Generic Promotion of Mangos and Its Impact on the U.S. Demand for Mangos

An Evaluation of the National Mango Board

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August, 2021

Preface

This report is intended to provide an analytical foundation for evaluating the impact of the National Mango Board (NMB) programs to the extent those programs enhance the U.S. demand for mangos. Econometric demand models are developed and estimated with the purpose of measuring that impact. Using an extensive household data base purchased by the NMB, models are estimated, showing the probability of buying mangos and the number of mangos once a purchasing decision is made. NMB programs are measured based on each household's awareness of mango promotions and the NMB expenditures. Both measures are shown to have a positive statistical impact on U.S. mango demand.

Approximately 1,000 completed household survey data entries are sent to this author each month and those data are merged with the database. As of June 2021, that database included nearly 170,000 observations extended back to 2008. Household awareness questions started in 2013, hence all the models in this report start with that year. Considerable care is taken to assure the data are representative of the U.S. population and are preserved in an accessible database owned by the NMB. All data are stored in a Stata format.

Unlike many commodity boards, the Mango Board maintains a continual evaluation of mango demand using the household database. While household data and statistical models cannot capture all the dimensions of the NMB programs, the information is used as input into decision making throughout the year.

Beyond funding the purchase of the consumption data, all aspects of maintaining the data are the responsibility of this author. Likewise every aspect of the analyses has been completed independent of the Board members and staff. While I coordinated with the Director of Research (Dr. Leo Ortega), he has intentionally kept a hands-off policy except for scheduling and clarifications. The analyses are independent of the National Mango Board. Likewise, the content of this report was independently completed by me. The text is technical in nature, so the plan after completion is to draft a short tri-fold brochure that focuses on the conclusions in a nontechnical format.

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Table of Content

pages

1. The National Mango Board . . . . . #7

(1.1) Mango Supplies . . . . . #8
(1.2) National Mango Board Brief History . . . . . #12
(1.3) NMB Assessments and Expenditures . . . . . #16
(1.4) NMB Promotion Examples . . . . . #18
(1.5) NMB Website . . . . . #20

2. Mango Demand Measurement. . . . . #22

(2.1) The Concept of MP and MI . . . . . #22
(2.2) Household Tracker Data . . . . . #24
(2.2.1) Mango Buyer Data. . . . . #25
(2.2.2) Household Demographics and Health . . . . . #26
(2.2.3) Household Behavior and Attitudes . . . . . #27
(2.3) Promotion Awareness Questions . . . . . #27

3. Distribution of the Demand Drivers . . . . . #29

(3.1) Demographics and Attitudes . . . . . #29
(3.2) Reasons for Buying and Not Buying . . . . . #32
(3.3) Awareness of Promotions . . . . . #34

4. Mango Demand Models and Estimation . . . . . #37

(4.1) Mango Demand Probability Models . . . . . #37
(4.2) Market Penetration Estimates . . . . . #40
(4.3) Market Intensity Estimates. . . . . #44
(4.4) Dynamics in the MP and MI Coefficients . . . . . #48
(4.5) NMB Expenditure Models. . . . . #50
(4.5.1) MP and MI Expenditure Coefficients . . . . . #51
(4.5.2) Marginal Responses with the Expenditure Models . . . . . #52
(4.5.3) Expenditure versus Trends . . . . . #54

5. Estimating the National Mango Board Demand Enhancement Programs' Impacts. . . . . #56
(5.1) Estimating the ROI using the Awareness Model . . . . . #57
(5.2) Market Penetration versus Market Intensity . . . . . #61
(5.3) Relationship between Awareness and NMB Marketing Expenditures . . . . . #62

6. Other Demand Drivers . . . . . #65

(6.1) Demographics . . . . . #66
(6.2) Attitudes and Preference Drivers . . . . . #68
(6.3) Health Related Measures . . . . . #70
(6.4)_Reasons for Buying Mangos . . . . . #72
(6.5) Substitutes and Complement Effects . . . . . #73
(6.6) Price Effects on Mango Demand . . . . . #76

7. Conclusions and Implications . . . . . #80

(7.1) Structure of the National Mango Board . . . . . #80
(7.2) Major Conclusion . . . . . #82
(7.3) Implications . . . . . #85

8. References . . . . . #87

Appendices . . . . .

Appendix A . . . . . #89
Appendix B.1 . . . . . #106
Appendix B.2 . . . . . #108
Appendix B.3 . . . . . #110
Appendix C . . . . . #112
Appendix D . . . . . #113
Appendix E . . . . . #114

List of Figures

Figure 1. U.S. annual imports of mangos and the FOB mango values. . . . . #9

Figure 2. Seasonal share of mango imports into the U.S. market. . . . . #11

Figure 3. National Mango Board annual assessments and expenditures. . . . . #17

Figure 4. Examples of NMB promotion programs. . . . . #19

Figure 5. NMB website (http://www.mango.gov) . . . . . #21

Figure 6. Average awareness of mango promotions. . . . . #34

Figure 7. Sources of information for the promotion awareness. . . . . #35

Figure 8a. Changes in Market Penetration over a range of mango promotion expenditures. . . . . #53

Figure 8b. Changes in Market Intensity over a range of mango promotion expenditures. . . . . #54

Figure 9. Cumulative ROI using the mango promotion awareness models. . . . . #60

Figure 10. The relative impacts of market penetration versus market intensity. . . . . #62

Figure 11. Relationship between promotion awareness and the NMB expenditures. . . . . #64

Figure 12. Effects of demographics on the household demand for mangos. . . . . #67

Figure 13. Behavior and preference impacts on mango demand. . . . . #69

Figure 14. Health related demand drivers and their impacts on mango demand. . . . . #71

Figure 15. Ranking of the reasons for buying mangos and their impacts on the Index of Demand. . . . #74

Figure 16. Effects on mango demand from buying other fruits. . . . . #75

Figure 17. Retail price impacts on the demand for mangos. . . . . #79

List of Tables

Table 1. Distribution of the values for selected household demand drivers. . . . . #31

Table 2. Reasons for buying and not buying mangos. . . . . #33

Table 3. Crosstab between awareness and mango buyers. . . . . #36

Table 4. Probit model estimates for mango market penetration. . . . . #42

Table 5. Ordered Probit estimates for the mango market intensity model. . . . . #46

Table 6. MP and MI coefficients over time. . . . . #49

Table 7. Estimated ROI using the mango promotion awareness models. . . . . #58

1. The National Mango Board

Commodity generic promotions, what are they all about? Such programs have existed for decades and initially required state legislative or federal congressional approval depending on the scope of the program(s). With the enactment of the 1996 Commodity Promotion, Research and Information Order (ACT), national generic programs (or commonly referred to as "*commodity checkoff programs*") could be implemented without congressional approval, but instead receive federal approval through the executive branch via the United State Department of Agriculture (USDA). All steps in the process from concept to final approval of a national program are under the control of the U.S. Secretary of Agriculture. Each federally approved checkoff is governed and implemented by the commodity industry with the USDA having full oversight responsibilities including veto power.

Specific rules and regulations are usually unique to each commodity, yet there are many commonalities across the national programs. Each checkoff has governance authority for the design, implementation and staffing of the Board to meet the needs of the specific commodity industry. Industry participation is usually mandatory and the Board has the authority to collect assessments to underwrite all aspects of the checkoff. Given this significant Board power, each national checkoff operating under the ACT must be accountable to the Secretary of Agriculture. That accountability is assured by having a USDA-AMS staff and/or legal representative at all Board meetings and requiring an independent scientific evaluation of the effectiveness of the promotions. That evaluation is generally completed with statistical models to measure the economic benefits of the generic promotions. But with a few exceptions, those evaluations are completed every 5-years with the timing unique to each checkoff.

One needs to turn to the Federal Register for the specific rules and regulations for each commodity (Federal Register). Economic evaluations can usually be found within each commodity Board and within the Agriculture Marketing Services (AMS) of the USDA (See Ward, Ch.10 in Briz and de Felipe, 2012).

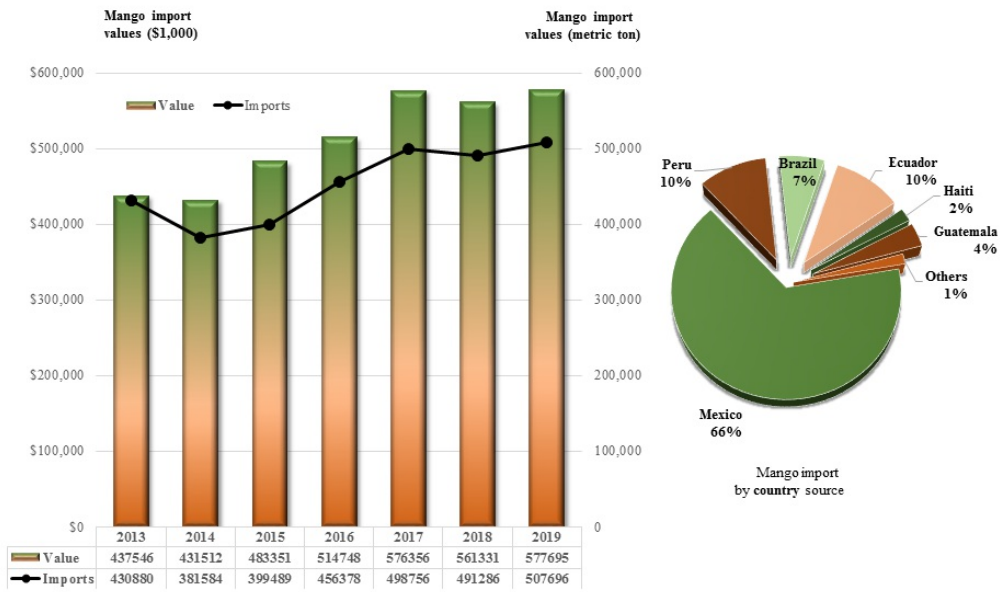
As of this writing, there are 21 national checkoff programs under the oversight of the AMS. One of those is the National Mango Board (NMB), the subject of this report. In the following pages, a detailed evaluation of the economic impacts of the Mango Board's programs is addressed with those impacts scientifically measured using econometric models. The report is intended to provide insight into the underlying research structure to support the economic modeling and then to set forth nontechnical conclusions about measured benefits (or lack of benefits.) While this author works with the NMB, the evaluation has been independently completed without any substantiative input from the Board staff or advertising agency. Staff input has been mostly in the form of wording, editing, clarification and facilitating. This report is intended to address only the demand side of the mango industry and, hence, does not deal with production and supply issues. Generic promotions are intended to enhance demand through a process of disseminating information about the attributes and uses of mangos. Enhancement may be in the form of expanding demand and/or lessening any decline in demand. For a program to be judged successful, there must be measurable economic benefits and those benefits must be distributed equitably among those required to fund the National Mango Board programs.

(1.1) Mango Supplies

Most mangos in the U.S. marketplace are imported with only small quantities grown in Hawaii, California, Texas and Florida. Mangos are a subtropical fruit found throughout the subtropical belt worldwide (See Ward, Ch.14 in Briz and de Felipe, 2013). Mango

consumption is part of the culture in many countries but much less so in the U.S. A large potential market in the U.S. and low market penetration were major reasons guiding the industry to pursue a generic promotion program for the U.S. market. The mango industry is one of two commodities with a national check-off program for a commodity having substantial imports. Avocado programs are similar but have a strong domestic production base.

Mangos are imported mostly as fresh whole fruit and up to 2019 the NMB focus has been on the whole and/or cut mangos. Recently the frozen sector was incorporated into the promotion strategies but in 2020 the frozen sector voted to be removed from the mango checkoff. That sector will not be included in the evaluations of the NMB since generic promotions programs for frozen mangos through 2019 were relatively small and as of late



	2013	2014	2015	2016	2017	2018	2019
Value	437546	431512	483351	514748	576356	561331	577695
Imports	430880	381584	399489	456378	498756	491286	507696

Figure 1. U.S. annual imports of mangos and the FOB mango values.

2020 no longer part of the NMB programs.

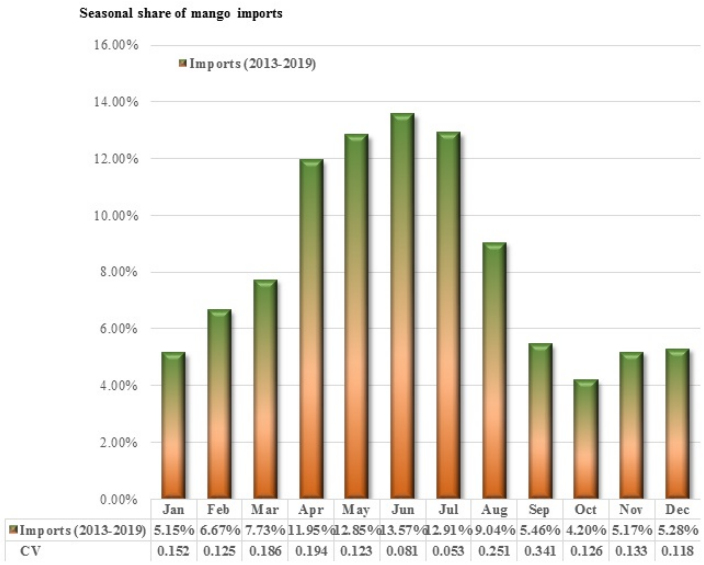
From 2013 through 2019, mango imports into the U.S. totaled 3.17 million metric tons with a FOB economic value of 3.58 billion dollars. Imports increased from .430 million metric tons to .508 million metric tons in 2019. FOB value increased from $437 to $578 million ending in 2019. The exact numbers are in Figure 1. In volume and value terms, these changes represent a 32% increase in import values and a 17.8% increase in quantity.

All but one percent of U.S. imports originated from Brazil, Mexico, Ecuador, Guatemala, Haiti, and Peru. Figure 1 shows both annual imports since 2013 and the major countries of origin. Supplies flow into the U.S. marketplace throughout the year since productions are above and below the equator. Approximately 66% of the imports are from Mexico usually crossing the U.S/Mexico borders from January into August. Those imports account for 58.4% of the FOB import value. Mexico's share of all U.S. mango imports has remained in the 61% to 67% range since 2013. Ecuador and Peru shares of the U.S. market are nearly equal with slightly more than 10% each. Those remaining shares are seen in Figure 1.

It is a quick calculation to derive the import FOB price by dividing the values in Figure 1 by the volumes. Import prices averaged $1,132 per metric ton across the Central and South American mango exporting countries. There are slight differences season-to-season and year-to-year, but the range is generally small. Those major differences are from the "other-country" category that accounts for around 1.0% of the imports. Those mangos are specialty varieties that command premium prices. With the higher prices, those other mangos capture 9.4% of the FOB import values. Prices can range from $5,000 to nearly $10,000 per metric ton for more specialized mangos.

Figure 2 provides a seasonal distribution of imports for all countries combined. Peak imports in the summer months are clear yet the shares shown for each month point to the availability of mangos in the U.S. marketplace throughout the year. Both the seasonality and availability are important supply chain factors that have implications for the NMB programming. Many of the seasonal patterns in Figured 2 can be attributed to the countries-of-origin and the normal production and maturity cycles found in Central and South America.

An obvious question is, have those shares in Figure 2 changed that much over the last decade or so? One quick way to address variations in seasonal shares of the imports is to calculate the relative shares over time or, simply, the coefficient of variation (CV) where



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Imports (2013-2019)	5.15%	6.67%	7.73%	11.95%	12.85%	13.57%	12.91%	9.04%	5.46%	4.20%	5.17%	5.28%
CV	0.152	0.125	0.186	0.194	0.123	0.081	0.053	0.251	0.341	0.126	0.133	0.118

Figure 2. Seasonal share of mango imports into the U.S. market.

$CV = \left(\hat{\sigma}_{Share} / \hat{\mu}_{Share} \right)$. A CV of zero would indicate there was no variation within the month across the years from 2013 through 2019. The larger the CV points to more share variation for each month.

The bottom row in Figure 2 includes those CV values with August and September being the months with the greatest seasonal variation across the years. Overall, the seasonal patterns are generally very stable as reflected with the CV's of .34 or less. Again, such stability is important when setting longer term marketing programs within the U.S. marketplace.

(1.2) National Mango Board Brief History

Figures 1 and 2 depict the supply data to which mango marketing programs are intended to supply through demand enhancement efforts. While there are many varietal differences, mangos have enough common attributes that one might expect generic promotion programs to benefit the entire mango industry.

Awareness of the history leading up to a commodity board is often lost as Board, staff, and Federal administrators change over time. For some checkoff programs it is nearly impossible to find documentation that lead to the final approval of the checkoff. The US Federal Register is a great source of this type information when the programs are under federal authorization. That documentation can be found for the first considerations of a federal promotion program for mangos. Given that space is not a limitation for this report, it is worth including some of the background in this discussion.

Initial industry inquiries were in or near 2001, then final National Mango Promotion

Board became effective on Nov. 3, 2004. As stated in the Federal Register (DOC. No. FV-20-707-FR) ... *"This rule establishes the Mango Promotion, Research, and Information Order (Order) under the Commodity Promotion, Research, and Information Act of 1996. Under the Order, first handlers and importers of 500,000 or more pounds of mangos will pay an initial assessment of ½ cent per pound on domestic and imported mangos to the National Mango Promotion Board (Board). The Board will be appointed by the Secretary of Agriculture (Secretary) to conduct a generic program of research and promotion, industry information, and consumer information needed for the maintenance, expansion, and development of domestic markets for fresh mangos."*

Background documentation is quoted below directly from the Federal Register in order to preserve this history in a compact NMB report. Specifically, ...*"On June 29, 2001, the Fresh Produce Association of the Americas (Association) submitted a proposal for a national promotion, research, and information order for fresh mangos to the Department, pursuant to the Act to: (1) develop and finance an effective and coordinated program of research, promotion, industry information, and consumer information regarding mangos; (2) strengthen the position of the mango industry in U.S. markets; and (3) maintain, develop, and expand domestic markets for mangos. The Association submitted changes to their proposal on November 1, 2001 and the Department published the modified proposed rules on both the Order [67 FR 54908] and the referendum procedures [67 FR 54920] in the Federal Register on August 26, 2002, each with a 60-day comment period. Twenty-two comments from 21 persons or organizations were received by the deadline. Nineteen of the 22 comments were in support of the proposed program while three were opposed. These comments and related Start Printed Page 59122changes to the Order were discussed in the October 9, 2003, issue of the Federal Register in the proposed rule on the Order [68 FR 58556] and the final rule on the referendum procedures [68 FR 58552].*

First handlers and importers of mangos voted to implement the program in a referendum held November 10 through November 28, 2003. Under the Order, first handlers and importers of

500,000 or more pounds of mangos per calendar year will pay an initial assessment of ½ cent per pound on domestic and imported mangos to the National Mango Promotion Board (Board). This will generate about $2.5 million to administer the program: about 8 percent from domestic production and 92 percent from imports. (Exports of U.S. mangos are exempt from assessments.) The Board will use the funds to pay for the aforementioned program development areas as well as administration, maintenance, functioning of the Board, and expenses incurred by USDA in implementing and administrating the Order, including referendum costs.

The program will be administered by the Board under USDA supervision. The Board will be composed of 20-members; eight U.S. importers, one U.S. first handler, two U.S. producers, seven foreign producers, and two non-voting wholesalers and/or retailers. If domestic production increases, additional U.S. first handlers will be added to the Board.

... Sections 1206.1 through 1206.24 of the Order define certain terms, such as mango, first handler and importer, which are used in the Order.

Sections 1206.30 through 1206.37 include provisions relating to the establishment, adjustment, and membership; nominations; appointments; term of office; vacancies; procedures; compensation; reimbursement; and powers, duties, and prohibited activities of the Board. The Board is the governing body authorized to administer the Order through the implementation of programs, plans, projects, budgets, and contracts to promote and disseminate information about mangos, subject to oversight of the Department.

Sections 1206.40 through 1206.43 cover budget review and approval; financial statements; authorize the collection of assessments; specify how assessments are used; specify who pays the assessment and how; exemptions; and authorize the imposition of a late-payment charge on past-due assessments.

The initial assessment rate shall be ½ cent per pound for domestic mangos and imported mangos. The assessment rate will be reviewed and may be modified with the approval of the

Department, after the initial continuance referendum which will be conducted after the program has been in operation 5 years. The assessment rate may be changed without a referendum. Persons failing to remit total assessments due in a timely manner may also be subject to actions under federal debt collection procedures as set forth in 7 CFR 3.1 through 3.36 for all research and promotion programs administered by USDA [60 FR 12533, March 7, 1995].

Sections 1206.50 through 1206.52 address programs, plans, and projects; require the Board to periodically conduct an independent review of its overall program; and address patents, copyrights, trademarks, information, publications, and product formulations developed through the use of assessment funds.

Sections 1206.60 through 1206.62 concern reporting and recordkeeping requirements for persons subject to the Order and protect the confidentiality of information from such books, records, or reports.

Sections 1206.70 through 1206.78 describe the rights of the Secretary; address referenda; authorize the Secretary to suspend or terminate the Order when deemed appropriate; prescribe proceedings after suspension or termination; and address personal liability, separability, amendments, and the OMB control numbers."

Almost every commodity checkoff program has gone through revisions including administrative changes, assessment rates and definitions of those subject to the assessments. Two major revisions to the NMB have occurred. Effective 2012, the mango assessment rate was increased from one-half cent per pound to three-quarters of a cent per pound. In 2019, frozen mangos were incorporated into the definition of mangos subject to the assessment and in 2020 subsequently removed. Several referendums have been approved since 2004. The inclusion of frozen was not without controversy and in 2020 a new referendum on continuing frozen within the NMB domain was underway. While less dramatic, the Board size and representation have been revised all within the purview of the Commodity

Promotion, Research and Information Order (ACT) of 1996.

(1.3) NMB Assessments and Expenditures

Based on the existing levels of assessments and imports, the NMB collected $73.1 million from 2007 through 2019. During the same years, the Board spent $69.8 million. Annual assessments and expenditures are plotted in Figure 3 using the bars to reflect the assessments and the line to denote the expenditures. The large jump in 2013 is a result of the increased assessments in 2012. Collections of funds and the resulting expenditures would seldom be equal because of reserve requirements and the timing needs to implement different programs that do not parallel the assessments.

Two charts are presented in the lower part of Figure 3 with the two charts defined according to the years 2007-2012 and 2013-2019. These pinwheel charts illustrate the allocation of funds to specific program areas such as marketing, research, etc. In the latter years, marketing accounted for about 61% of the total expenditure dollars followed with research at 20%. Industry programs are in 3rd place with expenditures approaching 7% of the 2013-2019 years. Administrative, oversight, Board meetings, and others equaled 12% of the expenditures for 2013-2019. During the 2007-2012 years, these operational type expenditures accounted for about 14% of the dollars. Among these other expenditures unique to the NMB is the cost of translations. All of the imports come from countries where English is not the first language (see Figure 1). Board meetings and reports are often presented in both English and Spanish thus incurring the translation expenses. Likewise, nearly all of the mangos in the U.S. marketplace are imported and that too adds custom expenses not found to the same relative degree in other national checkoff programs.

Marketing, research and industry programs could not exist without the other supporting activities. Marketing is the most direct demand enhancing activity to reach potential buying households. Research into packaging and distribution, ripening, quality control, health and nutrition, and product uses at the consumer level; all eventually contribute to the demand enhancing efforts, although at levels removed from the direct contact with the household decision maker.

Ultimately, the question is ... do these programs have an economic impact on the demand for mangos? That question is the focus of the analytical sections of this report.

