorb the additional supply available from 2009 through 2017 are shown below:

  - Hong Kong: Average price declines 196.2% for its average excess tons available.
  - Israel: Average price declines 22.4% for its average excess tons available.
  - Mexico: Average price declines 10.7% for its average excess tons available.
  - China: Average price declines 5.3% for its average excess tons available.
  - E.U.: Average price increases 30.8% for its average excess tons available.
  - E.U. (slope for 2009-17): Average price declines 36.6% for its average excess tons available.

Factors Other Than Price Which Could Impact Shipment Volume

Issue. If shipments and price per ton have increased since the tariffs were reduced/eliminated, does it suggest that factors other than price could have impacted demand for U.S. pistachios? If so, what factors might have caused shipments to increase when prices rose?

Analysis. Conventional economics suggest that as prices rise for products, the demand for those products decline—and vise-versa. This would be evident with a downward-sloping-to-the-right demand curve with price on the X axis (vertical) and quantity demanded on the Y-axis (horizontal). And, the flatter the slope of the demand curve, the more sensitive demand is to price increases or decreases. Similarly, as more or less quantity of goods becomes available, it is to be expected that the price for those goods would have to decline or rise respectively to be absorbed in the marketplace.

A review of the results were made to evaluate whether there was evidence that shipment volume rose or declined directly with price declines or increases. This included an examination of the

growth in shipment volume, prices per metric ton, inflation rates, and computations of price elasticity.

Results. Based on the analyses conducted and reported above, it is clear that shipment volume was not completely a function of price. This conclusion is based on the following findings:

- Shipment volume rose at a much faster rate after the tariffs were reduced/eliminated than before they were changed. Shipments rose an average of 3.3% per year before the tariffs were reduced/eliminated, and 9.3% per year after the tariffs were reduced/eliminated. Therefore, it is evident that tariff reduction/elimination did impact shipment volume, and that demand is at least somewhat sensitive to price.

- However, tariff reduction/elimination could not have been the sole determinant of shipment volume since prices per metric ton also rose at a faster rate once the tariffs were reduced/eliminated. Before the tariff reduction/elimination, and not including Hong Kong in the analysis due to its unusual price fluctuations, prices declined an average of -12.5% per year while the tariffs were in place, but rose an average of 3.9% per year after the tariffs were reduced eliminated. With Hong Kong included in the analysis, prices declined an average of -9.0% per year with the tariffs in place, and declined an average of -2.8% per year after the tariffs were reduced/eliminated—indicating that the rate of decline in price was slower after the tariffs were reduced/eliminated. Furthermore, inflation during the period from 2009 through 2017 when all five geographic areas had reduced/eliminated tariffs, was not the dominate factor since it averaged only 2.27% per year—well below the changes in price that occurred.

- In examining individual price-shipment (demand) relationships *while the tariffs were in place*, when the price-shipment points were arrayed by time, only 50.0% of the computed elasticities were negative as would be expected in conventional price-quantity relationships. When the price-shipment points were arrayed by price and not time, only 63.3% of the computed elasticities were negative. Negative and positive elasticities were found at various individual price points and did not necessarily occur just at lower or higher prices per metric ton. If there was a strong direct relationship between price and quantity demanded, all or nearly all elasticities would have been negative.

- In examining individual price-shipment (demand) relationships *after the tariffs were reduced/eliminated*, when the price-shipment points were arrayed by time, only 59.3% of the computed elasticities were negative as would be expected in conventional price-quantity relationships. When the price-shipment points were arrayed by price and not time, only 47.5% of the computed elasticities were negative. Negative and positive elasticities were found at various individual price points and did not necessarily occur just at lower or higher prices per metric ton. If there was a strong direct relationship between price and quantity demanded, all or nearly all elasticities would have been negative.

It is difficult, of course, to identify specific factors in each geographic area which could have a cause-and-effect relationship that impacted price and shipments (demand). Since the prices used in these analyses were to the importers, it is unknown the extent to which those reductions were

passed on to consumers. However, given the growth in shipment volume, there can be no question that consumer demand has increased—there is no reason to believe that importers would be hoarding U.S. pistachios in storage.