Expenditures are one measure of the efforts of the NMB through the Board's messaging. Many evaluation studies including earlier evaluations of mangos developed models where these expenditures were incorporated into the models. This, of course,

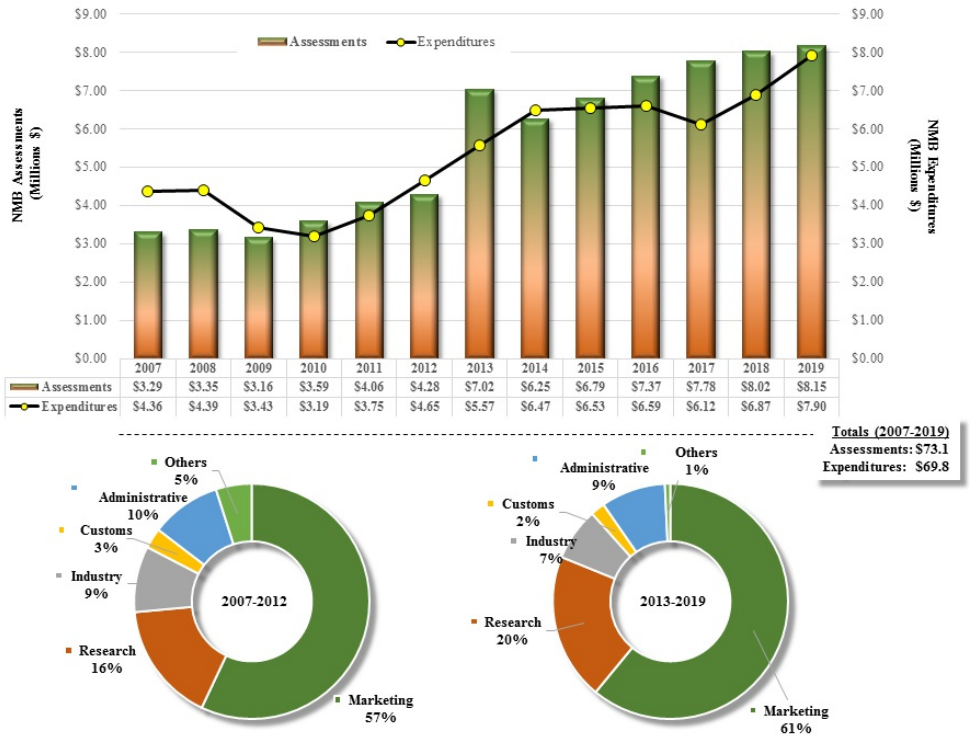


Figure 3. National Mango Board annual assessments and expenditures.

assumes that potential consumers are exposed to the messaging in a fairly equal way since the messages are broadly disseminated through printed, electronic, visual, and audio media.

An alternative measure of the efforts would be to directly ask shoppers if they were aware of any promotions of mangos. Promotion awareness is not a new concept but has grown in use through collection of household survey data. Such data provide a whole new avenue for measuring the potential impact of generic promotion programs. The demand models developed later in this report rely on the use of household consumer tracking data that includes measures of "*promotion awareness*." Content of these data is fully explored in section (2) under Mango Demand Measurement.

(1.4) NMB Promotion Examples

Generic promotions are all about influencing the potential buyer's purchasing decisions through both objective and subjective messaging. In both cases, a household may or may not be awareness of the messaging and may or may not buy mangos. Creativity in the messaging is the key to influencing the shopper. The message may be in choosing the best in-store display, education on how to judge quality and ripeness, how to cut and use mangos, how to choose the most effective media platform, and even how to best delivery the message via targeting, timing, and location.

Sport event display...

Food presentation...

In-store mango bin ...

Spokesperson...

Nutrition education ...

Figure 4. Examples of NMB promotion programs.

So what are some of the examples of delivering the message? From a list of hundreds of examples, Figure 4 includes five photos of mango promotion activities. Across the top is a photo of a large mango in-store display tied to a major sport event. This event calls attention to the range of colors, packaging, and sizes while associating mangos with a seasonal sport event. Another is a display box with mangos stacked in the container and messages about a mango as a super fruit on the sides of the container. Thousands of these containers were produced and distributed in selected retails grocery chains throughout the United States. Specifics of both of these displays can be obtained from the staff of the NMB.

Two photos in Figure 4 feature food celebrities with one showing a variety of uses of mangos and the other with a specific food dish. Using spokespersons are intended to instill confidence based on the high visibility of the person(s) and their creativity with foods.

The bottom right photo is a printed form depicting the nutritional content of mangos. Mango consumption in terms of size (cup) is tied to well know healthy food consumption guidelines.

Again these examples are all intended to give guidance to shoppers before and during their shopping excursion. Such promotions may increase awareness but their ability to influence the decision to buy is still an analytical question addressed later.

(1.5) NMB Website

Unlike the promotion efforts to reach households via the tools noted above, a website is a tool for shoppers to gain more detailed information about a product. Action to acquire information is up to the individual to visit the website. Repeat visits to a website are often tied the visual appeal and content of the website. Equally important for a successful website is the ease of moving through a site to find specific content. Richness of content

should increase the use of the website as long as one can navigate the site with some ease.

One page from the NMB website is captured in Figure 5. Across the top of each page are several drop-down sections where one can easily download a wide range of information about all aspects of mangos from supplies to consumption. Since the website is readily accessible, it is not necessary to discuss the content within each section. The site is updated frequently and can be quickly expressed in Spanish or English with the top right bottom highlighted in green.

Support for the NMB website changed over the years and there were months when the server was down. Visits for all 12 months in 2019 are available. Website visits averaged 115,913 per month during 2019. Maximum visits of 167,477 occurred in July and the minimum of 74,439 in December 2019.

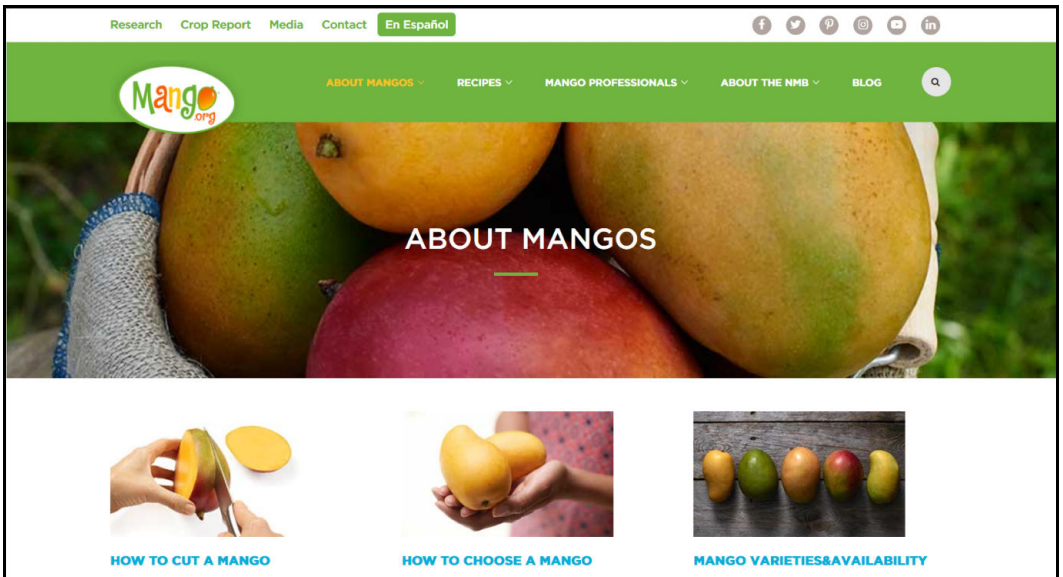


Figure 5. NMB website (http://www.mango.gov)

2. Mango Demand Measurement

Demand is a measure of the willingness to purchase a product or service given the price, purchasing power, information, and the attributes of the buyer and the product/service. Price is clear; purchasing power is most often measured with income; one measure of information is promotion awareness; buyer attributes relate to demographics, behavior and attitudes; and product attributes can be partially judged with visual and nonvisual forms, storability, and uses. For mangos, important product attributes will become clearer later. We know that shelf-life is important at each stage in the mango distribution channels and that mangos are not a staple part of the U.S. consumption diet. These two attributes point to demand models that account for entry into the market and levels of consumption once a household decides to buy mangos. Throughout the remaining discussions, these two components to demand will be referred to as *market penetration (MP)* and *market intensity (MI)*

(2.1) The Concept of MP and MI.

Define M as the demand for mangos with M measured in the number of whole mangos purchased in a defined period such as a two-week shopping window. A two-week frequency is selected because of the shelf-life of mangos and to accommodate the collection of data on household buying behavior. The shopping window will closely parallel calendar months and years with the shopping times identified as *periods*.

Both MP and MI must be precisely measured where:

$$MP = \begin{cases} 1 & if\ a\ buyer \\ 0 & otherwise \end{cases}$$

and

$$MI = \begin{cases} 0 & no\ whole\ mango \\ 1 & one\ whole\ mangos \\ 2 & two\ whole\ mangos \\ \vdots & \\ k & k\ whole\ mangos \end{cases}$$

M depends on both MP and MI where MP and MI are functions of demand drivers. Let MP=*f*(P,A,X) and MI=*f*(P,A,Z) where P is the price of a whole mango, A is a measure of promotions, and X and Z are other demand drivers that may differ between market penetration versus market intensity. That is, X could equal Z but not necessarily and the impacts of either X or Z likely differ between MP and MI.

A very flexible modeling specification would be to consider the likelihood of each value in MP and MI. That likelihood is usually expressed as the probability of each scale value occurring or the Prob(MP|P,A,X) and Prob(MI_j|P,A,Z) where j is the number of whole mangos purchased in the period. Since MI can take a number of integer values (i.e., 0, 1,2,...), market intensity is derived where:

$$MI = \sum_{j=0}^{k} \left(\Pr ob(MI_j) \times j \right)$$

Mango demand is then defined as:

$$M = HWD \times Prob(MP) \times MI$$

letting HWD be the number of U.S. households. In words, the demand for mangos depends on the household population, the probability of becoming a buyer, and the number of mangos bought once a buyer. The fact that mango demand depends on market penetration and market intensity has major implications for the types of generic promotions, targeting, and messaging. When considering the potential impact of generic advertising, it is important to know the impacts of the generic programs (e.g., A) on market penetration and market intensity. Once A→MP and A→MI, impacts are quantitatively known, we know A→M from which the benefits from the National Mango Board (i.e., ROI) can be shown. Measuring those potential impacts requires the use of advance econometric procedures typically know a Probit and Ordered Probit modeling. One cannot move to that step without the appropriate data about the household shopper.

(2.2) Household Tracker Data

In 2008 the NMB initiated an inquiry into alternative ways to collect consumer data about the purchases of mangos. Since then household data have been collected on a monthly basis and processed by this author and stored in a Stata database. As of Dec. 2020 (the ending period for this evaluation), 165,349 observations are in the database. Actual data points are currently posted beyond December 2020, but due to the unusual circumstances of 2020 and time constraints, the analysis cutoff date was set to period=167 or Dec. 2020. Much of the data in 2021 were not available during these analyses.

Each month this author received around 1,000 observations collected and processed by MetrixLab, a Macromill Group company. These data are checked for consistencies and

then added to a Stata database maintained by the NMB. Use of the database is fairly technical and NMB staffs are still in the early stages of learning the Stata program. Since most of the evaluations beyond the five-year requirement involved econometric modeling, the same data are stored in a TSP format mostly for modeling purposes. TSP is an advanced econometric language and is very efficient for large models and simulations. Later evaluation results are all based on the TSP models.

The mango tracker database can be grouped into three broad categories: Purchases of mangos; demographics/attitudes/behavior; and promotion awareness. Appendix A includes the actual household questionnaire design and questions. Note that over the years, questions have been added or deleted, sample sizes have been adjusted, and respondents changed. Even with the household responses, the data are not pooled cross-sectionally since different households are used in each reporting period. Household differences are captured through the demographics. It is extremely important all new households are included each month since there are questions about recalling promotions. Using the same households each month would compromise the recalling results.

(2.2.1) Mango Buyer Data

Probably the most important information from the tracker is the response to buying or not buying mangos in the defined period and, if a buyer, how many mangos. Buying or not-buying is a way to measure *market penetration*. Buying mangos may be in a form other than whole mangos such as cut mangos. Thus the probability is for buying mangos in any form (i.e., whole, cut or sliced). Hence, a buyer could indicate no whole mangos in the defined period. That is precisely why the MI definition included zero whole mangos. Whole mangos are the primary product but the definition accounts for other forms. A probability

for whole mangos is easily derived when MI is zero or positive. Those probabilities will be shown in the analytical sections.

If a mango buyer (MP>0), the data on MI give the quantitative measures of actual purchases. From those data, the probability of the number of mangos can be estimated. Actual number of mangos could be used in the analytics but estimating the probability of each number of mangos is less restrictive compared to a linear response function.

As shown in Appendix A, the specific buying questions are:

Q2 Fruit Purchased Past 2 Weeks . . .

> *Thinking just about the last two weeks between [defined dates], please indicate if you bought fresh mangos ... whole individually, whole packaged, cut/sliced, in platter combination, restaurant disk, I did not buy mangos.*

Q4a Number whole mangos purchased ...

> *In total, how many whole mangos did your buy in the last two weeks? If you are not sure, please give your best estimate.*

(2.2.2) Household Demographics and Health

Standard demographics included income, age, education, gender, ethnicity, household size, and regional residency. Many of these variables included a broad range of categories that were collapsed into smaller groups. Each demographic is carefully defined in the modeling section as variables expected to be demand drivers. Households included in the tracker were selected to keeps a sample balance consistent with national population demographic distributions. This selection is intended to reduce any bias because of over sampling a specific demographic group. Each demographic definition is shown in the questionnaire in Appendix A.

In addition to the standard demographics, households were asked to indicate the

health situation of family members. Obesity, blood pressure, cholesterol, diabetes, allergies, mobility, sight, and the individual perception of their health status relative to peers were used to measure health situations.

(2.2.3) Household Behavior and Attitudes

Several attitudinal/behavioral measures included questions about food expenditures; numbers of other fruits purchased; preferences for organic foods; desire to experiment with new foods; seeking out fruits and vegetables; reading labels; and exercising. Most of these questions were phased it terms of agreement to disagreement using a five-point Likert scale. These potential demand drivers have the possibility of moving the demand curve in different directions. Accounting for these impacts is essential while trying to estimate the impact of the checkoff. One wants to make sure any estimated impact of promotions is not just picking up the effect of an omitted demand driver.

Each of these added drivers is carefully defined in the modeling section as well as defined in Appendix A.

(2.3) Promotion Awareness Questions

Households being aware of the generic promotions are the closest measurement to the decision making process. The initial tracker did not have questions about awareness and in 2013 such questions were added:

Q17a. Ad awareness . . .

> *During the past two weeks between [define dates] do you recall hearing or seeing any mention of a promotion, or advertisement for mangos?*

This awareness response is a "Yes" on "No." That can be coded with a zero or one and entered into the MP and MI models as a binary variable. A positive and statistically significant coefficient in the MP model would indicate that the promotions attract households to buy mangos. Likewise, a positive coefficient in the MI model would indicate that awareness impacts how many mangos were purchased. There is nothing in the models that would link any effectiveness within MP and MI. In fact, one would generally expect any impact on MP and MI to differ.

A second type promotion question related to the household sources of information: Households' awareness of promotion can indicate one or more of the sources. There is a Yes or No to each source can be included in both the MP and MI models as binary variables:

Q17b. Source of awareness . .

> *From which of the sources below did you recall hearing or seeing any mention of a promotion or advertisement of mangos during the past 2 weeks between [define dates] - In-store promotions; Internet; Magazines; Newspapers; Trade shows; Restaurant Menus; Others.*

3.0 Distribution of the Demand Drivers

In section 2 the demand drivers were identified in the data content of the mango household tracker. The statistical effects of potential drivers must be estimated in order to determine the importance of each driver. Interpretation of those effects depends on the distributions found in each variable. For example, if there was not variation in incomes in the database it would be impossible to measure the effects on income on mango demand. Also, all data variation in each variable must be reasonably close to the population distribution of the variable. Hence, before including those potentials in the demand models, one must know the distribution properties of each potential demand driver as shown in Table 1.

(3.1) Demographics and Attitudes

Table 1 provides more details of those demand drivers closely aligned with the household characteristics. Within the table are the drivers and the distributions of the characteristics within each potential driver. Note that in the modeling section the impacts on mango demand are shown.

The standard demographics (i.e., income, education, age, and race) need little discussion since they are well understood. Through the household responses, there is a considerable range of distributions that parallel the national statistics. Race is a good example where blacks account for 13% of the tracker data and is very close to the national average. The distributions would never be exactly as the national distributions, but in each case they are similar.

Several of the drivers are measured in terms of the household's level of agreement to disagreement to specific questions. In every case, there is considerable variation in the scoring and that variation is essential to the ability to measure of the impacts on demand. Since those agreement variables are not clear just with the label(s) in Table 1, each is explained here.

Healthier...represents the question that "I am healthier than most people." Any response is fairly subjective by the household and the intent of the question is to see later how the household perception of ones-self influences buying behavior. Note that around 31% agree and 31% disagreed to the question. Again, the models will show us the importance of the perception about relative health.

Health problems, unlike the healthier question, reflect actual health problems within the household. While the data include health problems for each person in the household, the variable with anyone in the household is used since the shopping is generally for the total household and not just one individual. Around 39% of the households have someone with high blood pressure; 35% with cholesterol issues; and 26% dealing with obesity of a family member. For each health problem from blood pressure to sight in Table 1, the measure is binary or simply a "yes" or "no" to the question. Resulting impacts on both market penetration and market intensity follow from the econometric models.

Households were asked if they *count calories*; *exercise* at least three-times a week; eat more *fruits* and *vegetables*; search out *new foods*; read *labels*; *experiment* with foods; and seek out *organic* foods. All of these require specific action by the household shopper and may or may not impact the likelihood of buying mangos. The distributions are easily interpreted so do not need additional discussion until we see the impact of each on the demand for mangos.

Table 1. Distribution of the values for selected household demand drivers.

Drivers	Shares	Drivers	Shares	Drivers	Shares	Drivers	Shares
Income		**Education**		**Age**		**Race**	
Under $50,000	48.36%	High School or Less	20.68%	18-24 Years	12.29%	White/Non-Hispanic	66.89%
$50/74,999	21.01%	College	64.51%	25-44 Years	40.19%	White/Hispanic	9.22%
$75/$100,000	12.04%	Graduate	13.58%	45-54 years	16.43%	Black/African American	13.07%
Over $100,000	12.40%	Other Education	1.23%	55 & overr	31.08%	Asian	3.99%
No Answer	6.19%					All Others	6.82%
Read Labels		**Healthier**		**Count Calories**		**Exercise**	
Completely disagree	17.17%	Completely disagree	11.96%	Completely disagree	21.72%	Completely disagree	24.88%
Somewhat disagree	19.08%	Somewhat disagree	19.91%	Somewhat disagree	19.49%	Somewhat disagree	18.07%
Neither	25.36%	Neither	37.63%	Neither	24.40%	Neither	19.58%
Somewhat agree	19.15%	Somewhat agree	19.45%	Somewhat agree	16.33%	Somewhat agree	14.61%
Completely agree	19.25%	Completely agree	11.05%	Completely agree	18.06%	Completely agree	22.86%
Organics		**Eat More V&F**		**New Foods**		**Health Problems**	
Completely disagree	23.95%	Completely disagree	13.44%	Completely disagree	12.92%	Blood Pressure	39.13%
Somewhat disagree	18.98%	Somewhat disagree	19.73%	Somewhat disagree	20.82%	Diabetes	20.15%
Neither	23.61%	Neither	36.05%	Neither	32.22%	Cholesterol	35.04%
Somewhat agree	15.30%	Somewhat agree	18.20%	Somewhat agree	20.84%	Alergies	15.48%
Completely agree	18.16%	Completely agree	12.59%	Completely agree	13.20%	Obesity	25.78%
						Mobility	19.00%
Regions		**cont.-Regions**		**Numbers of Other Fruits**		Sight/Hearing	15.98%
New England	4.31%	South Atlantic	20.02%	0	35.20%		
Middle Atlantic	15.68%	East South Central	5.13%	1	10.10%		
East North Central	18.17%	West South Central	9.15%	2	11.08%		
West North Central	7.20%	Mountain	6.90%	3	9.87%		
		Pacific	13.45%	4 plus	33.75%		

Finally, Table 1 shows the regional distribution of the households. Regional residency of the household likely captures customs, weather, cooking habits, population density, and general lifestyles not fully reflected in the other demographics. Inclusion of regions in the demand models provides a way to identify target markets and/or areas needing specific marketing attention.

Seasonality is also included in the later models with month binary variables included in the demand function. As will be seen, the season variables follow patterns similar to the supply distribution first shown in Figure 2.

(3.2) Reasons for Buying and Not Buying

Included in the mango tracker are a series of questions about why the household did or did not buy mangos in the defined period. Reasons for buying can be incorporated into the Market Intensity model since all households in MI purchased mangos in some form. That is even true even if the household did not buy whole mangos. Remember, if MP=1 in a period that household is a buyer for that period. Reasons for not-buying cannot be included in the Market Penetration model since the MP model includes both buyers (MP=1) and non-buyers (MP=0). The reasons for not buying differ from the reasons for buying (see Table 2), hence the reasons for not-buying do not exist when MP=1. That is the not-buying reasons by definition do not exist when market penetration is positive. This will be clearer in Section 4.

Table 2 shows the rankings of reasons for buying and not buying mangos based on the attributes of mangos. In the left columns in Table 2 households were asked to indicate their top reason, 2nd and 3rd reasons for buying. The 1st column is the top ranking and the 2nd column shows the ranking for each attribute included in the top three reasons. Dominant reasons center around the physical characteristics of mangos and price with ripeness being the major reason for buying. Ripeness, price, freshness, and quality are very similar when looking at the inclusion in the top three rankings. Appearance, color, and size, comprise the second group. Rankings of the remainder are evident in the table. Interestingly, advertising was at the very bottom but as we will see later promotion awareness will give a different positive signal.

In direct contrast, reasons for non buying mangos were more tied to the household's perceptions. Taste, not thinking about eating, and not feeling like eating is at the top of the list and more related to the household's taste and preferences. A household could indicate

one or more reasons so the percentages are based on the total numbers of responses to the question(s). For example, 16.1% of those giving reasons for not buying ranked taste as the number one reason. Equally important from a marketing standpoint is the list at the bottom in terms of what is less important to non-buyers. Diet, size, country-of-origin, and packing were all ranked near the bottom of the list (right the column in Table 2).

To emphasize again, the non-buyer variables are not included in the subsequent models while the reasons for buying are in the MI models. Impacts of those will be shown in Section 4.

Table 2. Reasons for buying and not buying mangos.