There are a variety of factors other than price that could impact shipment volume, including:

- ***Perceived differences in product quality.*** Given the good reputation of U.S. pistachios, it is likely that consumers in other countries were willing to pay higher prices for American-grown pistachios. The quality factors could be in terms of taste, size, and product consistency. Since APG has engaged in marketing education programs to highlight the quality of U.S. pistachios, this may have significantly reduced price sensitivity.

- ***Perceived product safety.*** Closely related to product quality is the issue of product safety. Consumers are willing to pay higher prices for products they consider safer to use than competing items. U.S. pistachios may have been viewed as being produced under better farming practices, being more naturally grown, etc. which could have caused consumers to place higher value on these pistachios. Similarly, as APG has used marketing education programs to inform consumers of grower practices, this could have added value to U.S. pistachios.

- ***Nature of the product.*** Consumers are willing to pay at least slightly higher prices for products they consider to be necessities and/or good for them. In recent times, APG has promoted pistachios as being a healthy choice, so consumers may have been willing to pay more for U.S. pistachios because they view the product as healthy and good quality.

- ***Price differentials among competing products.*** APG's efforts to reduce/eliminate tariffs helped "level the playing field" for U.S. pistachios relative to those produced and marketing by other countries. To the extent that prices of competing items are reasonably close, consumer can be expected to opt for those that they consider to be of higher quality or from better sources. The marketing education programs of APG in these geographic areas could have served to make U.S. pistachios more attractive since their prices were similar to other pistachios as well as other nut products.

- ***Proportion of total expenditures.*** For many consumers, the price of a product is not especially relevant since it accounts a very small part of total household expenditures. To the extent that purchasing U.S. pistachios is viewed as being something special or a healthy option, price may not have been a determining issue because the total cost is low in relation to total spending.

Overall, it is important to emphasize that it appears APG's efforts to reduce/eliminate tariffs resulted in increased shipments of U.S. pistachios to these five geographic areas. However, it also is likely that price was not the only relevant factor in this growth in shipments. APG's efforts to generically market American-grown pistachios appear to have been a contributing factor to the increase in shipments.

SUMMARY AND CONCLUSIONS

The analyses related to the reduction/elimination of tariffs in these geographic areas indicate that:

- Actual total shipments for the years after which the tariffs were reduced/eliminated for each country were more than 2.3 billion pounds (nearly 1.1 million metric tons) greater than what would have been expected if the tariffs remained in place.

- The average increase in actual shipments over projected shipments if tariffs remained just from 2009 through 2017 when all geographic areas had tariff reductions/eliminations was nearly 187.6 million pounds (more than 85,000 metric tons) per year.

- The actual total dollar value of the shipments for the years after which the tariffs were reduced/eliminated for each country was nearly $3.0 billion greater than what would have been expected if the tariffs remained in place. On an inflation-adjusted basis, this was more than $2.7 billion greater than what would have been expected if the tariffs remained in place. If the significant price fluctuations in Hong Kong and China were eliminated, the total dollar value of the shipments would have been nearly $4.5 billion greater (more than $4.4 billion on an inflation-adjusted basis).

  For an average year between 2009 and 2017 when all of the geographic areas had tariff reductions/eliminations, the average dollar value of shipments was nearly $172.5 million per year greater than projected dollar values if tariffs remained. On an inflation-adjusted basis, the average actual dollar value was nearly $158.2 million more per year. If the price fluctuations of Hong Kong and China were eliminated from this analysis, the average increase in the dollar value of shipments would have been nearly $355.5 million per year (nearly $354.7 million per year on an inflation-adjusted basis).

- The additional pounds of U.S. pistachios that would have gone into U.S. and World Storage per year if the tariffs remained and the pistachios were not diverted to other global markets ranged from a low of nearly 93.8 million pounds (42,500 metric tons) in 2015 to a high of nearly 285.2 million pounds (nearly 129,350 metric tons) in 2017. It is unlikely that growers would have wanted to build this much inventory in storage, so diversion to other markets at possibly lower prices might have been a necessary option.