	Ranking - Buyers			Ranking - NonBuyers
Mango Buyers	1st	1st/2nd/3rd	Non-Buyers	
Ripe	14.23%	37.70%	Taste	16.10%
Price	13.44%	37.23%	Did not think about	13.52%
Fresh	12.23%	35.87%	Did not feel like eating	10.39%
Quality	11.39%	31.12%	Too expensive	10.09%
Apperance	9.42%	29.29%	Not on sale	7.41%
Color	5.50%	19.55%	Not available	5.65%
Size	5.00%	20.73%	Not familiar	5.58%
Organic	4.51%	11.88%	Out of season	4.99%
Store	3.99%	11.44%	Cutting/cleaning/peeling	4.77%
Aroma	3.56%	13.14%	How to eat	4.30%
Package	2.37%	7.56%	Look not appealing	4.12%
Cool	2.30%	7.94%	Other	3.82%
Adv	1.68%	5.16%	Picking ripeness	2.74%
			Had some	1.90%
			Wrong color	1.34%
			Not on diet	1.07%
			Wrong size	0.88%
			Where grown	0.77%
			Packaging	0.56%

(3.3) Awareness of Promotions

Household awareness is at the core of this evaluation since awareness is a direct measure of the promotions reaching the households. Whether or not awareness moves the mango demand curve is an empirical question. Before moving to that fundamental question, it is useful to see the distribution since the data were collected since 2013. Figures 6 and 7 are used to illustrate the promotion awareness. Collection of awareness data started in 2013 and is now part of the monthly tracker. Over the 2013-2020 years, 7.42% of the households indicated some awareness of mango promotions. Indicated earlier, the measure is binary as it enters the demand models. Awareness has fluctuated across the years as well as considerable within year variation. As seen in Figure 6, 2018 was somewhat unusual with the substantial drop in awareness during that year. NMB expenditures did drop in 2017 (see Figure 3) it is not clear what contributed to the awareness levels in 2018. The NMB staff did

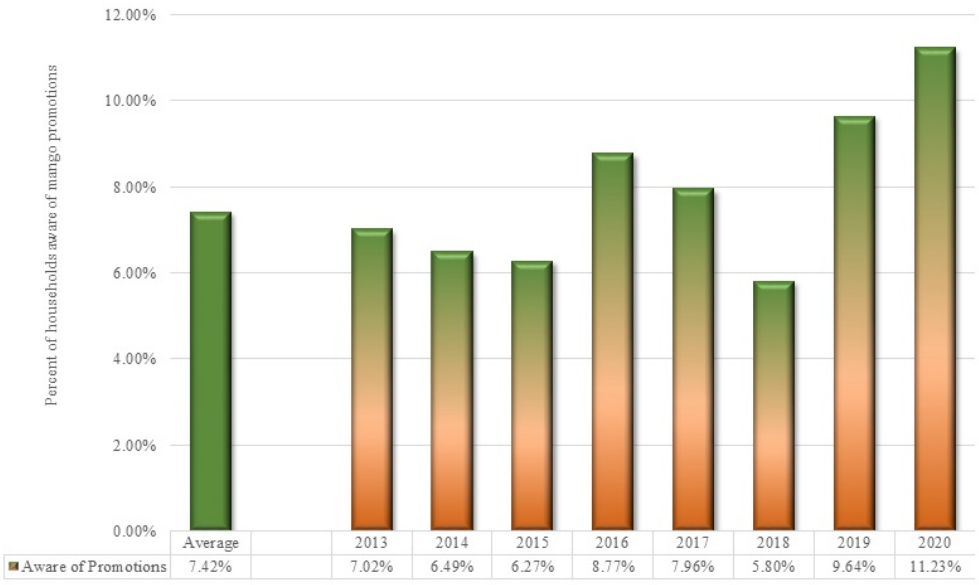


Figure 6. Average awareness of mango promotions.

followup with the data collection company to make sure there was not something unusual with the tabulations. Similar patterns were observed with the other commodities included in the tracker. Likewise, the full collection and tabulation process was reviewed by the company and everything seems to be in order.

Figure 6 provides a snapshot of the awareness recognizing that each household's actual data enters the market penetration and market intensity models instead of these annual numbers.

When aware, each household was further asked to indicate their sources of information (see Figure 7). Those sources included in-store, internet (social media), magazines, newspapers, and all others. Nearly 40% of the households pointed to in-store as their primary source of information. Printed media (i.e., magazines and newspapers) combined for almost 32% and the internet was around 15%. These percentages are

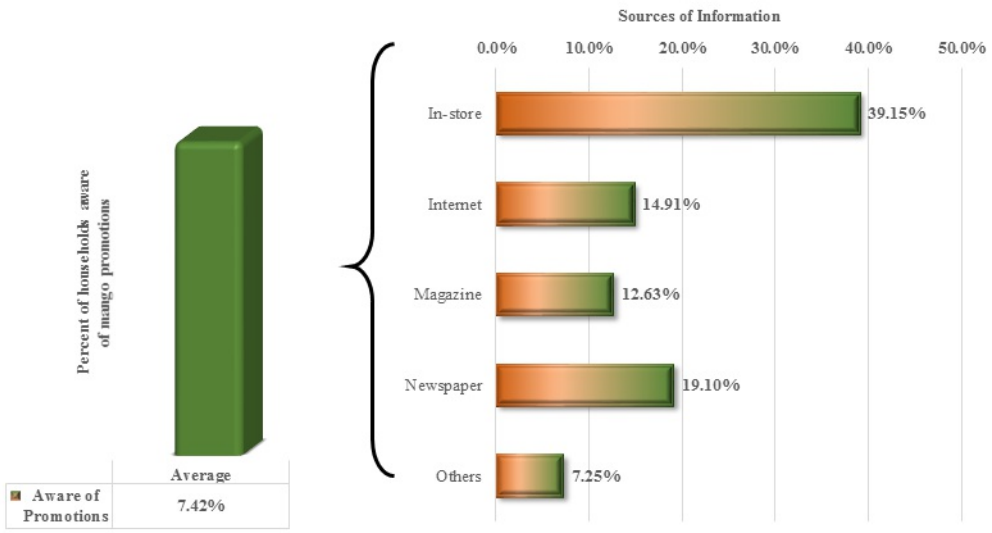


Figure 7. Sources of information for the promotion awareness.

monitored monthly and more detailed data about the social media have been added in 2019. Throughout the years since 2013, the in-store has remained the dominant source for information. In-store types of promotions were illustrated in the media examples (see Figure 4).

One question about awareness is raised with the argument of causality, arguing that buyers will naturally know mango promotions. While awareness will be treated as a right-hand-side (i.e., independent) variable in the MP and MI models, a quick crosstab between buying and awareness provides some quick insight into the question. In Table 3, buyers and non-buyers are on the left column and awareness or not aware are on the first row.

In Table 3, buyers and non-buyers are on the left column and awareness or not aware are on the first row. The number of households from the years 2013 through 2020 totaled 84,441. Among buyers, 70% were not aware of mango promotions and 30% were aware.

For non-buyers, 96.4% were not aware and 3.6% were aware. Major differences in the percentages aware between buyers and non-buyers indicate there is a positive association with generic promotions (i.e., compare 29.96% with 3.58% in the Aware column). These arguments will be fully developed in the next section.

Table 3. Crosstab between promotion awareness and mango purchases.

	Not Aware	Aware
Buyers	8493	3633
"	*70.04%*	*29.96%*
Not Buyers	69724	2591
"	*96.42%*	*3.58%*
Total	78,217	6,224
	92.63%	*7.37%*

4.0 Mango Demand Models, Estimation and Simulations (Technical)

This is a technical section but the most essential step for estimating the economic impact of the National Mango Board given the data are in place. As just discussed, those data are available from the household tracker (see Appendix A). Market penetration (MP) and market intensity (MI) are the two components of mango demand to be specified and estimated with the demand drivers from Section 3.

(4.1) Mango Demand Probability Models

MP is binary since the household did or did not buys mangos in a defined period. Let the demand drivers in the MP model be defined with the matrix X (i.e., the variables defined in Section 3). Prob(MP_j=1)=$F(X_j\beta)$ or the likelihood of buying mangos in a period is some function of the demand drivers and the estimated impact (coefficient) of each driver. Adopting the assumption of a standard normal distribution (Φ) for the F leads to the well-known Probit model for estimating MP as shown below. Almost all econometric software

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$$\text{Prob}(\text{MP}_\text{j} = 1) = \Phi(X_j\beta) = \int_{-\infty}^{X_j\beta} \frac{1}{\sqrt{2\pi}} \exp^{\left(-z^2/2\right)} dz$$

where

$$\lim_{z\to+\infty} \Phi(z) = 1 \text{ and } \lim_{z\to-\infty} \Phi(z) = 0$$

Then, from standard econometric text (Johnston and DiNardo, 1997) the Probit follows:

$$\text{Prob}(\text{MP}_\text{j} = 1) = \Phi(X_j \frac{\beta}{\sigma}) \text{ and } \text{Prob}(\text{MP}_\text{j} = 0) = 1 - \Phi(X_j \frac{\beta}{\sigma})$$

---

packages will estimate the Probit so details about the estimation techniques are not presented here (TSP; Stata; Long).

Once the MP model is estimated, each driver is explored in terms of that driver's impact on the probability of buying mangos and specifically the impact of the promotion awareness.

$$MI_j^0 = \begin{cases} 1, \text{if the household did not buy whole mangos} \\ 0, \text{otherwise} \end{cases}$$

$$MI_j^1 = \begin{cases} 1, \text{if the household bought one whole mango} \\ 0, \text{otherwise} \end{cases}$$

$$MI_j^2 = \begin{cases} 1, \text{if the household bought two whole mangos} \\ 0, \text{otherwise} \end{cases}$$

$$\vdots$$

$$MI_j^k = \begin{cases} 1, \text{if the household bought k whole mangos} \\ 0, \text{otherwise} \end{cases}$$

Estimation of the MI model is more complicated since MI takes a range of ordinal values ranging for 0 to k (e.g., 0,1,2,...) but again depends on the assumption about the distribution similar to that of the Probit with the standard cumulative normal notation Φ. Since the demand drivers are likely to differ in MI compared with MP, Z will denote those market intensity drivers and δ's are the corresponding parameters. The task is to estimate the probability of each number of mangos purchased in a shopping period.

Theoretically, $\tilde{MI}_j^k = Z_j\delta + \varepsilon_j$ but the residual is unknown and the parameters (δ)

$$MI_j^0 = 1 \text{ if } \tilde{MI}_j^0 < \tau_0$$

$$MI_j^1 = 1 \text{ if } \tau_0 < \tilde{MI}_j^1 < \tau_1$$

$$MI_j^2 = 1 \text{ if } \tau_1 < \tilde{MI}_j^2 < \tau_2$$

$$\vdots$$

$$MI_j^k = 1 \text{ if } \tilde{MI}_j^k > \tau_k$$

must be estimated. With the standard normal assumption, the actual market intensity (MI) equals one if $\tilde{MI}_j^k$ lies between intervals of thresholds (τ) that must be estimated. Typical notation is below and those thresholds are shown in the subsequent estimates.

Probabilities of the levels of market intensity can be easily estimated using $Z_j\delta$ letting Z include an intercept as the first vector in Z. Then:

$$\text{Prob}(\text{MI}_j^0 = 1) = \Phi\left(\frac{(\tau_0 - Z_j\delta)}{\sigma}\right)$$

$$\text{Prob}(\text{MI}_j^0 = 1) = \Phi\left(\frac{(\tau_1 - Z_j\delta)}{\sigma}\right) - \Phi\left(\frac{(\tau_0 - Z_j\delta)}{\sigma}\right)$$

$$\vdots$$

$$\text{Prob}(\text{MI}_j^k = 1) = 1 - \Phi\left(\frac{(\tau_{k-1} - Z_j\delta)}{\sigma}\right)$$

The detail steps for estimating the δ and τ are not presented and are readily available in Long, Stata, and TSP. At this point, the most important factor is that both δ and τ are estimated correctly since they are essential to getting to the promotion impacts. Once the probabilities are estimated, it is a linear step to estimate the market intensity across any of the demand drivers captured in Z.

Market intensity is a function of Z, the demand drivers for MI, and the estimated MI follow using the probabilities:

$$\hat{MI}_j = \sum_{i=0}^{k} \text{Prob}(\tilde{MI}_j^i = 1) \times (i)$$

And $\tilde{MI}_j^k$ depend on the demand drivers. Likewise, with $\hat{MI}_j^k$ one can explore how

market intensity (i.e., the number of mangos) changes across any combination of the demand drivers including the promotion awareness. Statistics (t-test) for each parameter give a method for judging the confidence one can place on any of the conclusions drawn from the models.

(4.2) Market Penetration Estimates

In Table 4 the full Probit model for market penetration (MP) is presented. The demand drivers and their categories are in the first two columns followed with the variable notations and symbols. There are 76 coefficient estimates with their corresponding t-values (last two columns). Most of the drivers were identified in Section 2, Table 1. Many of the demand drivers are categorical and mutually exclusive, and one cannot include each category in the estimation. That is the classical dummy variable trap. If we know the value (zero or 1) for four of the categories, say with the income variable as an example, then the fifth category is known my definition. For example using age, if we know that ZAG2=0, ZAG3=0, and ZAG4=0; then by definition ZAG1=1. Or if ZAG2=1, ZAG3=0, and ZAG4=0; then by definition ZAG1=0 since the categories are mutually exclusive. A household can be only in one category at a time for a specific demand driver like Age.

An accepted way to deal with the dummy variable trap is to drop one of the variables for each driver when there is more than one category for that driver. The notation for each category shows which category was dropped for each driver. For example, the income coefficient estimates are for ZINC2, ZINC3, and ZINC4. Hence, ZIN1 is the base from which the impacts of the other income levels are compared. Likewise, the t-values show if a particular category is statistically different from that base.

Referencing income again, β_3 is positive and statistically different from the lower

income group because the t-value of 3.13 is statistically different from zero. For those scaled with the levels of agreement to disagreement, all of the coefficients and t-values are relative to the neutral agreement score. Each coefficient gives an indication of the direction of the impact of that particular variable. Most of the directional impacts will be shown in Section 6.

Moving down the columns in Table 4, the impact of price on the likelihood of buying mangos is negative and statistically highly significant. Higher prices do discourage households to purchase mangos. Exact price responses are illustrated in Section 6.

Turning now to the most important variable, awareness of the promotions of mangos is the last variable in the demand drivers in Table 4. The response is positive and statistically different from zero as evident with the t-value of 34.3.

Given the positive sign, the evidence is strong that awareness has impacted the household decision to buy or not buy mangos in some form. Using the coefficient alone is difficult to really see the impact other than promotions have enhanced the demand for mangos. Section 5 will be dedicated to showing the magnitude of that impact. Table 4 provides the scientific bases for illustrating the estimated impact.

Table 4. Probit model estimates for mango market penetration.

Drivers	Categories	Variables	Symbols	Coef	t-Test
		C	β0	-1.86763	-13.54073
Income	$50/75,000 (21.0%)	ZINC2	β1	-0.01903	-0.69100
"	75/$10000 (12.0%)	ZINC3	β2	0.08664	2.71095
"	Over $100,000 (12.4%)	ZINC4	β3	0.10105	3.12866
"	No Answer (6.1%)	ZINC5	β4	-0.04464	-0.72186
Education	College	ZEDU2	β5	0.00945	0.32506
"	Graduate	ZEDU3	β6	0.16428	4.32086
"	Other Education	ZEDU4	β7	0.08201	0.60399
Race	White/Non-Hispanic	ZRACE1	β8	-0.23597	-5.03847
"	White/Hispanic	ZRACE2	β9	-0.04087	-0.76691
"	Black/African American	ZRACE3	β10	-0.02194	-0.41833
"	Asian	ZRACE4	β11	0.12986	2.15001
Age	25-44 Years	ZAGE2	β12	-0.22276	-7.01178
"	45-54 years	ZAGE3	β13	-0.59352	-14.84499
"	55 & overr	ZAGE4	β14	-0.89800	-23.49768
Calories	Comp. disag.	ZCAL1	β15	0.03228	0.90655
"	Somewhat disag.	ZCAL2	β16	0.02355	0.75177
"	Somewhat agree.	ZCAL4	β17	-0.08319	-2.53526
"	Comp agree.	ZCAL5	β18	-0.10841	-3.26167
Months	Jan	ZMTH1	β19	0.08053	1.50146
"	Feb	ZMTH2	β20	-0.03820	-0.75004
"	Apr	ZMTH4	β21	0.10993	2.22418
"	May	ZMTH5	β22	-0.02169	-0.43649
"	Jun	ZMTH6	β23	0.07737	1.59321
"	Jul	ZMTH7	β24	0.11187	2.25052
"	Aug	ZMTH8	β25	0.18272	3.66422
"	Sep	ZMTH9	β26	0.07803	1.57678
"	Oct	ZMTH10	β27	0.14896	2.88841
"	Nov	ZMTH11	β28	0.13416	2.63081
"	Dec	ZMTH12	β29	0.05585	1.09931
Hwd Size	Members	HWD	β30	0.31288	5.92034
New Foods	Comp. disag.	ZEXPR1	β31	0.17219	5.15905
"	Somewhat disag.	ZEXPR2	β32	0.02216	0.78206
"	Somewhat agree.	ZEXPR4	β33	-0.10519	-3.01916
"	Comp agree.	ZEXPR5	β34	0.05099	1.10361
Exercise	Comp. disag.	ZEXER1	β35	-0.25209	-7.70488
"	Somewhat disag.	ZEXER2	β36	-0.06235	-1.88891
"	Somewhat agree.	ZEXER4	β37	-0.13511	-3.46370
"	Comp agree.	ZEXER5	β38	-0.19436	-4.81741
Healthier	Comp. disag.	ZHLTH1	β39	0.23359	6.12970
"	Somewhat disag.	ZHLTH2	β40	0.13809	4.79911
"	Somewhat agree.	ZHLTH4	β41	0.01293	0.35732
"	Comp agree.	ZHLTH5	β42	0.16335	3.17155
Fru & Veg	Comp. disag.	ZFRVG1	β43	0.12538	3.53384
"	Somewhat disag.	ZFRVG2	β44	0.05607	1.93168
"	Somewhat agree.	ZFRVG4	β45	0.12940	3.33525
"	Comp agree.	ZFRVG5	β46	0.23043	4.30177

Table 4 continued. Probit model estimates for the mango market penetration.

Labels	Comp. disag.	ZLABELS1	β47	-0.12338	-3.68997
"	Somewhat disag.	ZLABELS2	β48	-0.07414	-2.43635
"	Somewhat agree.	ZLABELS4	β49	0.11452	2.91749
"	Comp agree.	ZLABELS5	β50	0.14230	3.03439
Organics	Comp. disag.	ZORG1	β51	0.24381	7.03401
"	Somewhat disag.	ZORG2	β52	0.17316	5.60046
"	Somewhat agree.	ZORG4	β53	-0.07783	-2.29837
"	Comp agree.	ZORG5	β54	-0.13188	-3.77280
Blood Pres	Yes	ZHLTH_BP	β55	-0.07543	-2.63795
Diabetes	Yes	ZHLTH_DB	β56	0.18342	5.89725
Cholerstrol	Yes	ZHLTH_CL	β57	0.02011	0.69237
Allegies	Yes	ZHLTH_AG	β58	0.16632	5.55154
Obescity	Yes	ZHLTH_OB	β59	0.03428	1.14806
Mobility	Yes	ZHLTH_MB	β60	0.12010	3.52779
Sight	Yes	ZHLTH_SI	β61	0.12301	3.57753
Regions	Middle Atlantic	ZDIV2	β62	0.20397	3.57803
"	East North Central	ZDIV3	β63	-0.03460	-0.59975
"	West North Central	ZDIV4	β64	-0.01919	-0.28086
"	South Atlantic	ZDIV5	β65	-0.02452	-0.44131
"	East South Central	ZDIV6	β66	-0.21715	-3.09113
"	West South Central	ZDIV7	β67	-0.14634	-2.37371
"	Mountain	ZDIV8	β68	-0.06152	-0.93794
"	Pacific	ZDIV9	β69	0.03405	0.59256
Price	Retail $/mango	PRWHOLE1	β70	-2.69919	-106.34986
Food Exp	Dollars	HFOODEXP	β71	0.07976	15.60044
Num of Fruits	0	DFRU1	β72	1.46587	18.42595
"	1	DFRU2	β73	1.60231	21.29233
"	2	DFRU3	β74	1.80704	24.67423
"	3	DFRU4	β75	2.77742	43.93204
Prom Aware	Aware	WASAWARE	β76	1.26516	34.34267

Dependent variable: MANGOBUY
Probit Model through Dec. 2019
Number of observations = 83832 Scaled R-squared = .669273
Number of positive obs. = 12051 LR (zero slopes) = 51021.9 [.000]
Mean of dep. var. = .143752 Schwarz B.I.C. = 9440.50
Sum of squared residuals = 2100.92 Log likelihood = -9004.05
R-squared = .797723
Fraction of Correct Predictions = 0.970226

(4.3) Market Intensity Estimates

Table 5 gives the Ordered Probit model estimates for the market intensity (MI) model. Many of the variables in the MP model are included in the MI model. Discussion of the categorical variables in MI parallel the discussion above for the MP model. However, the MI differs in three unique ways. First, prices are known for all purchases. Prices negatively impact how many mangos to buy and is statistically very significant (see variable WPRICE or δ_{66}).

Second, the MI model includes the reasons for buying mangos discussed with Table 2. All of the reasons are positive and statistically significant. All impacts will be part of the discussion in Section 6.

Third, the MI model includes a variable labeled Mills Ratio. A Mills Ratio is usually included in these type models to prevent sample selection bias. Discussion of the Mills Ratio is beyond the scope of this analysis except to highlight its meaning. If the coefficient for the Mills Ratio (δ_{86}) was not statistically significant then one could simply take the sample of those household buying and estimate a model ignoring all of the non-buyers. If statistically significant as is the case here, inclusion of the Mills Ratio is one way to deal with sample selection issues. Accounting for the potential effects of non-buyers in the sample is a way to assure there is no selection bias when drawing inferences about any of the estimates and particularly the promotion effect.

Finally, the thresholds discussed earlier is this section are reported in the bottom of Table 5 with the notation MU2-MU13 that correspond to the τ's identified as the thresholds.

Variable WASAWARE or aware of promotions is shown to be positive and statistically significant with a t-value of 14.8. The MP coefficient β_{76} and δ_{85} in the MI model show that awareness of promotions both attract households to buy mangos and then

how many to purchase once a buyer. Section 5 is dedicated to showing the magnitudes of those impacts and the implied ROI to the National Mango Board.

Note at the bottom right of Table 5 the distributions of buying mangos are shown for the data included in the models. Approximately 20% of the households did not buy whole mangos but were buyers of mangos in cut/sliced forms and in restaurants or similar outlets.

Table 5. Ordered Probit estimates for the mango market intensity model.

Drivers	Categories	Variables	Symbols	Coef	t-Test
		C	δ0	-11.99531	-31.18694
Income	$50/75,000 (21.0%)	ZINC2	δ1	0.03868	1.42351
"	75/$10000 (12.0%)	ZINC3	δ2	0.10743	3.49615
"	Over $100,000 (12.4%)	ZINC4	δ3	0.15192	4.85251
"	No Answer (6.1%)	ZINC5	δ4	-0.03247	-0.49835
Education	College	ZEDU2	δ5	-0.03719	-1.29335
"	Graduate	ZEDU3	δ6	0.01330	0.36252
"	Other Education	ZEDU4	δ7	-0.01410	-0.11585
Race	White/Non-Hispanic	ZRACE1	δ8	-0.16522	-4.04078
"	White/Hispanic	ZRACE2	δ9	0.03008	0.67166
"	Black/African American	ZRACE3	δ10	-0.05871	-1.28883
"	Asian	ZRACE4	δ11	0.12910	2.52738
Age	25-44 Years	ZAGE2	δ12	-0.02772	-0.98921
"	45-54 years	ZAGE3	δ13	-0.11648	-2.98276
"	55 & overr	ZAGE4	δ14	-0.21621	-5.85887
Calories	Comp. disag.	ZCAL1	δ15	0.03600	1.07817
"	Somewhat disag.	ZCAL2	δ16	0.01353	0.44320
"	Somewhat agree.	ZCAL4	δ17	-0.05844	-1.73496
"	Comp agree.	ZCAL5	δ18	-0.05575	-1.60668
Months	Jan	ZMTH1	δ19	0.84729	16.89899
"	Feb	ZMTH2	δ20	-0.01616	-0.29944
"	Apr	ZMTH4	δ21	0.12138	2.28705
"	May	ZMTH5	δ22	0.06596	1.29147
"	Jun	ZMTH6	δ23	0.09539	1.85546
"	Jul	ZMTH7	δ24	0.14229	2.83902
"	Aug	ZMTH8	δ25	0.13232	2.60540
"	Sep	ZMTH9	δ26	0.11626	2.26370
"	Oct	ZMTH10	δ27	0.14311	2.78065
"	Nov	ZMTH11	δ28	0.09776	1.81817
"	Dec	ZMTH12	δ29	0.10056	1.89411
Hwd Size	Members	HWD	δ30	0.06191	1.18116
New Foods	Comp. disag.	ZEXPR1	δ31	0.09470	2.87742
"	Somewhat disag.	ZEXPR2	δ32	0.05336	1.84906
"	Somewhat agree.	ZEXPR4	δ33	-0.01380	-0.36520
"	Comp agree.	ZEXPR5	δ34	0.05723	1.09499
Exercise	Comp. disag.	ZEXER1	δ35	0.02825	0.85293
"	Somewhat disag.	ZEXER2	δ36	0.04738	1.46095
"	Somewhat agree.	ZEXER4	δ37	-0.00168	-0.04100
"	Comp agree.	ZEXER5	δ38	0.03842	0.88422
Healthier	Comp. disag.	ZHLTH1	δ39	0.14826	4.12442
"	Somewhat disag.	ZHLTH2	δ40	0.03796	1.29927
"	Somewhat agree.	ZHLTH4	δ41	0.01935	0.50227
"	Comp agree.	ZHLTH5	δ42	0.07128	1.31403
Fru & Veg	Comp. disag.	ZFRVG1	δ43	0.07437	2.13816
"	Somewhat disag.	ZFRVG2	δ44	0.07503	2.49407
"	Somewhat agree.	ZFRVG4	δ45	-0.08076	-1.93742
"	Comp agree.	ZFRVG5	δ46	0.01977	0.34360

Table 5 continued. Ordered Probit estimates for the mango market intensity model.

Labels	Comp. disag.	ZLABELS1	δ47	0.08615	2.58354
"	Somewhat disag.	ZLABELS2	δ48	0.03245	1.04474
"	Somewhat agree.	ZLABELS4	δ49	0.02664	0.64766
"	Comp agree.	ZLABELS5	δ50	0.09492	1.83630
Blood Pres	Yes	ZHLTH_BP	δ51	0.01311	0.43928
Diabetes	Yes	ZHLTH_DB	δ52	0.04979	1.55791
Cholerstrol	Yes	ZHLTH_CL	δ53	0.02787	0.90822
Allegies	Yes	ZHLTH_AG	δ54	-0.00464	-0.15019
Obescity	Yes	ZHLTH_OB	δ55	-0.03863	-1.20755
Mobility	Yes	ZHLTH_MB	δ56	0.04382	1.20621
Sight	Yes	ZHLTH_SI	δ57	0.01393	0.38268
Regions	Middle Atlantic	ZDIV2	δ58	0.00762	0.13669
"	East North Central	ZDIV3	δ59	-0.05853	-1.02225
"	West North Central	ZDIV4	δ60	-0.00851	-0.12169
"	South Atlantic	ZDIV5	δ61	0.03422	0.62589
"	East South Central	ZDIV6	δ62	0.04222	0.58573
"	West South Central	ZDIV7	δ63	-0.01297	-0.21976
"	Mountain	ZDIV8	δ64	-0.00146	-0.02314
"	Pacific	ZDIV9	δ65	0.01930	0.34665
Price	Retail $/mango	WPRICE	δ66	-0.79155	-37.82707
Reasons	Price	ZPRICE	δ67	0.56885	28.74519
"	Color	ZCOLOR	δ68	0.57776	27.70526
"	Size	ZSIZE	δ69	0.58775	28.01863
"	Organic	ZORGANIC	δ70	0.57837	26.65897
"	Cool	ZCOOL	δ71	0.58650	24.55049
"	Store	ZSTORE	δ72	0.53962	24.15915
"	Adver	ZADVER	δ73	0.57214	21.37527
"	Fresh	ZFRESH	δ74	0.58747	29.99344
"	Packg	ZPACKG	δ75	0.55261	22.65137
"	Ripe	ZRIPE	δ76	0.59966	30.48623
"	Aroma	ZAROMA	δ77	0.59805	27.07230
"	Appear	ZAPPEAR	δ78	0.55898	27.89303
"	Quality	ZQUALITY	δ79	0.62740	31.74794
Food Exp	Dollars	HFOODEXP	δ80	0.06296	14.31684
Num of Fruits	0	DFRU1	δ81	0.19316	1.30258
"	1	DFRU2	δ82	0.13836	0.97436
"	2	DFRU3	δ83	0.11227	0.80802
"	3	DFRU4	δ84	0.29293	2.23611
Prom Aware		WASAWARE	δ85	0.35499	14.86654
Mills Ratio		IMILLS	δ86	0.38235	18.45164
Thresholds		MU2	τ1	0.69591	49.26361
Thresholds		MU3	τ2	1.29842	76.63173
Thresholds		MU4	τ3	1.59256	88.37203
Thresholds		MU5	τ4	1.90733	99.28267
Thresholds		MU6	τ5	2.13888	105.86762
Thresholds		MU7	τ6	2.36104	110.74718
Thresholds		MU8	τ7	2.39941	111.41969
Thresholds		MU9	τ8	2.50711	113.02176
Thresholds		MU10	τ9	2.53551	113.37562
Thresholds		MU12	τ10	2.77706	115.13537
Thresholds		MU13	τ11	2.89111	115.21338

Table 5 continued. Ordered Probit estimates for the mango market intensity model.

Ordered Probit
Number of observations = 12051 LR (zero slopes) = 7010.12 [.000]
Mean of dep. var. = 3.54460 Schwarz B.I.C. = 23311.0
Std. dev. of dep. var. = 3.86894 Log likelihood = -22850.6
Scaled R-squared = .464309

0	2488	0.2065
1	2007	0.1665
2	2230	0.1850
3	1083	0.0899
4	1060	0.0880
5	679	0.0563
6	557	0.0462
7	86	0.0071
8	226	0.0188
9	56	0.0046
...		
13	997	0.0827

About 65% of the buyers purchased three or fewer mangos in a single buying period.

(4.4) Dynamics in the MP and MI Coefficients

The awareness coefficients in Tables 4 and 5 were based on the monthly household data from Jan 2013 through Dec 2019 for a total of 83,839. Actual observations in the estimated model differ by a small amount because of a few missing values among the demand drivers. Appendix B.1 and B.2 include the same content of Tables 4 and 5 while showing the estimates for the years ending in December of 2015, 2016, 2017, 2018, 2019, and 2020 (same as Tables 4 and 5). All of these estimates will be used later when comparing the effectiveness of the National Mango Board over time. As noted earlier, the estimates started with February 2013, the first month with complete information about household awareness of mango promotions. Section 5 will be based on the results through 2020 data.

In Table 6 the promotion awareness coefficients are shown for the MP and MI models estimated recursively. Adjacent to the year column are the MP and MI estimated

parameters and then in the lower portion of Table 6 includes the t-values for the awareness parameters.

Parameters can change with added data for many reasons. The promotion coefficients could change if the promotions were becoming more or less effective and/or if distribution of the awareness data changes.

Apparent from the numerical values, there were some numerical changes in the MP and MI parameters across the added years. The implications of these changes across the years will be discussed in Section 5 when showing generic promotion impacts. These same awareness coefficients and t-values are also in Appendix B.1 and B.2.

Market intensity was defined to include no whole mangos purchased in a two-week reporting period as also defined in Appendix B.1 and B.2. This was necessary since market penetration was defined as purchases of mangos in any form (i.e., including cut/sliced mangos) while total mango demand was demand to be just for whole mangos to be equal to HWD×Prob(MP)×MI where HWD=number of households. This will be detailed more in Section 5. Approximately 20% of those reporting buying mangos in a defined period did not buy whole mangos within that period. Rather within the 20% there were buyers purchasing fresh cut/sliced or some other form of mangos instead of whole mangos.

All models in this section provide the scientific foundation for estimating the

Table 6. MP and MI coefficients over time.

Ending Year	Coefficients MP	t-Value MP
2015	1.2974	22.1681
2016	1.3827	27.5369
2017	1.3205	29.9111
2018	1.3210	32.4771
2019	1.2652	34.3427
2020	1.2430	34.2928
	MI	MI
2015	0.3113	7.9930
2016	0.3774	11.3591
2017	0.3524	12.2093
2018	0.3536	13.3866
2019	0.3550	14.8665
2020	0.3679	17.0974

impact of the National Mango Board promotion efforts presented in the next section.

(4.5) NMB Expenditure Models

Up to this point, the MP and MI models were based on household awareness of the mango promotions. Awareness is the closest measure of each household's exposure to the mango promotions, mostly funded by the National Mango Board. An alternative approach could be to take the Board's monthly demand enhancement expenditures as a measure of promotion exposure while assuming within the reporting periods each household is equally exposed to the promotions indicated by the expenditures during each month and/or previous month. Including expenditure instead of awareness has traditionally been the method used in most evaluation studies when awareness data were not available. It is the judgement of this author that using awareness is a superior methodology. Yet it is also useful for comparison purposes to look at the modeling results with this alternative method for measuring the NMB programs.

Awareness is what the household recalls while expenditures measure the actual intensity. There are likely lags between the actual expenditures on an accounting basis and when the information actually reaches the household shopper. That is, there are possible lag effects when modeling with expenditures. Such lags are usually referred to distributed lag effects.

If the expectation is that a part of the lag effect is due to accounting delays between promotion (PRO) invoices and promotion deliveries, then one often used method is to expect that both PRO and PRO_{t-1} impact household behavior. Within these definitions, one can define $PRM=\lambda PRO + (1-\lambda)PRO_{t-1}$ with $0 \leq \lambda \leq 1.0$. While λ has to be estimated, the closer λ is to one, the greater the immediate effect of the programs within the same buying period.

Using looping estimating techniques, one can quickly determine the value of λ and that looping indicated λ=.55. That is, approximately 55% of the expenditure impact is realized in the same month and 45% from the previous month. Model estimates including actual lag expenditures also confirms that this value of λ is acceptable. These iterative estimates are not included in this report because of the added length but are available upon request.

Operationally, actual expenditures are reported for each month and same values are allocated to all households within that month. Then the previous month expenditures are also allocated to the current month. For longer lags, more previous monthly expenditures are allocated to the current month. For the purpose of including the expenditure model in this report, the actual model is reported in Appendix B.3.

As seen in Appendix B.3, the expenditures are included in both the Probit and Ordered Probit models using CCKTOT0 with CCKTOT0= $[.55PRO + .45PRO_{t-1}]^{.33}$. The .33 power is an accepted way for allowing nonlinear impacts of the expenditures on both market penetration (MP) and market intensity (MI). Generally, one would expect marginal responses to additional promotions to recline and the .33 is a method to test that possibility. A value for the power was derived in similar way used to determine the λ value. Again, those details are not included in this report.

To repeat, only the marketing expenditures are included in PRO. Later, when estimating the ROIs for the awareness models, the NMB total expenditures are used to calculate the full impact of the NMB programs.

(4.5.1) MP and MI Expenditure Coefficients

Two important coefficients from the expenditure models (Appendix B.3) show that the NMB programs have a positive statistically significant impact on both market penetration

and market intensity. In the Probit model (i.e., the probability of buying mangos), the expenditure coefficient value of .1624 is statistically significant with more than a 99% confidence level. Stated differently, marketing expenditures by the National Mango Board attract households to buy mangos. NMB positively impacts market penetration.

The right columns in Appendix B.3 show the impacts of all demand drivers on market intensity or the number of mangos purchased in a buying occasion. The CCKTOT0 coefficient is .0753 with a t-value of 4.2745, again pointing to more than a 99% confidence level. The Board's programs not only attract households to buy but positively influence the number of mangos purchased in a buying occasion.

These results using the expenditure approach confirms what has had already been shown with the household awareness results. Mango promotions positively impact market penetration and market intensity. While the actual levels of MP and MI may differ using promotion awareness versus promotion expenditures, the fact that both approaches point to the significant positive impacts adds confidence in the overall conclusions that the NMB's efforts impact household demand for mangos.

(4.5.2) Marginal Responses with the Expenditure Models

Awareness is a "yes" or "no" measure whereas expenditures are a numerical range over time. With the estimation periods, expenditures were never zero throughout the data up to Dec. 2020. Also, it is hard to visualize the expenditure impacts by just looking at the coefficient above. However, one can visually see the impacts by showing changes on market penetration and market intensity over simulated expenditure levels based on the model estimates in Appendix B.3.

Figures 8a and 8b illustrate the market penetration and market intensity responses

to simulated changes in the NMB marketing expenditures. On the bottom axis of both figures is a range of percentages with the 100% indicating the actual levels of expenditures over the periods from 2013:3 through 2020:12. Percentages to the left and right of the 100% indicate what if the total expenditures were some percent of the actual. For example, the 60% level points to expenditures at only 60% of the actual while 140% points to expenditures 40% above the actual. Figure 8a shows the corresponding changes in retail market penetration while 8b gives the changes in market intensity.

In Figure 8a and for the average expenditures, retail market penetration is estimated to be 15.68% of the households buying mangos in a two-week shopping period. If expenditures were cut by 40% of the average, MP would drop to 14.52%. Similarly, for a 40% increase over the average, MP increases to 16.64%. The lower portion of Figure 8a gives the incremental changes in market penetration with incremental increases (or decreases) in actual expenditures. The actual MP base depends on the values of the other

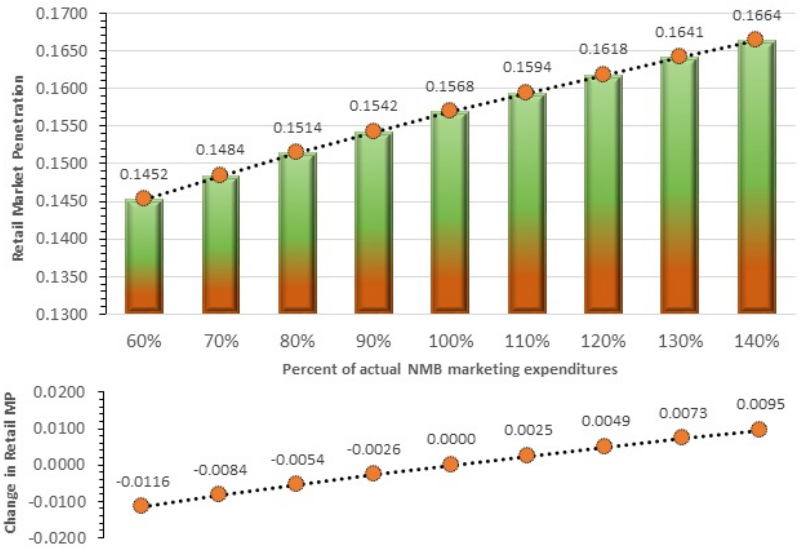


Figure 8.a. Changes in Market Penetration over a range of mango promotion expenditures.

demand drivers.

Figure 8b shows the changes for market intensity over the same range of expenditures. With a 40% decline in expenditures, market intensity or the average number of mangos per buyer would drop from 3.59 mangos to 3.43 per buying occasion. Similarly, with the 40% increase in expenditures, MI increases to 3.72 mangos on average.

At this point, the expenditure models suggest statistically that the NMB programs

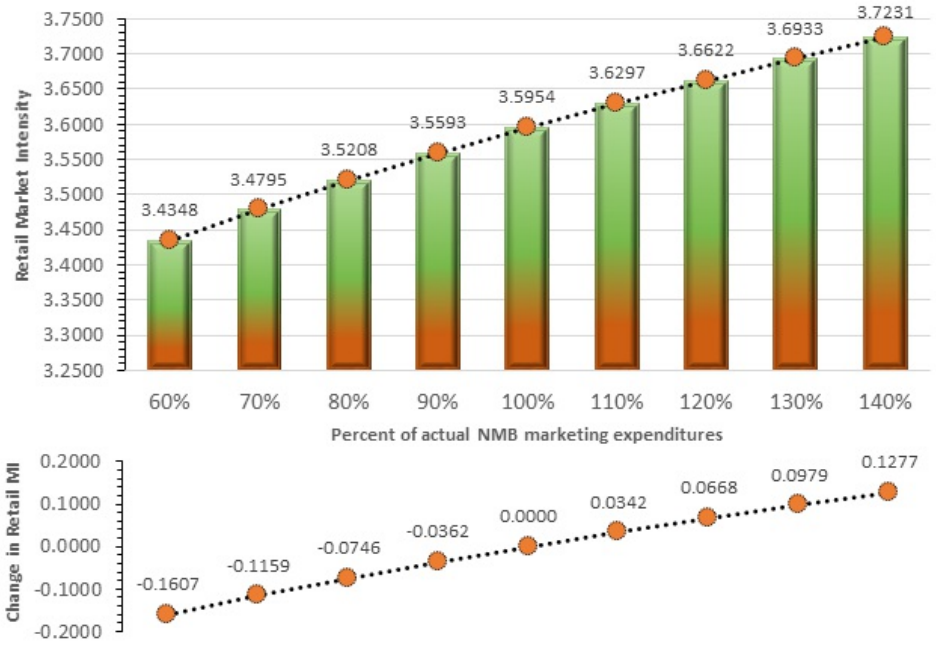


Figure 8b. Changes in Market Intensity over a range of mango promotion expenditures.

have a measurable impact on the U.S. demand for mangos.

(4.5.3) Expenditures versus Trends

Using expenditure models were considered as another independent way to consider

the impacts of the National Mango Board programs. As already indicated, a shortcoming of the expenditure approach was that for each month all households are assumed to be equally exposed to the messaging and that, obviously, is a strong assumption. Second, the data periods are fairly short for seeing a lot of variation in the expenditures. In fact, the correlation between a yearly time trend and the expenditures is .304. While not a particularly strong correlation, it is positive and statistically different from zero. When running the MP and MI models with a trend instead of the expenditures, one finds both variables (i.e., trend versus expenditures) to be similar in sign and significance. The time trend could be simply picking up the expenditure trend and/or other underlining longer term adjustments not related to promotions, or even longer term promotion effects (e.g., such as longer term household recall and education) not captured with the monthly expenditures.

The evaluation goal is to provide scientific measures of the National Mango Board programs using the strongest statistical evidence. To that point, the next Section will focus on the return-on-investment (ROI) using only the promotion awareness results since those models are based on explicit household indications of knowing about the promotion through direct exposure. The goal is to not overstate the estimated gains possibly attributable to statistical issues potential with the expenditure models. Even with this caveat, the patterns illustrated with Figures 8a and 8b do provide supporting results in terms of positive direction.

5. Estimating the National Mango Board Demand Enhancement Programs' Impacts

As emphasized several times, demand depends on the decision to buy and then how much. Market penetration measures the buying decision and market intensity reflects how much to purchase once the buying decision is complete. Total demand depends on the household base (i.e., HWD) times the percent of household buying times the volume of mangos or HWD×Prob(MP)×MI. While HWD is totally exogenous of mango demand drivers, Section 4 clearly establishes the links of MP and MI with human factors, product attributes, preferences and the use of information with information being expressed in terms of promotion awareness. Since the function of the National Mango Board is to develop and fund the dissemination of information about mangos, the driving goal is to determine if those efforts were worth the investment. That is, what is the return-on-investment to the NMB? Statistically, the Probit model (i.e., MP model) and the Ordered Probit model (i.e., MI model) establishes that awareness of mango promotions positively impacts both MP and MI. In this section, the goal is to provide an empirical measure of that impact. A later section will explore the other demand drivers.

While those measures are shown momentarily, it is important to realize those estimates of MP and MI are based on model coefficients with statistical properties yielding levels of confidence in the conclusions. One will never know precisely the actual number of household buyers and non-buyers because sampling is required. We do know the high level of statistical confidence placed on the MP and MI demand coefficients as documented in Table 6 with the t-values.

(5.1) Estimating the ROI using the Awareness Model

Table 6 included the MP and MI coefficient across time with the results pointing to some change in the values over the years. These values are typically determined with recursive estimation techniques. To gain the best insight into the ROIs up to an ending season or year, each calculated impact for each year is based on the model estimates up to each ending year as shown in Table 7. The first column in Table 7 identifies the type of calculation while each additional column corresponds to the ending data period. For example, the last column is labeled 2020 Jan-Dec and thus indicates the models based on data ending in December 2020 while the row values are just for Jan-Dec of 2020. Note that the last row provides the ROIs for each year ending data points. For each row there is a "Yes" and "No," indicating being aware or not aware of the mango promotions. All impacts of the NMB are the differences between the "Yes" and "No" for each row measurement. Changes across the columns (year endings) capture the impact of changes in all demand drivers and not just promotion. Appendix B includes all of the demand models.

First in Table 7, market penetration changes from .073 to .199 over the full range of year endings. Without awareness of mango promotions, those market penetration values range from .069 to .189. For 2020, the difference between Aware and Not Aware is nearly 1% point. Awareness moved from 18.9% to 19.9%. While that difference may initially appear small, the difference in awareness leads to one-percent more of the households buying mangos within a two-week shopping period.

Table 7. Estimated ROI using the mango promotion awareness models.

Mango Promotion Awareness Model	Promotion Awareness	Base 2013:Mar to 2015:Dec	2016 Jan-Dec.	2017 Jan-Dec.	2018 Jan-Dec.	2019 Jan-Dec.	2020 Jan-Dec.
Market Penetration	Yes	0.073	0.134	0.154	0.136	0.164	0.199
	No	0.069	0.125	0.146	0.129	0.155	0.189
Market Intensity	Yes	3.224	3.960	3.608	3.389	3.636	3.635
	No	3.056	3.656	3.398	3.211	3.407	3.402
Average Retail Price ($ per retail Mango)		$1.19	$1.34	$1.37	$1.28	$1.36	$1.38
		-millions-	*-millions-*	*-millions-*	*-millions-*	*-millions-*	*-millions-*
Household Mangos	Yes	2199	1773	1880	1523	1993	2426
"	No	1970	1530	1673	1375	1762	2160
Implied Increase in Mango Demand		229	243	208	148	231	266
Household Expenditures	Yes	$2,559.72	$2,380.71	$2,571.83	$1,930.86	$2,708.60	$3,330.71
"	No	$2,294.43	$2,048.82	$2,287.01	$1,743.07	$2,396.92	$2,962.95
Gains		$265.29	$331.89	$284.82	$187.78	$311.69	$367.75
FOB Equivalent (34.07% Margin)	Yes	$872.10	$811.11	$876.22	$657.84	$922.82	$1,134.77
"	No	$781.71	$698.03	$779.18	$593.87	$816.63	$1,009.48
FOB $ Difference		$90.38	$113.07	$97.04	$63.98	$106.19	$125.29
NMB Expenditures	$	$17.57	$6.59	$6.12	$6.87	$7.90	$6.63
Impied ROI (starting with March 2013)		**5.14**	**17.17**	**15.86**	**9.31**	**13.45**	**18.90**

Market intensities and average mango prices follow in the next two row descriptors. Then using HWD×Prob(MP)×MI gives the retail level mangos and then retail value using the retail price per mango. Retail dollar gains are the difference attributed to the promotion awareness. As a general rule, FOB mango prices are close to 34% of the retail prices and that factor is used to express the retail gain at the equivalent FOB level. Those gains are noted as FOB $ Difference.