- For the years in which all of the geographic areas had reduced/eliminated tariffs (i.e., 2009 through 2017), more than 1.7 billion pounds (nearly 785,000 metric tons) of U.S. pistachios would have gone into Storage if they were not diverted to other markets. This is an average of more than 192.0 million pounds (more than 87,000 metric tons) per year. As indicated above, it is unlikely that growers would have wanted to build this much inventory in storage, so diversion to other markets at possibly lower prices might have been a necessary option.

- U.S. Storage of pistachios would have increased annually from a low of a 52.5% (2015) to a high of a 451.2% (2010) if the tariffs remained in place. World Storage would have increased annually from a low of a 44.8% (2015) to a high of 268.3% (2010).

- The results of this analysis indicate that there was an increase in the tons shipped per 1% tariff reduction in Israel, China, and the E.U. This increase ranged from a low of nearly 317,250 pounds (143.9 metric tons) shipped per 1% tariff reduction in Israel to a high of more than 43.8 million pounds (19,890 metric tons) shipped per 1% tariff reduction in the E.U. The dollar value of the shipments per 1% reduction in tariffs ranged from a low of more than $1.0 million in Israel to a high of more than $126.2 million in the E.U. Finally, the dollar value per pound shipped per 1% reduction shipped ranged from a low of -$0.53 in China to a high of $0.56 per 1% reduction shipped in tariffs in the E.U. As previously indicated, China had significant price-per-ton fluctuations which suggests its results should be used with caution.

The analyses related to the relationship between the price of and demand for U.S. pistachios indicate that:

- Demand for U.S. pistachios is somewhat price sensitive. On an overall basis, and using all data points, the slope of the best fit trend line implies that a $1,000 increase in the price of U.S. pistachios resulted in a decline of 261.8 metric tons shipped—or 577.3 pounds for every $1.00 price increase. When the E.U., with its upward sloping demand curve was removed, it appears that a $1,000 increase in the price of U.S. pistachios resulted in a decline of 156.0 metric tons shipped—or 344.0 pounds for every $1.00 price increase. However, varying degrees of elasticity were found, and in only just over half of the data points did shipments decline with higher prices. This suggests that factors other than price, such as perceived better quality, safer due to better farming methods, more nutritious, etc. may influence demand for U.S. pistachios. This is further described as the last summary point.

- It was assumed that for every additional metric ton of U.S. pistachios available, the price would need to decline in order for it to be absorbed in the global marketplace. Based on the slopes of this analysis using shipments as the independent variable and prices as the dependent variable, the slopes ranged from a positive $0.0638 for the E.U. to a negative $0.6948 for China. If the E.U. is not included because of its upward-sloping demand curve, price declines ranging from $0.14 (Mexico) to $0.32 (China) would be needed per additional 1,000 pounds available.

  Based on the additional total supply from 2009 through 2017 that would have been available if U.S. pistachios were not shipped due to tariffs remaining in place, prices may have needed to decline as much as 196.2% (Hong Kong) to as little as 5.3% (China) excluding E.U. with its upward sloping curve. Using a weighted average based on excess demand in each geographic area, average prices for all geographic areas may have to decline 15.3% on an annual basis to absorb the additional supply available.

- While tariff reductions/eliminations have positively impacted shipments, price does not appear to be the sole determinant of the volume shipped. Shipments and prices per ton rose after the tariffs have been reduced/eliminated, and computed elasticities of demand show that there are many individual price-shipment points where prices and shipments rose together. Possible reasons for this are that APG's marketing education efforts have caused consumers to view U.S. pistachios as being a good value proposition for superior quality, safety, and being healthy and nutritious. Other factors could be that consumers view pistachios more of a necessity for good nutrition than a luxury, consider the prices comparable to competing items which makes U.S. pistachios more desirable, and the realization that purchases of U.S. pistachios are not a major expense in relation to total household purchases. Overall, it is important to emphasize that it appears APG's efforts to reduce/eliminate tariffs resulted in increased shipments of U.S. pistachios to these five geographic areas. However, it also is likely that price was not the only relevant factor in this growth in shipments. APR's efforts to market the U.S. pistachio brand appears to have been a contributing factor to the increase in shipments.