Row NMB Expenditures includes the NMB expenditures for each reporting period, generally Jan-Dec except for the starting period from 2013:Mar through 2015:Dec. While the gains are attributed to awareness, the costs to the NMB for achieving that awareness are those total Board expenditures. Dividing the FOB $ difference (with and without awareness)

by those expenditures gives the ROIs. All gains depend on the effectiveness of the awareness along with actual retail prices. For 2020, the ROI is estimated to be 18.9 which is substantially higher than previous years. While 2020 was an unusual year with more at-home consumption, the market penetration was higher with and without awareness. That does suggest there was more chance for in-store promotion exposure, thus potentially contributing to some of the higher ROI. The difference between the MP with and without awareness was largest in 2020, yielding ROIs all calculated for the calendar years (Jan-Dec). In prior reports, the ROI was based on the Jun-to-Jul months across two years. A decision was made to base everything on a calendar basis for this and subsequent reports.

For the bigger picture, what does the ROI mean when looking across the seasons? Since the USDA evaluations are generally over a five-year span, the cumulative effects of the promotion impacts are a useful way to illustrate the overall impact of the NMB's more recent efforts.

The upper bars in Figure 9 show the cumulative value of the FOB gains from Table 8, all expressed in million-dollar units. By the end of 2020, total FOB dollar gains attributed to the promotion awareness equaled $596 million rounded. Below the bars are the cumulative expenditures by the National Mango Board. Over the periods from 2013:Mar through 2020: Dec, total board expenditures equaled $51.68 million. Unlike earlier reports, these cumulative expenditures start with 2013:Mar and not back to the beginning of the NMB in 2008. Again the purpose of these periods is to provide a more recent evaluation of the programs and because collection of promotion awareness data started in 2013.

Dividing these cumulative expenditures into the cumulative gains provides a broader view of the effectiveness of the mango generic programs. Month-to-month expenditures to enhance demand may not precisely match up with awareness. In fact, the expenditure model

in the Section 4.5.1 showed a lag effect when expenditures were included in the demand model. With the cumulative expenditures, the overall return-on-investment equals **11.53** at the FOB level or points-of-entry. A slight upward trend in those ROI's is shown in the lower portion of Figure 9 with a substantial increase with the activities of 2020 (see Appendix C).

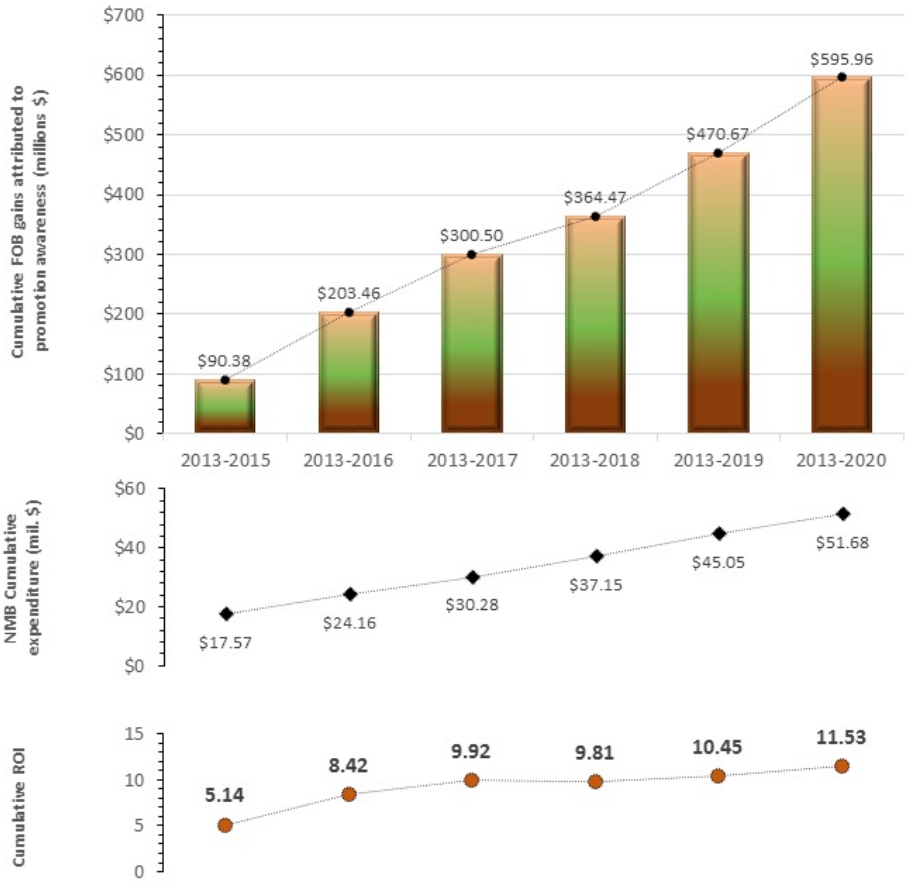


Figure 9. Cumulative ROI using the mango promotion awareness models.

(5.2) Market Penetration versus Market Intensity

During the early years of the National Mango Board evaluations before the availability of the promotion awareness data, the Market Intensity models failed to show a significant impact on Market Intensity. While the MI coefficients were positive, they were not statistically reliable. Since the inclusion of the promotion awareness data, both market penetration and market intensity have been shown to respond positively to the awareness of promotions and discussed in Section 4. The question of where the promotion gains are realized is important to developing marketing strategics. If all of the gains were from attracting new buyers, that calls for a broader marketing reach versus gains just from established buyers and more in-store emphasis. So the question of relative gains is extremely important.

Using the HWD×Prob(MP)×MI calculations, one can simulate the outcome if MI did not change with the promotion awareness using three calculations: (a) $HWD \times Prob(MP^{na}) \times MI^{na}$; (b) $HWD \times Prob(MP^{a}) \times MI^{na}$; (c) $HWD \times Prob(MP^{a}) \times MI^{a}$. The difference between (c)-(a) is the total gain attributed to the promotions while (b)-(a) equals the gain attributed to market penetration. Similarly, (c)-(b) gives the market intensity contribution to the promotion gains. These calculations are shown in Figure 10 over the years from 2015 through 2020 and then the overall average cross the years.

During the years included in Figure 10, both market penetration and market intensity both contributed to the gains from the promotions. On average, almost 46% of the gains are attributed to increasing market penetration or attracting mango buyers and around 54% attributed to changes in market intensity (see the right side of Figure 10). Since 2015, the relative importance of market penetration has decreased slightly from 51% to 42% by 2020.

These percentages will differ from year-to-year but the results in Figure 10 points

to relatively small chances since 2016. From a marketing policy standpoint, these numbers suggest focusing on both sides of the marketing design, attracting potential buyers and informing existing buyers. The NMB has been using both types of message targeting via in-store, print, and social media as illustrated in Figure 4.

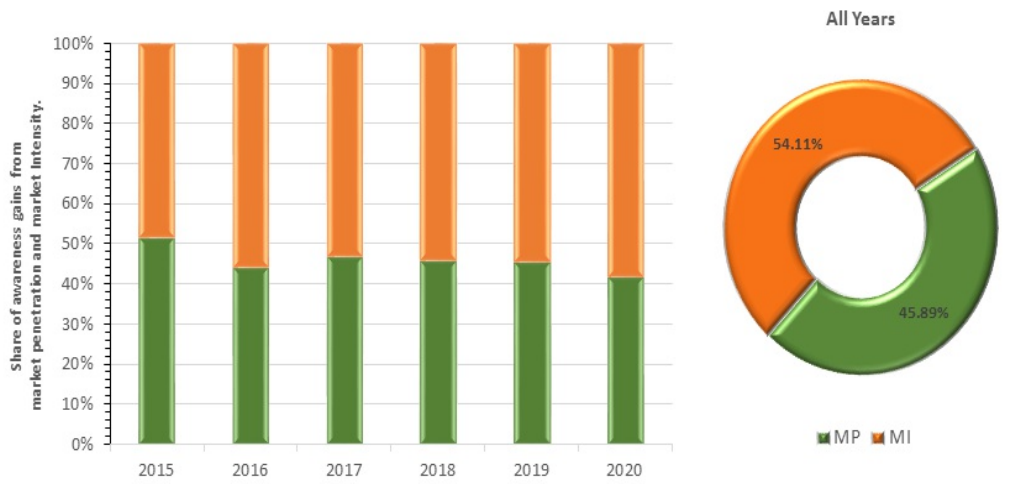


Figure 10. The relative impacts of market penetration versus market intensity.

(5.3) Relationship between Awareness and NMB Marketing Expenditures

Figure 9 shows the relationship between promotion awareness and the demand for mangos, resulting in the estimated ROI. The ROI was based on using the cumulative NMB expenditures up to the dates shown in the figure. Implicit in estimating the ROI is that there is a relationship between the awareness and the cost of achieving that awareness. Expenditures are spread over months and those accounting dollars do not necessarily match with when the demand enhancement efforts occurred. Some marketing efforts such as in-store displays may closely match with the marketing invoices while others potentially have

a longer term effect such as printed and/or media programs. In contrast, household promotion awareness is based on what the household indicates (i.e., recalled) when completing the household questionnaire (see Appendix A). The paramount question ... "is awareness linked back to the NMB expenditures?".

An analytical approach to this question is to assume that marketing impacts on awareness extend over a longer period of time and not just in the same month the awareness is measured. That is, the marketing effect is cumulative for several months. Such issues are often dealt with using a moving average form instead of the dollars in the same month as the awareness.

Moving averages requires one to specify the length of the averaging, say six months. After exploring several alternative, a six-month moving average in the marketing expenditures was finally adopted defining MKG as the monthly marketing expenditures with: MA_MKG= $\{MKG_{-1} + MKG_{-2} + MKG_{-3} + MKG_{-4} + MKG_{-5} + MKG_{-6}\}/6$. Note that the expenditures in the same month were omitted then awareness was regressed against MA_MKG. That relationship is illustrated in Figure 11 and the full estimates are in Appendix D.

In the midpoint of Figure 11, the moving average marketing expenditures are $340,000 averaged over the 2013:2-2020:12 months. For that midpoint (i.e., .34 in Figure 11) awareness is around 8% for the reporting households. With an increase to $540,000 six month average, awareness increases to near 12%. Nearly a doubling of the moving average expenditures increases awareness by almost four percentage points or 8% to 12% awareness. Within the expenditures explored, the relationship between awareness and expenditures is almost linear and statistically significant. The t-value is 5.16, thus pointing to more than a 99% confidence level in the estimated relationship.

The importance of Figure 11 cannot be overstated. Section 4 established that awareness leads to greater market penetration (MP) and more purchases per buyer (MI). Now that awareness is linked back to the NMB program dollars.

Interestingly, if one extends the expenditures back to zero in Figure 11, promotion awareness drops to 1.29% thus indicating some awareness of promotions in the absence of the NMB dollars. While this extension back to zero is outside the expenditure data range, it does add confidence to the premise that most of the awareness is attributable to the NMB.

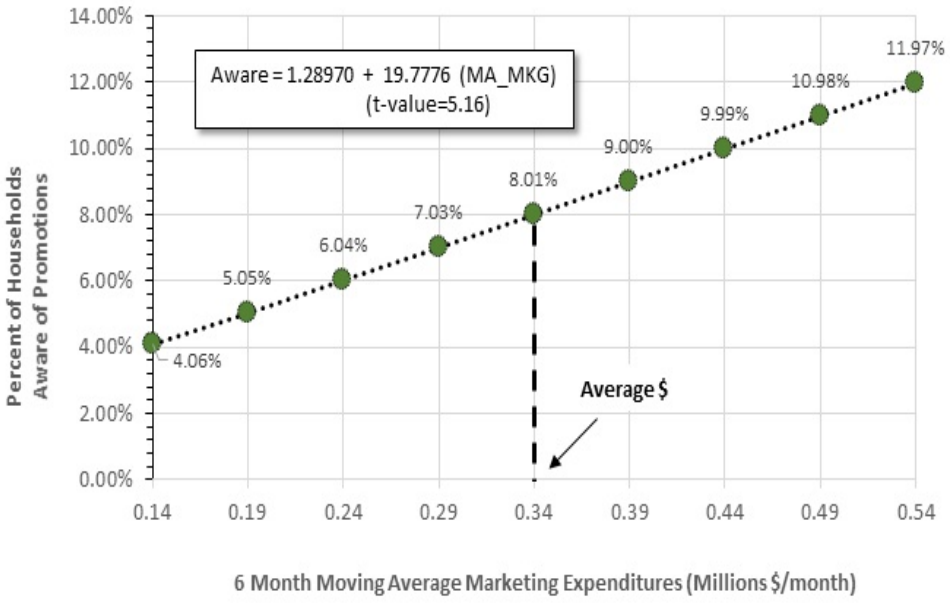


Figure 11. Relationship between promotion awareness and the NMB expenditures.

6. Other Mango Demand Drivers

Models for both market penetration and market intensity included other demand drivers beyond the promotions as first defined in Tables 4 and 5 (also see Appendix B.) One cannot focus on just one demand driver, such as the promotions, without accounting for other factors potentially shifting demand. Estimated impacts of other demand factors add credibility to inferences drawn about the promotion effects shown in Sections 4 and 5. If other drivers beyond the promotions showed unreasonable effects in terms of direction and magnitude, that would raise questions about the overall modeling. Hence, in this section the intent is to show the effects on mango demand from the other variables included in the Probit and Ordered Probit models. For some potential demand drivers, the directional effects should be clear based on theoretical arguments (i.e., income, price). Others such as attitudes, the direction and magnitude (if any) effects are not as clear theoretically. For example, preference for organic practices on the demand for mangos is not necessarily driven by theory and may just be a possible empirical impact.

To add greater insight into the overall performance of the models, this short section explores the role of the demand drivers beyond the promotion awareness and/or promotion expenditures.

As defined earlier, demand is the product of (households) times (market penetration) times (market intensity) or HWD × Prob(MP) × MI where both MP and MI can change with all of the variables included in the Probit and Ordered Probit models. Defining MP^0 and MI^0 to represent the average household, then a convenient way to illustrate the effects of other

demand drivers would be to express the impacts relative to the average household. Let ID be the Index-of-demand relative to the average household, then:

$$\mathrm{ID} = \frac{HWD \times \mathrm{Prob}(MP) \times MI}{HWD \times \mathrm{Prob}(MP^0) \times MI^0}$$

$$\mathrm{ID} = \frac{\mathrm{Prob}(MP) \times MI}{\mathrm{Prob}(MP^0) \times MI^0}$$

Demand is above the average with ID>1 and less than the average with ID<1. Note that both market penetration and market intensity can impact differently but with ID, it is the combined impact. If the driver impact on MP is opposite that of MI, there could even be offsetting effects. Furthermore, if a variable only occurs in either MP or MI, then effect on ID would be just to either MP or MI. "Reasons for buying mangos" are a good example where that variable only occurs in the market intensity side of the demand index. In the following subsections, this index approach will be used.

(6.1) Demographics

Income, education, ethnicity, and age are four expected important demographics found in almost all demand analyses. These demographics were defined with categories initially set forth in Table 1. This table showed the distribution for each demographic. Thus one may see the directional and size impacts, but the probability of each impact depends on the likelihood of that category occurring as shown in Table 1.

Figure 12 shows the range of impacts from four selected demographics. Income has a positive effect on the likelihood of buying mangos and the number of mangos per buyer. Demand above the average is particularly seen for incomes of $75,000 and higher. Around 6% of the household did not report their incomes and the drop in response among that group has little meaning. The overall takeaway is that mango demand increases across incomes but not in a linear pattern.

Results for education are somewhat mixed with no upward or downward trend. Households with the primary breadwinner having graduate educational experience do show the highest demand index of 1.07. That group is only 13.5% of the households.

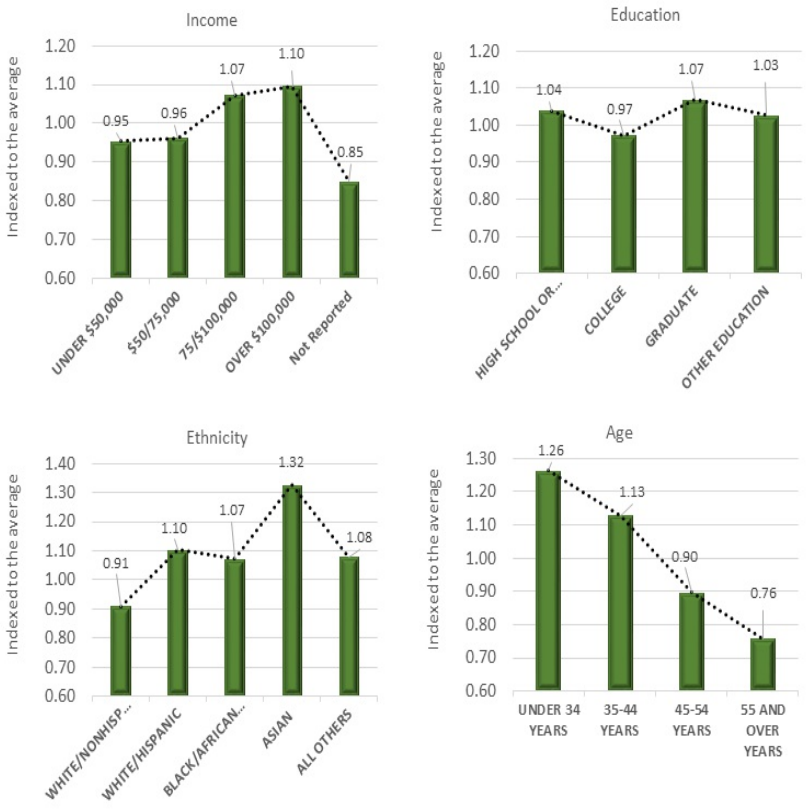


Figure 12. Effects of demographics on the household demand for mangos.

The more pronounced responses are seen with ethnicity and age in Figure 12. White non-Hispanics account for 67% of the households and their demand is under the average with the ID=.91. White-Hispanic are 9.2% of the population and the ID jumps to 1.10. Clearly Hispanic and non-Hispanic are big drivers within that ethnicity group. Asians' account for around 4% of the households while their preference for mangos is the highest at 32% greater than the average. The demand index across ethnicity has important implications when designing media programs that including targeting households by demographics.

Finally in Figure 12, demand for mangos declines almost linearly with household age. Nearly 31% of the households are in the oldest age category while having the lowest demand index. Similar to ethnicity, preferences for mangos across ages are so apparent that marketing to various age groups seems justified.

Notes again that the ID values are comparable across the charts since all of the ID values are indexed to the same base. Values of other demographics such as regional differences and household size are shown in a full table of all drivers in Appendix E.

(6.2) Attitude and Preference Drivers

Attitudes and preferences are always expected to influence a household's decision making process. Yet it is an empirical question if and to what degree emotional responses actually impact demand. Frequently, a Likert altitudinal scale of agreement is used to quantify attitudes and preferences. A five-point scale of agreement was used in the household questionnaire to measure the response to specific preference questions with the scale defined as: (completely disagree (1); somewhat disagree (2); neutral (3); somewhat agree (4); and completely agree (5)).

Concerns about calories are frequently raised as households are making food shopping decisions. Approximately 34% of the households surveyed agreed they count calories when shopping in general while 24% were neutral. In Figure 13 there is a positive and almost linear relationship between counting calories and buying mangos, giving a low index of .91 to 1.08 among those completely agreeing about counting calories. Most of the positive response comes from willingness to buy, where the counting calorie impact in the Market Penetration models is statistically different from zero. The directional effects in the Market Intensity (e.g., Ordered Probit Models) have similar signs to the Market Penetration, yet there is little statistical confidence that the coefficients are different from zero. Stated

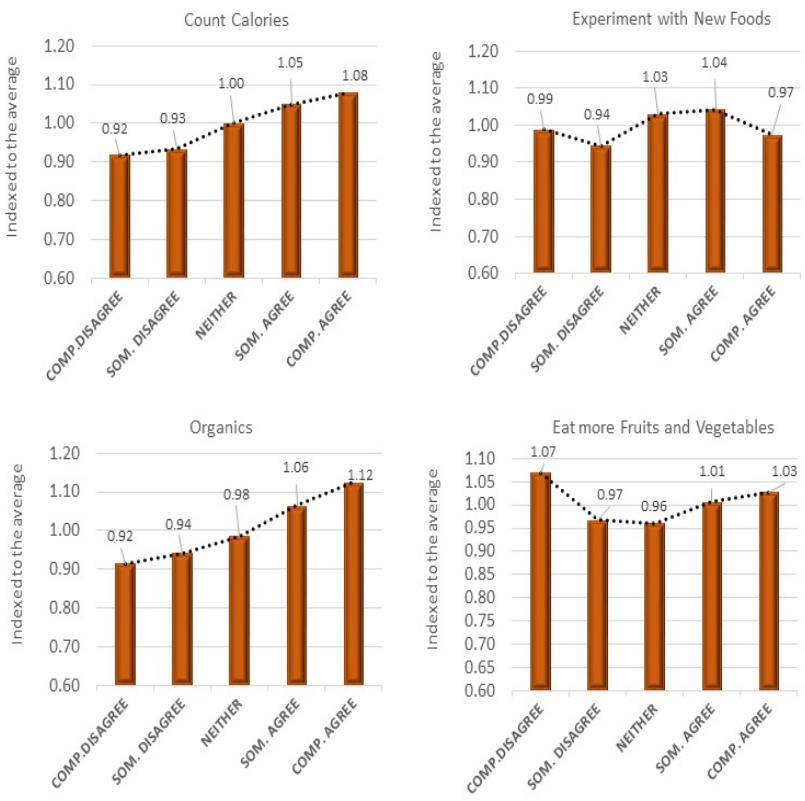


Figure 13. Behavior and preference impacts on mango demand.

differently, concerns about calories do not discourage buying mangos.

Since mangos are generally not considered part of the stable diet based on the low market penetration numbers, one expectation was that households who like to experiment with new foods may be more likely to buy mangos. The agreement scales were used to measure that willingness to the question..."I like to experiment with new foods." Nearly 34% of the households agree with this statement (see Table 1).

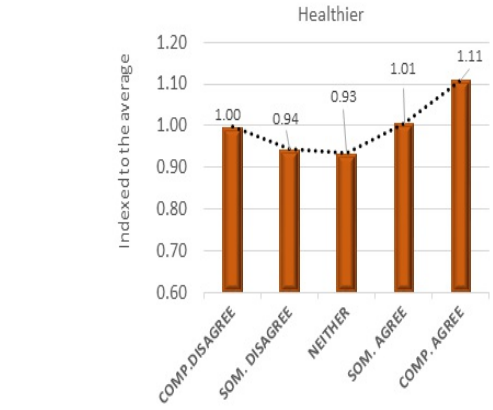
Statistically, there is generally confidence in the estimated coefficients, the numerical impacts are relative small when comparing the ID values and somewhat inconsistent across the agreement scores. For example, at both ends of the agreement spectrum the scores are nearly the same with .99 and .97. The highest and lowest scores are with the somewhat disagree and somewhat agree levels. Usefulness for marketing strategies in terms of positioning mangos in the category of new and/or exotic fruits are at best mixed. Similar mixed signals are seen for the statement that ..." I like to eat more fruits and vegetables." In contrast with a more specific question about the preference for organics, the index increased from a low of .92 to a high of 1.12 when completely agreeing with searching out organics (see Appendix E.) The organic coefficients were highly significant in the Probit Model and around 18% of the households completely agreed with the organic question.

Other behavior and preference responses are in Appendix E.

(6.3) Health Related Measures

Each household was asked about their general health status relative to their peers and also to actual health conditions inside the household. In the upper chart of Figure 14,

households scored levels of agreement to their health relative to others, clearly a somewhat subjective scoring since it is relative to a moving base. Still it is their perception that potentially influences purchasing decision. Agreeing and disagreeing about their health status was nearly 30% on both sides (see Table 1). In the upper portion of Figure 14 , there is a direct positive relationship between health perception and the purchases of mangos. Statistically and numerically, the demand gains are among those feeling their health is better than their peers. Households who feel they are healthier will more likely buy mangos. Both the MP and MI coefficients are statistically significant for the agreement for healthier. The



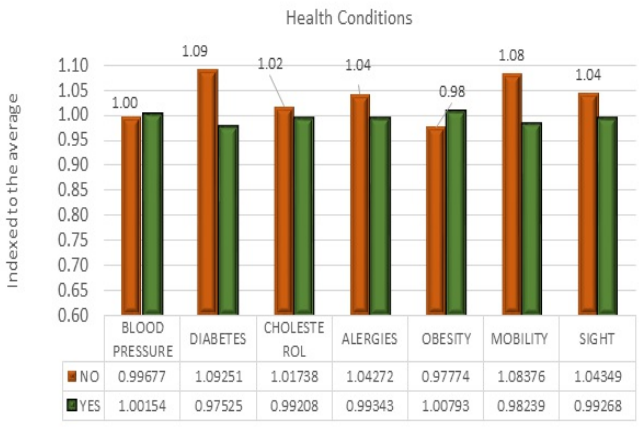


Figure 14. Health related demand drivers and their impacts on mango demand.

ID reaches 1.11 for the completely agree score.

Those same households were asked to indicate if anyone in the household had a specific health issue: blood pressure; diabetes; cholesterol; allergies; obesity; mobility and sight. The scoring was simply a Yes or No to each potential health factor.

Referencing Figure 14, the ID scores are shown for each health condition. Overall the ID scores show only minor differences except for diabetes and mobility. The mango demand index drops from 1.09 to .97 with the existence of diabetes in the family base. For mobility, the ID declines from 1.08 to .98.

An interesting observation is that 39% of the households indicated having someone in the household with blood pressure problems and 35% with cholesterol problems. Yet both these more pervasive health issues showed little effect on the demand for mangos. Similarly, 26% indicated a household member with obesity issues. The demand index slightly increased from .98 to 1.01 with the obesity issue. Again, the largest range of impact is with diabetes.

(6.4) Reasons for Buying Mangos

A question about why you purchased mangos was included in the questionnaire. Buyers were asked to rank their 1st, 2nd, and 3rd reason for buying mangos. These type questions were used to get a feel for the role of quality and other product attributes on the demand for mangos. These reason questions were obviously only included in the Ordered Probit model since the household had to be a buyer to respond to the question.

Figure 15 illustrates the full scope of ranking those reasons for buying mangos. The left of part (a) in Figure 15 gives the percentage of buying households who ranked each reason and then the percentage for the top ranking. For example, ripeness ranked top with 38% of the buyers having at least a 1st, 2nd, or 3rd place. Then 11% ranked ripeness as the top

reason. Price was nearly the same ranking with 37% at least ranking Price and 13% ranking this reason as the top reason. The reasons for buying are sorted from the top down to the least indicated rankings. Ripeness, Price, Freshness, Quality, and Appearance were all nearly 30% or higher. Beyond appearance, the importance of the reasons drops off as clearly seen in the remaining bars in Figure 15.

Every reason included buyers who did not rank a particular reason. While nearly half had substantial 1st, 2nd, or 3rd rankings. With the Index of Demand, one can see how each variable impacts mango demand relative to the average. Since many of the reasons have a low probability of ranking such as advertising (i.e., 5%), another way to illustrate the reasons impact on demand would be to compare the ID with no ranking to the average where ID=1.0.

Starting with Ripeness, if ripeness was not important (i.e., not ranked), mango demand would be 23% less than the average as illustrated in right part (b) of Figure 15. Very similar levels of seen for Price, Freshness, and Quality with 21%, 23% and 24%. These values along with those in (a) of Figure 15 show first the level of importance in just ranking and then their impacts on actual mango demand. Moving down the demand changes (b), one can quickly see relative impacts of each of the reasons for buying.

The combination of (a) and (b) in Figure 15 is important in that it establishes that the rankings translate into the volume of mangos purchased during a two-week buying occasion. Buyers ranked their reasons and with the econometric models, one can estimate how those rankings drive Mango demand.

(6.5) Substitutes and Complement Effects

For each reporting household, the total number of other fruits purchased during a specific two-week period is known. Without developing models for every fruit included in

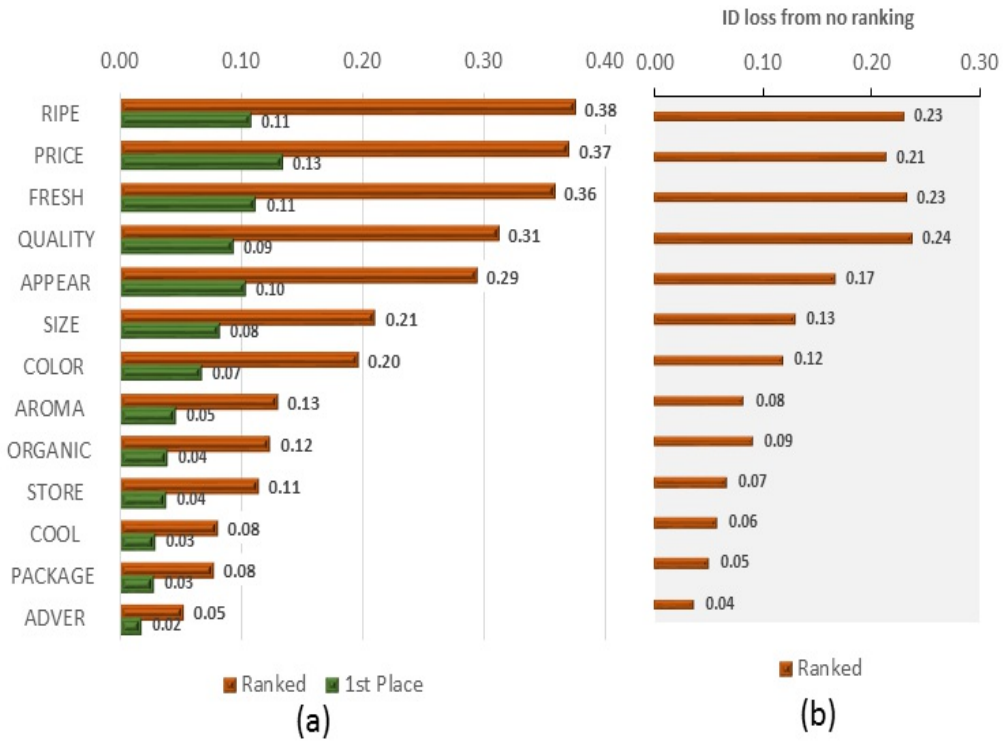


Figure 15. Ranking of the reasons for buying mangos and their impacts on the Index of Demand.

the questionnaire, an alternative approach to measuring the potential substitutes (or complements) would be to include those other fruits in the MP and MI models. One hypothesis could be that as the number of other fruit purchased goes up, the demand for mangos goes down. Equally feasible could be that if a household is likely to buy a variety of fruits, they potentially include mangos. The number of fruits purchased were included in the MP and MI models using DFRU1 through DFRU4. DFRU1 represents one other fruit; DFRU2 is two other fruits; DFRU3 is three other fruits; and DFRU4 is for 4 or more other fruits purchased in a single buying occasion. In the MP estimates, the coefficients for each DFRU are positive and statistically significant. For the MI or market intensity model, only DFRU4 is statistically different from zero (e.g., see the t-value for DFRU4 in Table 6).

Figure 16 provide graphic insight into the impact on mango demand as households buy other fruits during the same period. The bottom axis of Figure 16 indicates the number of other fruits purchased in a two-week shopping window exclusive of mango purchases. Excluding mangos, the average household purchased 3.25 fruits in the defined period. Roughly 35% of the households did not purchase any other fruits while 34.8% purchased 4 or more fruits as shown in the lower bars of Figure 16. Now the question is ... how did mango demand fair across the purchasing habits for other fruits?

Using the same ID (Index of Demand), at the average of 3.25 other fruits the demand index for mangos is 1.0. For those shoppers not buying any other fruits, the mango demand

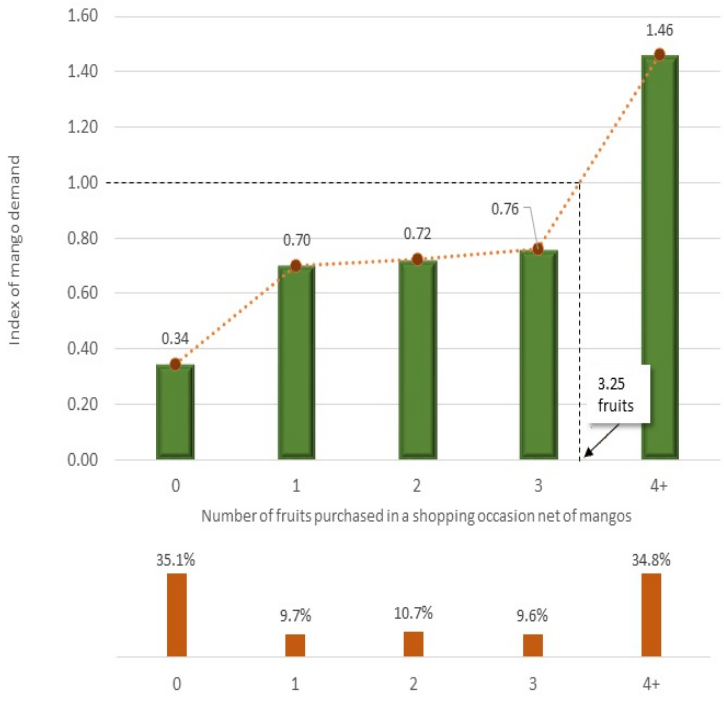


Figure 16. Effects on mango demand from buying other fruits.

index drops to .34. That is mango demand is only 34% of the average household. With purchases of 1, 2 or 3 other fruits, the demands for mangos increase from .70 up to .76 of the average households. Note again that ID is 1.0 when the number of fruits is 3.25.

The most profound conclusion follows when purchases of other fruits are four or more during the shopping window. Mango demand is 46% greater than the average among those shoppers classed as heavier users of other fruits. Those household buyers account for slightly more than a third of the households.

Visually, Figure 16 suggest the demand for varieties of fruits leads to purchases of more mangos. Instead of strong substitution, the numbers point to some degree of complementarity within the fruit categories. Theoretically, there is always some substitution within a food category and between food categories. Yet the empirical results point to a stronger demand for mangos when the desire is greater for a number of other fruits.

From a marketing standpoint, Figure 16 has implications for the location of mangos within store fruit sections. Rather than separating mangos totally from other fruits, locations within displays for other fruit could be beneficial.

(6.6) Price Effects on Mango Demand

Legally commodity promotion boards are not directly involved in pricing issues, since their functions are to enhance the demand for their specific commodity. To determine the effectiveness of enhancing demand one must understand the demand for that the commodity. Measuring demand cannot be accomplished without including prices in the demand models as has been the case in both the market penetration and market intensity models. There should always be a negative relationship between prices and quantity purchased as is the case for mangos. In Tables 4 and 5, prices coefficient for market penetration and market intensity are negative and statistically significant. Without question,

both models are theoretical consistent showing the negative relationship between mango purchases and prices.

Price elasticities are often quoted to express the price relationship showing a percentage change in price leads to a percentage change in quantity. Estimates of price elasticities implicitly require knowing the purchasing price. That is a particular problem with market penetration since among those who do not buy mangos, there is no reported price that a household may (or may not) have observed.

Among buyers, the price is reported. To fill the gap of missing prices among those not buying mangos, one approach is to assume that those households were exposed to the average price in the period under consideration and within the regional location of that household. That method was used to generate a price vector to include in the market penetration model. Clearly there could be measurement error with the price variable. Yet to completely ignore price in the model would be an even greater error.

In Table 4 and for the defined price, it is clear that price plays a major role in the decision to or not to buy mangos. Generally, for every five-cent price increase (or decrease) market penetration decreases (or increases) by nearly .012 units. In the simulations over prices, market penetration was around 16% when mango prices were near .88 dollars per mango. Increase the price to say $1.27 per mango, market penetration declines to about 6%. Obviously, potential buyers are very sensitive to the price of mangos.

In contrast to market penetration data, prices are known for those who did buy mangos. Hence it is straight forward to estimate the price effect on market intensity as shown in Table 5. The price coefficient is -.791 with a t-value at 37.83. That simply means there is more than a 99% level of confidence that the price coefficient is different from zero. The equivalent price elasticity is around -.62. Or, for every 10% change in price, market intensity or number of mangos purchased change in the opposite direction by 6.2%.

When comparing both market penetration and market intensity responses to price, the price elasticity is near -3.0. Rising prices lead to a substantial decline in mango demand mostly attributed to lower market penetration and some decline in the number of mangos purchased during the buying decisions.

Figure 17 includes a simulated example of the price impact on the demand for mangos in the U.S. marketplace. There are three plots in Figure 17 with the upper being market penetration; the middle gives market intensity; and the lower is the Index of Demand as developed earlier in this section. Simulated retail prices are on the bottom axis of each chart with retail prices ranging from $0.83 per mango to $1.30 per mango. These prices were simulated by adjusting the average retail price in increments of 5% points. For example, a mango price of 83 cents is 75% of the average retail price of $1.11 per mango for the periods simulated.

Economic demand theory tells us that the less essential the food to the diet, the more price sensitive is the household. Stated differently, households are generally less sensitive to price changes when the product is more essential to the household food consumption. Clearly, the decision to buy or not-buy mangos is very sensitive to prices as seen with the market penetration approaching 17% with the lower prices. Similarly, the likelihood of buying mangos drops with increases in the retail mango price. Market penetration is lowered to nearly 5% when prices are 25% above the average retail price per mango.

Market intensity in the middle chart of Figure 17 also depicts the negative buyer response to price increases. The average number of mangos per buying occasions drops from 3.91 mangos to 2.85 mangos over the price range shown. However, the market intensity is less price sensitive relative to the market penetration respond to prices.

Recalling that the Index of Demand is the full impact of changes in MP and MI, the lower chart in Figure 17 shows how the Index of Demand declines with price increases.

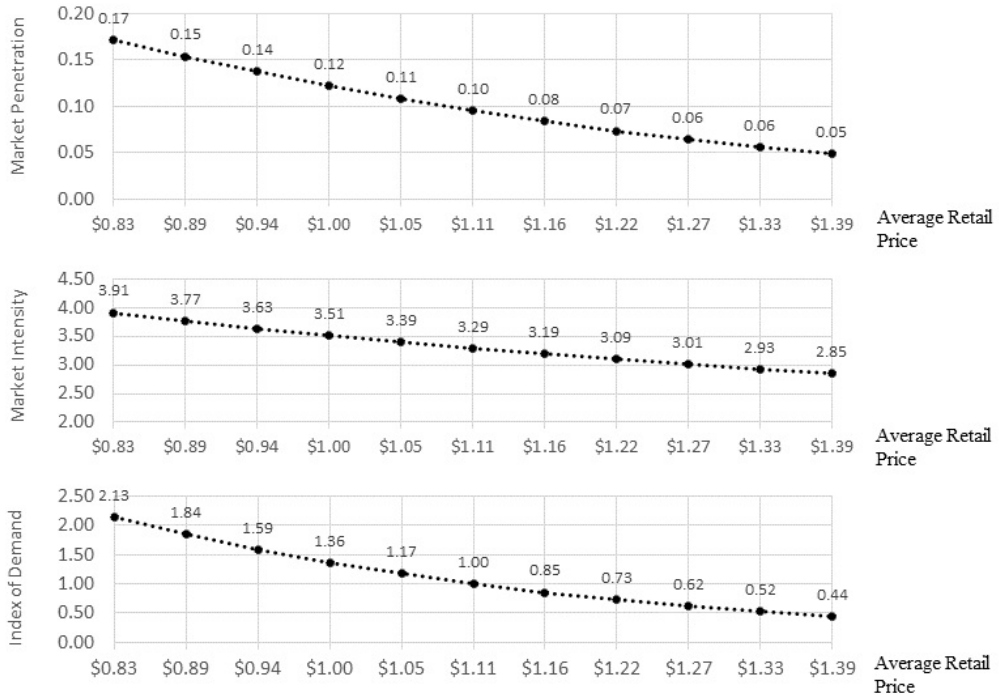


Figure 17. Retail price impacts on the demand for mangos.

Retail prices at 75% of the average retail price leads to almost a doubling of demand with most of that increase attributed to attracting households to buy mangos. The lower chart in Figure 17 points to demand being 44% of the average when prices are 25% above the average.

Price responses are interesting but not the focus of the overall evaluation of the National Mango Board. Yet to use the demand models to draw inferences about the promotions one has to be assured price is accounted for in the modeling and that is the case for both dimensions of the demand modeling.

7.0 Conclusions and Implications

In this empirical evaluation of the National Mango Board the analyses have been limited to measuring the impact of the Board's programs on the U.S. demand for mangos. Statistics alone cannot capture the full breath of any program, but with statistical techniques one can have scientific confidence in the conclusions and inferences. Confidence in the conclusions is essential for setting policies, projections, and adjustments. Before summarizing, it is useful to also recognize what is not captured with statistical models.

(7.1) Structure of the National Mango Board

Overall sight and leadership are key ingredients to the functioning of any commodity board. Leadership leads to creativity through the employment of staff with the skills to design and implement media programs. Econometrics models rely on the awareness and program expenditure data as the measures of effort without giving due credit to many hours of effort to design and deliver. The models tell us if the programs worked but much of the process is hidden within the data. Of course, that is generally true when using most databases. Aberrations in the data usually stand out, but the creative juices are frequently lost until one sees the empirical successes (or failures).

From the outset of the National Mango Board, a monitoring program was put in place to have a consistent measure of the demand for mangos. That was essential since little hard data on mango consumption were available prior to the start of the household survey noted in Appendix A and in the text of this report. With substantial funding, that database has been maintained while adding questions to the survey over the years. In fact, the question about awareness of promotions was not added until 2013 and that variable has become a major component to the evaluations. The entire database since its inception continues to be maintained and stored in an accessible format (i.e., a Stata dta format).

Designated staff can access those data as needed.

Figure 4 attempted to quickly depict the media programs and, of course, did not present the depth and dynamics involved. Content, graphics, media coordination, budgeting, and followup are all embedded in those programs. Several chapters could have been written on how the staff moved from inception to delivery of the messages. Those messages ranged from in-store displays to social media (see Figure 7). We have economic models that attempt to measure the impacts of the different media but have not included those in this report because of timing. At the time of this report, the in-store effects appeared to be the strongest effect on mango demand.

The National Mango Board faces unique challenges in that most of the Board members are from non-English-speaking countries. All Board meetings require simultaneous translation in nearly all meetings. Equally challenging are outreach programs by the staff to travel and communicate with producer organizations through Central and South America. While the outreach and communications seem to have worked, none of those successes are captured in this report. Outreach efforts were and are mostly designed to keep those, responsible for funding the programs, informed about the program efforts and impacts. Recent virus issues limited travel, but the staff mostly dealt with those limitations through online communications via Zoom and/or similar electronic communication tools.

Whole and fresh-cut mangos capture most of the industry and were included in the initial enabling legislation. In an effort to broaden the reach of the Board, considerable effort to integrate the frozen sector in the generic messaging was eventually met with resistence. After considerable investment in time and oversight by the NMB and the USDA, the frozen mango industry was first incorporated into the Mango Board and then subsequently removed after votes by the frozen sector. As of this writing, the frozen sector is not part of the National Mango Board. There are lessons to be learned by the entire process and, at some

point, those lessons need to be articulated. Here is not the place.

So what can be concluded from the empirical analyses? Those conclusions are in the next subsection.

(7.2) Major Conclusions

Evaluation of the National Mango Board was based on measuring the U.S. demand for mangos by dividing demand into two components: (a) percent of households buying mangos within a two-week shopping period (*Market Penetration*), and (b) recording the number of mangos per shopping occasion by each household mango buyer (*Market Intensity*). A Probit model was estimated for Market Penetration and an Ordered Probit model specified for Market Intensity. All of the statistical properties for both models are presented in the text and appendices. In both models the measure of the National Mango Board was specified through household awareness of the mango promotions and the Board's marketing expenditures. The purpose of using awareness and then expenditures was to determine the consistency of the conclusions using two measures of effort.

Major conclusions from the report:

(A) There is a positive association between household awareness and households buying mangos (see Table 3).

(B) Awareness of mango promotions has trended upward over the years with a few notable exceptions and particularly the 2018 season (see Figure 6).

(C) Both awareness of promotions and the NMB marketing expenditures have positive and statistically significant impacts on the probability of buying mangos (see Table 6 and Figure 8a).

(D) Both awareness of promotions and the NMB marketing expenditures have positive and statistically significant impacts on the number of mangos purchased in a two-week buying shopping period (see Table 6 and Figure 8b).

(E) Both the awareness and expenditure models show similar impacts on market penetration and number of mangos. However, the awareness models have the benefit that awareness is a direct measure of the household's exposure to the promotions. Whereas, using monthly marketing expenditures assume all households in a particular month have been equally exposed to the messaging.

(F) Mango demand is a product of the {number of households} × {probability of buying} × {the number of mangos purchased in a shopping period} and awareness impacts both penetration and intensity. Those impacts then facilitate estimating the return-on-investment (ROI)

(G) The demand models were estimated recursively first with monthly data from February 2013 through December 2015, and then adding an addition months for the next full year, ending with December 2020. With those estimates the ROI was derived for each year and then a cumulative ROI from 2015 through 2020.

(H) Year-to-year based on the calendar years, the ROI ranged from a low of 5.14 in 2013/2015 to a high of 18.90 in 2020. Since 2020 was unusual given the covid-19 problems, it is not totally clear what the 2020 issues had on the ROI values. The gains for 2020 were similar to 2019, but the marketing expenditures were less (see Table 7).

(I) Concerns about the downward trend in the ROI from 2016 to 2018 were expressed in prior Board reviews, but the ROI's for 2019 and 2020 point to a reversal in the ROI downward trend.

(J) Since the USDA requires a five-year evaluation, a cumulative ROI seem more in line with the evaluation goals. Over the years from 2013 through December 2020, the cumulative ROI equaled 11.53. Also, the cumulative averages generally trended

upward except of the slight adjustment in 2018. The ROI is substantial relative to many other commodity promotion programs.

(K) Early on with the National Mango Board programs, most of the estimated gains were from attaching new mango buyers. By 2020, the estimates suggest that slightly over half of the gains are attributed to the market intensity (see Figure 10). That is, the promotions now also entice mango buyers to purchase more mangos in a shopping occasion.

(L) Awareness is either a "Yes" or "No" for each household while the NMB expenditures are for each specific month assuming all households were exposed to the message. Subjectively, that is a strong assumption. Yet when calculating the monthly average awareness, there is a strong positive statistical relationship between monthly average awareness and a six-month moving average of marketing expenditures. This is the first time we have estimated that relationship (see Figure 11).

(M) Both the market penetration and market intensity models included many demand drivers beyond the promotions. Impacts of those drivers were included in a separate section and performed as expected based on coefficient signs and statistical significance. While the stories for each demand driver stand alone in their usefulness and implications, their importance to the promotion evaluation is that the models were theoretically consistent across all the demand drivers. That adds confidence to the use of the models when drawing inferences about the promotion effects. In particular, both market penetration and market intensity were negatively impacted by higher prices. Any theoretically wrong signs with prices would raise concerns about the validity of the models.

(N) Finally, there are usually food substitutes for most goods and, when possible, need to be accounted for in the modeling. For most demand models, relative prices are included to measure the possibility of substitutes. An alternative way was adopted in the study using the argument that the number of other fruits purchased in a buying occasion would likely impact the purchases of mangos (i.e., a potential

substitute or complementarity effect.) The models show that as households increase the number of fruits purchased in a two-week shopping period, they are more likely to also include mangos in the larger fruit shopping basket (see Figure 16.)

(7.3) Implications

Econometric models are tools, when used carefully, can be beneficial to the checkoff program decision making process. As use in this report, they first provide a scientific base for judging effectiveness through measuring the historical impacts on demand. One cannot ignore experience, yet the models provide a tool for judging with statistical confidence.

Once each demand driver's relationship on demand is known via the estimated coefficient(s), then the opportunities for exploring "what if" type questions are readily available. As part of the mango household research design, a simulator was developed to address many "what if" type questions. What if... *incomes decline*? What if ... *mango prices increase*? What is the ... *maximum potential impact by increasing promotion awareness*? What .... *would be the impact if the awareness coefficients were increased by some factor*? This last question in particularly interesting in that it gives some idea of the growth in demand if new innovative programs could change the link between awareness and demand. Awareness could be increased and the coefficient linking awareness and demand could also increase (or decline). The simulator based on the market penetration and market intensity models would show the levels of demand under a range of assumption. These are just a few of the type questions that can be explored with the existing mango demand simulator. It is taking the demand relations beyond the historical evaluation level.

As a last point, some variables could not be incorporated into the demand models because of the nature of the data. The most apparent is "Reasons for not buying mangos" presented in Table 2. That data could not be included in the market penetration models

simply because the data exist only for those not buying while market penetration includes both buyers and non-buyers. This variable, separate from the modeling, provides clues about types of messages needed to counter the reasons. *Taste* was the top reason for not buying and that could be countered with a wider variety of uses as suggested with current programs noted in Figure 4. Others such as "Did not think...", " Did not feel like...", "Not familiar...", etc. all point to changing knowledge and perceptions. It is at this point where the messaging creativity takes place. Models and statistics cannot sub plant creativity, but it highlights the focus and direction needed to attract potential mango buyers. Likewise, the ranking of reasons for not buying points to places where little gain could be expected through messaging. For example, see the lower level of concerns about the wrong size of mangos.

The bottom line from working with many commodities over the year, the National Mango Board's programs have succeeded in enhancing the U.S. demand for mangos. There are further opportunities given the still relative low level of market penetration compared to other more mainstream fruits.

8.0 References

AMS-USDA. (2014). Federal Agriculture Improvement and Reform Act of 1996. Pub. L. 104-127, 110 Stat. 1032, Apr. 4, 1996. Provisions generally referred to as the *Generic Commodity Promotion, Research and Information Act*. http://www.ams.usda.gov/ AMSv1.0/getfile?dDocName=STELDEV3004671

Forker, Olan and Ronald W. Ward. (1993) Commodity Advertising The Economics and Measurement of Generic Programs. Lexington Books. MacMillan. New York, NY.

Long, J.Scott. (1997). Regression Models for Categorical and Limited Dependent Variables. Advanced Quantitative Techniques in the Social Science Series 7. Saga Publications. Thousand Oaks, CA.

Long, J. Scott (2014). Regression Models for Cateogorical Dependent Variables Using Stata. Stata Press. College Station, Texas.

MetrixLab. (2020). Research Manager: Eileen Kirschbrown. www.MetrixLab.com

Mitchell, Michael N. (2020). Data Management Using Stata. Stata Press. College Station, Texas.

National Mango Board. (2021). http://www.mango.org/en/Home.

TSP. (2021) Time Series Processor. Timberlake Consultants Limited. www: www.timberlake.co.uk. (Note that TSP is no longer available through the original Developers.)

Ward, Ronald W. (2016). Estimating the Impact of the National Mango Board's Programs on the U.S. Demand for Mangos. An Application of Discrete Choice Modeling using both the Board Program Expenditures and Household . National Mango Board. Orlando, Florida and AMS-USDA.

Ward, Ronald W., Leonard Ortega, and Willian Watson. (2013). "Mangos Production and Consumption: Insight into Mango Trade and U.S. Demand." Chapter 14. *Metodologia y Funcionamiento de ls Cadena de Valor Alimentaria.* Coordinacion Julian Briz and Isabel de Felipe. Editorial Agricola Espanola, S.A. Ciparesss. Madrid, Spain. 2013. pp. 357-378.

Ward, Ronald W. (2012). "Commodity Generic Advertising: Its Economic Value in the Food Chain." Chapter 10. *Las Redes de Cadenas de Valor Alientarias en el Siglo XXI: Food Value Chain Network in the 21st Century.* Coordinacion Julian Briz and Isabel de Felipe. Editorial Agricola Espanola, S.A. 2012. pp. 253-276.

Ward, Ronald W. (2006) *"Commodity Checkoff Programs and Generic Advertising."* Choices. The Magazine for Food, Farm and Resource Issues. 2nd Quarter 2006. 21(2):55-60.

Ward, Ronald W. (1993). *The Beef Checkoff: Measuring Its Economic Impact.* Report UF#NCA 93.1. National Cattlemen's Association. Denver, Colorado. February, 1993. 40 pages.

Appendix A: National Market Board household data questionnaire.

Use "H:\ZMangoBoard\MT\STATADatabase\mango(168v7)_labels.dta"

. describe

This discription is very long, too much to include in this Appendix. Actual variable descriptions can be made available by emailing this author via rward@ufl.edu. The data base is privately funded and very large, so none of the actual data will be distributed without written approval by the National Mango Board. As of August 10, there are 171,257 observations with 1,993 variables covering the months from 2008 to June 2021.

National Mango Board Study – May 2021

P89639 (please note new project number – starts with March 2021 project)

QUESTIONNAIRE

Programmed Version: Feb.2013

Changes for 2013-2014 tracker are: Q17a, Q17b, Q17c, Q17d, Q17e
Changes for 2014-2015 are: Q17b and Q17b1
Change for 2017 (starting January) is: new question: Q.1b
Changes for 5/25/18 **Added questions 5/25 – Q16a, 16b, 16c**

Total Sample:

- N = 1000
- Adults 18+
- Personally shopped for food at either a grocery store, warehouse club store, mass merchandiser, or farmers market

Updates for every wave are on the following questions marked yellow:

- **Age within gender and Ethnicity quotas**
- **Q1a, Q2, Q3, Q17a, Q17b, Q17c, Q17d, Q17e**

P1 Welcome

Welcome to our survey!

We are interested in your opinions. If you qualify and complete this survey, you will receive ZoomPoints and an email from ZoomRewards confirming your point award with instructions on how to access your ZoomPoints account.

Please answer each question on your screen prior to proceeding to the next screen. If you experience any difficulty while taking this survey, please contact us at Survey Support.

Let's get started! Just click on the "CONTINUE" button to begin.

Create a weekly punch, to record which week the data is from

Please update with most current list in Q.5

Q5 Device [M]

Which best describes the device you are using right now to access the Internet?

- ○ A traditional desktop computer
- ○ A laptop/notebook computer
- ○ A tablet computer (e.g. Apple iPad, Galaxy Tab, Blackberry Playbook)
- ○ An e-reader device (e.g. Kindle, Nook, Sony Reader)
- ○ A TV-based browser or video game console (e.g. WebTV, Google TV, Microsoft X-Box, Nintendo Wii)
- ○ A large screen Smartphone (e.g. Apple iPhone, HTC Evo, Motorola Droid, Samsung Galaxy)
- ○ A small screen (<3") mobile phone
- ○ Other

SCREEN OUT IF ANYTHING BUT TRADITIONAL DESKTOP, LAPTOP OR TABLET

Q1 Age [M]

Please click on the category that includes your age.

- ○ 17 or younger [Screen Out]
- ○ 18-24
- ○ 25-34
- ○ 35-44
- ○ 45-54
- ○ 55-64
- ○ 65-70
- ○ Over 70

Q2 Gender [M]

Are you:

- ○ Male
- ○ Female

Create Dynamic Age/Gender Quotas as follows:

Males (Q.2 = 1) By Age:

18 – 24 (Q.1 = 2):	N =65
25 – 44 (Q.1 = 3,4):	N = 200
45 – 64 (Q.1 = 5,6):	N = 150
65+ (Q.1 = 7,8):	N = 85

Females (Q.2 = 2) By Age:

18 – 24 (Q.1 =2):	N = 65
25 – 44 (Q.1 = 3,4):	N = 200
45 – 64 (Q.1 = 5,6):	N = 150
65+ (Q.1 = 7,8):	N = 85

Q21 State [M]

In which state do you currently live?

○ AK	○ ID	○ MT	○ RI
○ AL	○ IL	○ NC	○ SC
○ AR	○ IN	○ ND	○ SD
○ AZ	○ KS	○ NE	○ TN
○ CA	○ KY	○ NH	○ TX
○ CO	○ LA	○ NJ	○ UT
○ CT	○ MA	○ NM	○ VA
○ DC	○ MD	○ NV	○ VT
○ DE	○ ME	○ NY	○ WA
○ FL	○ MI	○ OH	○ WI
○ GA	○ MN	○ OK	○ WV
○ HI	○ MO	○ OR	○ WY
○ IA	○ MS	○ PA	○ Outside the US

IF Q.21 = OUTSIDE THE US, SCREENOUT

Q3Ethnicity1

Which one of the following best describes you? (Select one.)

- ○ White/Caucasian
- ○ Black/African American
- ○ Asian
- ○ Pacific Islander
- ○ Native American
- ○ Other
- ○ Prefer not to answer

Q4 Ethnic2 [M]

Are you Spanish / Hispanic / Latino?

- ○ Yes
- ○ No
- ○ Prefer not to answer

Create Ethnicity2 Dynamic Quota Variable as follows:

Black/African American: Q.3 = Punch 2 [Black/African/American] **[Quota =** 130**]**
Spanish/Hispanic/Latino: Q.4 = Punch 1 [Yes] **[Quota=**140**]**
Non-Spanish/Hispanic/African American; punch if Q.3 not equal to punch 2 AND if Q.4 = No or Prefer not to answer
[Quota=730 **scripted quota**

Q7 Grocery Shopping Past 30 Days

Where have you **personally shopped for food** in the **past 30 days**? (Select all that apply)

Randomize all but none

- ❑ Grocery store
- ❑ Warehouse club store (Costco, Sam's Club, etc)
- ❑ Internet grocery store (Peapod, Fresh Direct, etc)
- ❑ Mass merchandiser (Wal-Mart, Target, etc)
- ❑ Convenience Store (Gas station, 7-11, Quik Check, etc.)
- ❑ Farmer's market / Produce stand (including free-standing carts)
- ❑ None of the above **[Exclusive] [Screenout]**

Q8 Products Purchased at store

When **grocery** shopping, which of the following products do you **typically purchase**? (Select all that apply)

Randomize first 12 choices

- ❑ Breads/Cereals/Grains/Pasta
- ❑ Cleaning products
- ❑ Whole or sliced fresh fruits
- ❑ Health and beauty products
- ❑ Beef or Pork
- ❑ Pet food or supplies
- ❑ Poultry or Fish
- ❑ Candy
- ❑ Salty Snacks
- ❑ Whole or sliced fresh vegetables
- ❑ Dairy
- ❑ Beverages
- ❑ None of the above **[Exclusive] [Screenout]**
- ❑ I never go grocery shopping **[Exclusive] [Screenout]**

Q13 Dollars spent on foods

In a **typical week**, about how much money do you spend on groceries? *Please include all of the food and non-food items you buy in grocery stores (including internet), convenience stores, warehouse or mass merchandise and produce stands*. DO NOT INCLUDE restaurant or take out purchases or large, non-recurring items you don't purchase regularly.

Weekly grocery spending $ _____ [0-750]

Screen out of Q13 equals $0

Q13a Dollars spent on specifics

Considering the [pipe in $ amount from Q13] you spend on a weekly basis, how much money do you spend on each of the following?

Randomize all except other (Other will be a hard prompt, not piped)

Pipe in from Q8 if selected

Breads/Cereals/Grains/Pasta	_____$0-750
Cleaning products	_____$0-750
Whole or sliced fresh fruits	_____$0-750
Health and beauty products	_____$0-750
Beef or Pork	_____$0-750
Pet food or supplies	_____$0-750
Poultry or Fish	_____$0-750

Candy	_____$0-750
Salty Snacks	_____$0-750
Whole or sliced fresh vegetables	_____$0-750
Dairy	_____$0-750
Beverages	_____$0-750
Other	_____$0-750

Validate and show total to consumer – must equal amount in Q13 – we don't show a running total here – even in the error.

MAIN QUESTIONNAIRE – From Tracker

Q1a Grocery Shopping Past 2 Weeks

Which of the following have you, personally purchased in a store, farmer's market, from a street vendor or at a restaurant between **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**? Select all that apply.

RandomizMondaye all but none

- ❑ Whole or sliced fresh fruits
- ❑ Whole or sliced fresh vegetables
- ❑ Breads/Cereals/Grains/Pasta
- ❑ Beef or Pork
- ❑ Dairy
- ❑ Poultry or Fish
- ❑ Candy
- ❑ Salty snacks
- ❑ Beverages
- ❑ None of the above **[EXCLUSIVE]**

Q1b Fruit Purchased Past 6 Months

Excluding the period between **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**, which of the following fresh fruits or vegetables have you purchased **in the past six months**? Select one in each row.

	Yes, purchased in past six months	No, did not purchase in past six months
Apples	❑	❑
Artichokes	❑	❑
Avocados	❑	❑
Bananas	❑	❑
Cantaloupes	❑	❑
Cucumbers	❑	❑
Grapefruits	❑	❑
Honeydews	❑	❑
Kiwis	❑	❑
Mangos	❑	❑
Oranges	❑	❑
Papayas	❑	❑
Pears	❑	❑
Peppers (green/red/orange/yellow)	❑	❑
Pineapples	❑	❑
Pomegranates	❑	❑
Watermelons	❑	❑

If none of the above is selected in Q1a, auto-punch I did not buy this fresh fruit/vegetable for all rows in Q2.
If neither fruits nor vegetables is selected in Q1a, auto-punch I did not buy this fresh fruit/vegetable for all rows in Q2.

Bananas	❑	❑
Cantaloupes	❑	❑
Cucumbers	❑	❑
Grapefruits	❑	❑
Honeydews	❑	❑
Kiwis	❑	❑
Mangos	❑	❑
Oranges	❑	❑
Papayas	❑	❑
Pears	❑	❑
Peppers (green/red/orange/yellow)	❑	❑
Pineapples	❑	❑
Pomegranates	❑	❑
Watermelons	❑	❑

Q3 Where Purchase Fruit/Vegetable

Where did you purchase the whole and/or cut/sliced/peeled [pipe in fruit/vegetable name] you bought **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**? (Select all that apply.)

Randomize first 8 5

- ❑ Grocery store
- ❑ Warehouse club store (Costco, Sam's Club, etc.)
- ❑ Farmers' Market/ Produce Stand (including free-standing carts)
- ❑ Convenience Store (Gas station, 7-11, Quik Check, etc.)
- ❑ Mass Merchandisers (Target, Wal-Mart)
- ❑ Other, please specify

IF BOUGHT FRUIT SLICED/PEELED BY ITSELF, and NOT WHOLE OR WHOLE BUT PREPACKAGED, SKIP TO Q5.
SHOW Q4a and Q4b and Q4c on the same page

Q4a Number purchased whole

In total, how many **whole** [pipe in fruit/vegetable name] did you buy in the last two weeks? If you are not sure, please give your best estimate.

Programmer: allow 1 to 50

Q4b Lbs purchased whole

In total, how many pounds of **whole** [pipe in fruit/vegetable name] did you buy in the last two weeks?

Programmer: allow in increments of .25. Range of .25 to 20

↕	Lbs

Q4c Amount Spent Whole

In total, how much did you pay for the **whole** [pipe in fruit/vegetable name] you bought in the last two weeks? Please enter dollars and cents.

Programmer: allow $0.01-$100.00

IF DID NOT BUY FRUIT SLICED/PEELED BY ITSELF, SKIP TO Q6.
SHOW Q5a and Q5b on the same page

Q5a Lbs purchased prepared

In total, how many pounds **cut/sliced/peeled** [pipe in fruit/vegetable name] (not part of a platter) did you buy in the last two weeks? If you are not sure, please give your best estimate.

Programmer: allow in increments of .25. Range of .25 to 20

↕	Lbs

Q5b Amount Spent Prepared

In total, how much did you pay for the **cut/sliced/peeled** [pipe in fruit/vegetable name] (not part of a platter) you bought in the last two weeks? Please enter dollars and cents.

Programmer: allow $0.01-$100.00

Q6 Who Purchased For

Who in the household ate the whole and/or cut/sliced/peeled [pipe in fruit/vegetable name]? (Select all that apply)

- ❑ You, yourself
- ❑ Spouse
- ❑ Other adult in household
- ❑ Teen in household, 13-17
- ❑ Child in household, 6-12
- ❑ Child in household 5 or younger
- ❑ Someone outside the household
- ❑ No one ate them yet **[EXCLUSIVE]**

IF FRUIT/VEGETABLE IS NOT MANGOS, PINEAPPLES, PAPAYAS, ORANGES OR AVOCADOS SKIP TO Q9.

Q7 Varieties

What varieties of whole and/or cut/sliced/peeled [pipe in fruit/vegetable name] did you purchase? (Select all that apply)

Randomize first 7

- ❑ [PIPE IN IF MANGOS] Haden
- ❑ [PIPE IN IF MANGOS] Kent
- ❑ [PIPE IN IF MANGOS] Tommy Atkins
- ❑ [PIPE IN IF MANGOS] Kiett
- ❑ [PIPE IN IF MANGOS] Francine
- ❑ [PIPE IN IF MANGOS] Ataulfo
- ❑ [PIPE IN IF PINEAPPLES] Smooth Cayenne
- ❑ [PIPE IN IF PINEAPPLES] Cayenne
- ❑ [PIPE IN IF PINEAPPLES] Queen
- ❑ [PIPE IN IF PINEAPPLES] Golden
- ❑ [PIPE IN IF PINEAPPLES] Red Spanish
- ❑ [PIPE IN IF PAPAYAS] Pink Formosa
- ❑ [PIPE IN IF PAPAYAS] Red Formosa
- ❑ [PIPE IN IF PAPAYAS] Red Sunshine
- ❑ [PIPE IN IF PAPAYAS] Solo
- ❑ [PIPE IN IF ORANGES] Pera
- ❑ [PIPE IN IF ORANGES] Valencia
- ❑ [PIPE IN IF ORANGES] Navel
- ❑ [PIPE IN IF AVOCADOS] Hass
- ❑ [PIPE IN IF AVOCADOS] Fuerte
- ❑ [PIPE IN IF AVOCADOS] Gwen
- ❑ [PIPE IN IF AVOCADOS] Pinkerton
- ❑ [PIPE IN IF AVOCADOS] Reed
- ❑ [PIPE IN IF AVOCADOS] Zutano

- ❑ Other
- ❑ I'm not sure **[Exclusive]**

Q8 Country of Origin

What was the country of origin of the whole and/or cut/sliced/peeled [pipe in fruit/vegetable name] you purchased in the past two weeks? (Select all that apply)

Randomize all but other and not sure.

- ❑ [PIPE IN IF MANGOS, PAPAYA, ORANGES, PINEAPPLES] Brazil
- ❑ [PIPE IN IF MANGOS] Ecuador
- ❑ [PIPE IN IF MANGOS] Peru
- ❑ [PIPE IN IF MANGOS, PAPAYA, ORANGES, AVOCADOS] Mexico
- ❑ [PIPE IN IF MANGOS] Guatemala
- ❑ [PIPE IN IF MANGOS] Haiti
- ❑ [PIPE IN IF PINEAPPLES, PAPAYA] Hawaii
- ❑ [PIPE IN IF PINEAPPLES] Thailand
- ❑ [PIPE IN IF PINEAPPLES] The Philippines
- ❑ [PIPE IN IF PINEAPPLES] Paraguay
- ❑ [PIPE IN IF PAPAYAS] Vietnam
- ❑ [PIPE IN IF PAPAYAS, AVOCADOS] Indonesia
- ❑ [PIPE IN IF ORANGES, AVOCADOS] USA
- ❑ [PIPE IN IF, AVOCADOS] Chile
- ❑ [PIPE IN IF, AVOCADOS] Dominican Republic
- ❑ [PIPE IN IF ORANGES] Israel
- ❑ Other
- ❑ I'm not sure **[Exclusive]**

Q9 Factors in Selection

When choosing whole and/or cut/sliced/peeled [pipe in fruit/vegetable name] in the past two weeks, what factors went into your decision? Please select the three most important factors. Please check the box under "first choice" to indicate the factor that most influenced your choice; the box under "second choice" to indicate the factor that was second most important in your choice and the box under "third choice" to indicate the factor that was third most important to your choice.

Randomize all but other	**First Choice**	**Second Choice**	**Third Choice**
Price	❍	❍	❍
Color	❍	❍	❍
Size	❍	❍	❍
Organic	❍	❍	❍
Where it was grown	❍	❍	❍
Store specials	❍	❍	❍
TV/Radio/newspaper advertising	❍	❍	❍
Freshness	❍	❍	❍
Packaging	❍	❍	❍
Quality	❍	❍	❍
Ripeness (firmness)	❍	❍	❍

Aroma	❍	❍	❍
Appearance	❍	❍	❍
Other	❍	❍	❍

Q10 How Used

How have you used the whole and/or cut/sliced/peeled [pipe in fruit/vegetable name] you bought in the past two weeks? (Select all that apply)

Randomize all but other and have not used them yet

- ❑ Ate as a snack
- ❑ Ate plain
- ❑ Pureed/added to a smoothie
- ❑ Used in a recipe
- ❑ Used in a salad
- ❑ Ate with cereal
- ❑ Squeezed into a juice
- ❑ Used it as a dessert
- ❑ Other
- ❑ Have not used them yet **[Exclusive]**

END OF SECTION

ASK Q15 ONLY FOR ORANGES AND MANGOS, IF NOT PURCHASED WHOLE, PREPACKAGED, SLICED/PEELED ALONE (FIRST THREE COLUMNS) IN Q2. ASK EVERYONE WHO QUALIFIES; ELSE SKIP TO Q17A

Create two sections containing Q15 and Q16, one for Mangos and one for Oranges

Q15 Why Not Purchase Fruit All

Why didn't you purchase fresh [pipe in fruit/vegetable name], either sliced or whole, in the past two weeks? (Select all that apply)

Randomize all but other

- ❑ Too expensive
- ❑ Not on sale
- ❑ Not the right color
- ❑ Not the right size
- ❑ Did not like where it was grown
- ❑ Did not like the packaging
- ❑ No one in my household likes the taste
- ❑ Just didn't think of it
- ❑ Not available
- ❑ Not in season
- ❑ Not familiar with this fruit/vegetable
- ❑ Hard to select /pick ripe ones
- ❑ Already have some at home
- ❑ Didn't feel like eating them recently
- ❑ Not good for my diet
- ❑ I don't like cutting, cleaning and peeling them
- ❑ I don't know how to eat or prepare them
- ❑ They don't look appealing
- ❑ They are difficult to slice
- ❑ Other, please specify

IF Q15 only one is selected, Autopunch and SKIP TO Q17A.

Q16 Why Not Purchase Fruit Main

What is the **main reason** you did not purchase fresh [pipe in fruit/vegetable name], either sliced or whole, in the past two weeks? (Select one.)

Randomize all but other

○ [PIPE IN ALL RESPONSES FROM PRIOR QUESTION]

Q17a. Ad awareness

During the past two weeks between **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**, do you recall hearing or seeing any mention of a promotion, or advertisement for each of the types of fruits below from any sources? (Select one per row.)

	Yes	No
Apples	☐	☐
Artichokes	☐	☐
Avocados	☐	☐
Bananas	☐	☐
Cantaloupes	☐	☐
Cucumbers	☐	☐
Grapefruits	☐	☐
Honeydews	☐	☐
Kiwis	☐	☐
Mangos	☐	☐
Oranges	☐	☐
Papayas	☐	☐
Pears	☐	☐
Peppers (green/red/orange/yellow)	☐	☐
Pineapples	☐	☐
Pomegranates	☐	☐
Watermelons	☐	☐

IF "NO" TO ALL FRUITS, SKIP TO Q17C

Q17b. Source of awareness

From which of the sources below did you recall hearing or seeing any mention of a promotion, or advertisement for each of the types of fruits during the past 2 weeks between **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**? (Select all that apply per row.)

PIPE IN FRUITS WITH "YES" IN Q17A AS ROWS

	In-store promotions	Internet	Social Media	Magazines	Newspapers	TV	Restaurant Menus	Others
Apples	☐	☐	☐	☐	☐	☐	☐	☐
Artichokes	☐	☐	☐	☐	☐	☐	☐	☐
Avocados	☐	☐	☐	☐	☐	☐	☐	☐
Bananas	☐	☐	☐	☐	☐	☐	☐	☐
Cantaloupes	☐	☐	☐	☐	☐	☐	☐	☐
Cucumbers	☐	☐	☐	☐	☐	☐	☐	☐
Grapefruits	☐	☐	☐	☐	☐	☐	☐	☐
Honeydews	☐	☐	☐	☐	☐	☐	☐	☐
Kiwis	☐	☐	☐	☐	☐	☐	☐	☐
Mangos	☐	☐	☐	☐	☐	☐	☐	☐
Oranges	☐	☐	☐	☐	☐	☐	☐	☐

Papayas	❑	❑	❑	❑	❑	❑	❑	❑
Pears	❑	❑	❑	❑	❑	❑	❑	❑
Peppers (green/red/orange/yellow)	❑	❑	❑	❑	❑	❑	❑	❑
Pineapples	❑	❑	❑	❑	❑	❑	❑	❑
Pomegranates	❑	❑	❑	❑	❑	❑	❑	❑
Watermelons	❑	❑	❑	❑	❑	❑	❑	❑

Q17b2. Social media

ASK IF RESPONDENT SELECTS "SOCIAL MEDIA" FOR MANGOS

You mentioned seeing advertising for mangos on social media. What platform was that? (Select all that apply)

- ❑ Facebook
- ❑ Instagram
- ❑ Twitter
- ❑ YouTube
- ❑ Pinterest
- ❑ Some other social media channel
- ❑ Can't remember [EXCLUSIVE]

Q17b1. You selected 'Other' as the source where you recalled hearing or seeing any mention of promotion or advertisement for the following fruit/s. Which specific source is this? Please specify the source on the box provided for each fruit.

PROGRAMMER NOTE: PIPE IN THE FRUITS WITH THE 'OTHER' OPTION SELECTED IN Q17B. PROGRAM ONE BOX FOR EACH FRUIT AND WRITE THE FRUIT NAME ON TOP OF THE BOX.

Q17c Frequency eating fruits –out of home

During the past two weeks between **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**, have you eaten food or had a beverage at a restaurant or any other eating establishment that had any of the fruits listed below as an ingredient or menu item?

	Yes	No
Apples	❑	❑
Artichokes	❑	❑
Avocados	❑	❑
Bananas	❑	❑
Cantaloupes	❑	❑
Cucumbers	❑	❑
Grapefruits	❑	❑
Honeydews	❑	❑
Kiwis	❑	❑
Mangos	❑	❑
Oranges	❑	❑
Papayas	❑	❑
Pears	❑	❑
Peppers (green/red/orange/yellow)	❑	❑
Pineapples	❑	❑
Pomegranates	❑	❑
Watermelons	❑	❑

IF "NONE" FOR ALL FRUITS, SKIP TO Q17E. OTHERWISE, CONTINUE.

Q17d Type of dish

During the past two weeks between **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**, which type of dishes did you order at a restaurant or other eating establishment that included the fruits listed below as an ingredient or menu item? (Select all that apply per row.)

PIPE IN FRUITS THAT ARE NOT "NONE" IN Q17C AS ROWS

	Appetizer	Salsa	Salad	Entree	Sandwich	Dessert	Beverage	Don't Know/Don't recall
Apples	❑	❑	❑	❑	❑	❑	❑	❑
Artichokes	❑	❑	❑	❑	❑	❑	❑	❑
Avocados	❑	❑	❑	❑	❑	❑	❑	❑
Bananas	❑	❑	❑	❑	❑	❑	❑	❑
Cantaloupes	❑	❑	❑	❑	❑	❑	❑	❑
Cucumbers	❑	❑	❑	❑	❑	❑	❑	❑
Grapefruits	❑	❑	❑	❑	❑	❑	❑	❑
Honeydews	❑	❑	❑	❑	❑	❑	❑	❑
Kiwis	❑	❑	❑	❑	❑	❑	❑	❑
Mangos	❑	❑	❑	❑	❑	❑	❑	❑
Oranges	❑	❑	❑	❑	❑	❑	❑	❑
Papayas	❑	❑	❑	❑	❑	❑	❑	❑
Pears	❑	❑	❑	❑	❑	❑	❑	❑
Peppers (green/red/orange/yellow)	❑	❑	❑	❑	❑	❑	❑	❑
Pineapples	❑	❑	❑	❑	❑	❑	❑	❑
Pomegranates	❑	❑	❑	❑	❑	❑	❑	❑

Q17c Frequency eating fruits –out of home

During the past two weeks between **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**, have you eaten food or had a beverage at a restaurant or any other eating establishment that had any of the fruits listed below as an ingredient or menu item?

	Yes	No
Apples	❑	❑
Artichokes	❑	❑
Avocados	❑	❑
Bananas	❑	❑
Cantaloupes	❑	❑
Cucumbers	❑	❑
Grapefruits	❑	❑
Honeydews	❑	❑
Kiwis	❑	❑
Mangos	❑	❑
Oranges	❑	❑
Papayas	❑	❑
Pears	❑	❑
Peppers (green/red/orange/yellow)	❑	❑
Pineapples	❑	❑
Pomegranates	❑	❑
Watermelons	❑	❑

IF "NONE" FOR ALL FRUITS, SKIP TO Q17E. OTHERWISE, CONTINUE.

Q17d Type of dish

During the past two weeks between **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**, which type of dishes did you order at a restaurant or other eating establishment that included the fruits listed below as an ingredient or menu item? (Select all that apply per row.)

PIPE IN FRUITS THAT ARE NOT "NONE" IN Q17C AS ROWS

	Appetizer	Salsa	Salad	Entree	Sandwich	Dessert	Beverage	Don't Know/Don't recall
Apples	❑	❑	❑	❑	❑	❑	❑	❑
Artichokes	❑	❑	❑	❑	❑	❑	❑	❑
Avocados	❑	❑	❑	❑	❑	❑	❑	❑
Bananas	❑	❑	❑	❑	❑	❑	❑	❑
Cantaloupes	❑	❑	❑	❑	❑	❑	❑	❑
Cucumbers	❑	❑	❑	❑	❑	❑	❑	❑
Grapefruits	❑	❑	❑	❑	❑	❑	❑	❑
Honeydews	❑	❑	❑	❑	❑	❑	❑	❑
Kiwis	❑	❑	❑	❑	❑	❑	❑	❑
Mangos	❑	❑	❑	❑	❑	❑	❑	❑
Oranges	❑	❑	❑	❑	❑	❑	❑	❑
Papayas	❑	❑	❑	❑	❑	❑	❑	❑
Pears	❑	❑	❑	❑	❑	❑	❑	❑
Peppers (green/red/orange/yellow)	❑	❑	❑	❑	❑	❑	❑	❑
Pineapples	❑	❑	❑	❑	❑	❑	❑	❑
Pomegranates	❑	❑	❑	❑	❑	❑	❑	❑

Watermelons	❑	❑	❑	❑	❑	❑	❑	❑

Q17e Website visited

During the last two weeks between **[Friday, April 16th, 2021 and Friday, April 30th, 2021]**, have you visited any website for an organization that promotes any of the following fruits? (Select one for each row.)

	Yes	No
Apples	❑	❑
Artichokes	❑	❑
Avocados	❑	❑
Bananas	❑	❑
Cantaloupes	❑	❑
Cucumbers	❑	❑
Grapefruits	❑	❑
Honeydews	❑	❑
Kiwis	❑	❑
Mangos	❑	❑
Oranges	❑	❑
Papayas	❑	❑
Pears	❑	❑
Peppers (green/red/orange/yellow)	❑	❑
Pineapples	❑	❑
Pomegranates	❑	❑
Watermelons	❑	❑

IF "NO" TO ALL FRUITS, SKIP TO Q15

Q17f Download materials

Did you download any consumer related materials from the website that promotes… (Select one for each row.)

PIPE IN ALL FRUITS THAT ARE "YES" IN Q17E AS ROWS

	Yes	No
Apples	❑	❑
Artichokes	❑	❑
Avocados	❑	❑
Bananas	❑	❑
Cantaloupes	❑	❑
Cucumbers	❑	❑
Grapefruits	❑	❑
Honeydews	❑	❑
Kiwis	❑	❑
Mangos	❑	❑
Oranges	❑	❑
Papayas	❑	❑
Pears	❑	❑
Peppers (green/red/orange/yellow)	❑	❑
Pineapples	❑	❑
Pomegranates	❑	❑
Watermelons	❑	❑

THE FOLLOWING QUESTIONS ARE FROM REPLENISHMENT QUESTIONNAIRE

Q15 Agreement with statement

Please tell us how much you agree or disagree with the following statements. Use the scale below, where a 5 means you **Completely Agree** with a statement and 1 means you **Completely Disagree** with a statement.

Validate one per row

Randomize all	Completely agree (5)	(4)	(3)	(2)	Completely disagree (1)
I try to count the number of calories I eat each day	❍	❍	❍	❍	❍
I seek out organic foods	❍	❍	❍	❍	❍
I eat fresh foods much more frequently than packaged foods	❍	❍	❍	❍	❍
I read ingredients on labels of the foods I buy	❍	❍	❍	❍	❍
I prefer to buy my produce from certain stores/outlets	❍	❍	❍	❍	❍
I go out of my way to get certain types of produce	❍	❍	❍	❍	❍
I eat fruits and vegetables more than other people my age	❍	❍	❍	❍	❍
I feel that I am healthier than my peers	❍	❍	❍	❍	❍
I exercise at least 3 times a week	❍	❍	❍	❍	❍
I frequently experiment with new foods	❍	❍	❍	❍	❍

There are additional questions in the survey that were not used in this evaluation so are not included in the questionnaire presented above. Likewise, a few questions were deleted and others added over the years. The main purpose for including this portion of the NMB questionnaire is to allow reviewers of the NMB evaluation to see the overall source of the database funded by the NMB.

Appendix B.1: Market Penetration (Probit) Model estimates over time.

Probit	Ending Dec. 2020	Dec. 2020	Ending Dec. 2019	Dec. 2019	Ending Dec. 2018	Dec. 2018	Ending Dec. 2017	Dec. 2017	Ending Dec. 2016	Dec. 2016	Ending Dec. 2015	Dec. 2015
Models	Per=167	Per=167	Per=155	Per=155	Per=143	Per=143	Per=131	Per=131	Per=119	Per=119	Per=107	Per=107
Mkt Pene	Coef.	t-Values	Coef.	t-Values	Coef.	t-Values	Coef.	t-Values	Coef.	t-Values	Coef.	t-Values
C	-1.7213	-12.2650	-1.8676	-13.5407	-2.0623	-13.3547	-2.1726	-12.6725	-2.2275	-11.3934	-1.9599	-8.7592
ZINC2	-0.0275	-1.3078	-0.0190	-0.6910	0.0211	0.6992	0.0257	0.7704	0.0527	1.3672	0.0115	0.2580
ZINC3	0.1007	2.7683	0.0866	2.7110	0.1113	3.1600	0.1070	2.7218	0.1131	2.4582	0.0529	0.9745
ZINC4	0.0992	2.4503	0.1011	3.1287	0.1375	3.8577	0.1775	4.5394	0.2205	4.9215	0.1721	3.2955
ZINC5	-0.0809	-1.0781	-0.0446	-0.7219	-0.0157	-0.2318	-0.0866	-1.1614	-0.0444	-0.5303	-0.0190	-0.2105
ZEDU2	-0.0285	-1.0009	0.0094	0.3251	0.0426	1.3031	0.0652	1.7973	0.0929	2.2016	0.1039	2.1346
ZEDU3	0.1303	3.6757	0.1643	4.3209	0.1764	4.1543	0.1979	4.2027	0.2084	3.7880	0.2281	3.5460
ZEDU4	0.0065	0.4688	0.0820	0.6040	0.0687	0.4605	-0.0300	-0.1763	-0.0586	-0.2945	-0.1473	-0.6481
ZRACE1	-0.2206	-4.7107	-0.2360	-5.0385	-0.2085	-4.0705	-0.1981	-3.4636	-0.1079	-1.6095	-0.1511	-1.9972
ZRACE2	-0.0124	-0.3638	-0.0409	-0.7669	-0.0128	-0.2196	-0.0209	-0.3229	0.0177	0.2341	0.0226	0.2631
ZRACE3	-0.0154	-0.4025	-0.0219	-0.4183	0.0160	0.2792	0.0084	0.1321	0.1123	1.5270	0.1518	1.8329
ZRACE4	0.1878	3.1867	0.1299	2.1500	0.1780	2.6853	0.1819	2.4686	0.2574	2.9956	0.3208	3.2618
ZAGE2	-0.2249	-7.5659	-0.2228	-7.0118	-0.2455	-6.9920	-0.2553	-6.6168	-0.2822	-6.3479	-0.2994	-5.9305
ZAGE3	-0.5967	-15.4485	-0.5935	-14.8450	-0.5784	-13.1290	-0.5873	-11.8008	-0.5959	-10.3107	-0.6234	-9.3074
ZAGE4	-0.8804	-23.4144	-0.8980	-23.4977	-0.9075	-21.5171	-0.9042	-19.5731	-0.9274	-17.2080	-0.9132	-14.7608
ZCAL1	-0.1333	-2.9515	0.0323	0.9066	0.0390	0.9986	0.0401	0.9367	0.0587	1.1968	0.0479	0.8331
ZCAL2	-0.1082	-3.6429	0.0236	0.7518	0.0311	0.9067	0.0246	0.6524	0.0571	1.3080	0.0603	1.1764
ZCAL4	0.0575	2.1886	-0.0832	-2.5353	-0.0730	-2.0207	-0.0830	-2.0882	-0.0808	-1.7461	-0.0558	-1.0448
ZCAL5	0.0970	2.9683	-0.1084	-3.2617	-0.1060	-2.8729	-0.1427	-3.4506	-0.1537	-3.1403	-0.1486	-2.6092
ZMTH2	0.0372	-1.4150	0.0805	1.5015	0.0129	0.2179	-0.0167	-0.2521	-0.1926	-2.4647	-0.1650	-1.8056
ZMTH3	-0.0275	-0.8508	-0.0382	-0.7500	-0.0389	-0.7035	0.0475	0.7727	0.0159	0.2249	0.2179	2.6727
ZMTH4	0.0536	0.2694	0.1099	2.2242	0.0925	1.7065	0.1421	2.3409	0.0961	1.3802	0.2066	2.5697
ZMTH5	-0.0505	-1.8553	-0.0217	-0.4365	-0.0328	-0.6034	0.0141	0.2348	0.0868	1.2480	0.0839	1.0478
ZMTH6	0.0855	0.9965	0.0774	1.5932	0.1006	1.9036	0.0885	1.5226	0.1679	2.4760	0.1641	2.1039
ZMTH7	0.1441	-0.0245	0.1119	2.2505	0.1133	2.0848	0.1453	2.4004	0.1651	2.3480	0.3377	4.1235
ZMTH8	0.1766	1.6861	0.1827	3.6642	0.1216	2.2159	0.0954	1.5775	0.1145	1.6419	0.2368	2.9707
ZMTH9	0.0489	-0.6393	0.0780	1.5768	0.0476	0.8792	0.0208	0.3501	0.0749	1.0688	0.0950	1.1809
ZMTH10	0.0995	0.4050	0.1490	2.8884	0.0929	1.6263	0.0540	0.8489	0.0021	0.0281	0.0624	0.7247
ZMTH11	0.0942	1.1033	0.1342	2.6308	0.1600	2.8440	0.1054	1.7078	0.0597	0.8467	0.0866	1.0722
ZMTH12	0.0767	0.7551	0.0558	1.0993	-0.0192	-0.3444	0.0479	0.7708	-0.0080	-0.1126	-0.1305	-1.5680
HWD	0.2456	4.3820	0.3129	5.9203	0.3390	5.8379	0.3472	5.3996	0.3133	4.2380	0.2681	3.1383
ZEXPR1	-0.0061	-2.3333	0.1722	5.1591	0.1458	3.9382	0.1461	3.5578	0.1075	2.2453	0.0961	1.6880
ZEXPR2	-0.1027	-4.3709	0.0222	0.7821	-0.0182	-0.5837	-0.0262	-0.7537	-0.0690	-1.6821	-0.0671	-1.3834
ZEXPR4	0.0366	1.3834	-0.1052	-3.0192	-0.1302	-3.3970	-0.1022	-2.4119	-0.0820	-1.6818	-0.0448	-0.8107
ZEXPR5	0.1581	5.1619	0.0510	1.1036	0.0552	1.0990	0.0999	1.8276	0.1258	2.0763	0.1922	2.8889
ZEXER1	-0.1546	-4.8522	-0.2521	-7.7049	-0.2887	-7.9832	-0.2782	-6.9213	-0.2962	-6.2212	-0.2207	-3.9019
ZEXER2	-0.1495	-4.5008	-0.0623	-1.8889	-0.0821	-2.2628	-0.0719	-1.7842	-0.0835	-1.7841	-0.0252	-0.4551
ZEXER4	-0.0576	-1.6657	-0.1351	-3.4637	-0.1525	-3.5757	-0.1401	-2.9726	-0.0847	-1.5820	0.0039	0.0646
ZEXER5	-0.2215	-7.2901	-0.1944	-4.8174	-0.1960	-4.4516	-0.1688	-3.4971	-0.1401	-2.5626	-0.0896	-1.4554
ZHLTH1	0.0657	0.6219	0.2336	6.1297	0.2456	5.8179	0.2991	6.4424	0.3095	5.7088	0.3127	4.7962
ZHLTH2	-0.0180	-0.9064	0.1381	4.7991	0.1473	4.6494	0.1494	4.2333	0.1449	3.5009	0.1322	2.7099
ZHLTH4	0.1278	5.1791	0.0129	0.3573	0.0144	0.3623	0.0555	1.2707	0.1056	2.1232	0.1187	2.1372
ZHLTH5	0.2296	6.7353	0.1634	3.1716	0.2026	3.6065	0.2494	4.0468	0.2951	4.2572	0.3161	4.1157
ZFRVG1	0.2689	1.4572	0.1254	3.5338	0.1055	2.6813	0.1038	2.3834	0.1508	2.9348	0.0282	0.4565
ZFRVG2	0.1373	3.2626	0.0561	1.9317	0.0415	1.2940	0.0339	0.9459	0.0758	1.7902	0.0070	0.1405
ZFRVG4	0.0323	0.9483	0.1294	3.3353	0.1352	3.2014	0.1156	2.4781	0.1414	2.6811	0.1586	2.7181
ZFRVG5	0.0886	2.4341	0.2304	4.3018	0.2215	3.8115	0.2319	3.7190	0.2895	4.2269	0.2905	3.9088
ZLABELS1	0.1995	2.0186	-0.1234	-3.6900	-0.0951	-2.5705	-0.0805	-1.9511	-0.0435	-0.8998	-0.0331	-0.5809
ZLABELS2	0.1451	2.7287	-0.0741	-2.4364	-0.0755	-2.2472	-0.0403	-1.0742	-0.0316	-0.7126	-0.0651	-1.2446
ZLABELS4	-0.0910	-3.4781	0.1145	2.9175	0.1446	3.3822	0.1602	3.3990	0.1891	3.5270	0.2176	3.6377
ZLABELS5	-0.1878	-6.5228	0.1423	3.0344	0.1760	3.4693	0.2100	3.8314	0.2498	4.1228	0.2527	3.7689
ZORG1	-0.2048	-5.4009	0.2438	7.0340	0.2476	6.5228	0.2313	5.5715	0.2255	4.7259	0.2107	3.7621
ZORG2	-0.1225	-4.1281	0.1732	5.6005	0.1671	4.9115	0.1375	3.6491	0.1062	2.4235	0.0682	1.3147
ZORG4	0.2056	7.7460	-0.0778	-2.2984	-0.0492	-1.3270	-0.0728	-1.7692	-0.0183	-0.3842	0.0522	0.9613
ZORG5	0.3458	11.6504	-0.1319	-3.7728	-0.1268	-3.2855	-0.1130	-2.6404	-0.0438	-0.8788	-0.0029	-0.0516
ZHLTH_BP	-0.0501	-1.9078	-0.0754	-2.6380	-0.0798	-2.5198	-0.0573	-1.6321	-0.0351	-0.8628	-0.0236	-0.5015
ZHLTH_DB	0.1600	6.0011	0.1834	5.8973	0.1988	5.8014	0.2194	5.7788	0.2274	5.1947	0.2122	4.1491
ZHLTH_CL	0.0416	1.2642	0.0201	0.6924	0.0044	0.1385	0.0059	0.1650	0.0242	0.5829	0.0153	0.3168
ZHLTH_AG	0.1784	5.8056	0.1663	5.5515	0.1471	4.4396	0.1122	3.0545	0.1679	4.0001	0.1760	3.6532
ZHLTH_OB	0.0278	1.8808	0.0343	1.1481	0.0542	1.6383	0.0583	1.5899	0.0226	0.5309	0.0078	0.1592
ZHLTH_MB	0.1408	4.5623	0.1201	3.5278	0.1208	3.1957	0.0902	2.1452	0.0453	0.9230	0.0308	0.5459
ZHLTH_SI	0.1315	3.8258	0.1230	3.5775	0.1261	3.3079	0.1212	2.8768	0.1175	2.3978	0.0721	1.2677

Appendix B.1:continued

ZDIV2	0.1513	3.2133	0.2040	3.5780	0.2375	3.7687	0.2497	3.6050	0.1722	2.2559	0.0931	1.0745
ZDIV3	-0.1424	-1.7963	-0.0346	-0.5997	-0.0666	-1.0424	0.1125	1.5883	0.2276	2.8783	0.1670	1.8724
ZDIV4	-0.1395	-1.5607	-0.0192	-0.2809	-0.0310	-0.4107	0.1216	1.4413	0.1348	1.3782	0.0770	0.7033
ZDIV5	-0.0548	-0.7604	-0.0245	-0.4413	-0.0286	-0.4647	-0.0196	-0.2903	0.0108	0.1458	-0.0560	-0.6660
ZDIV6	-0.2598	-3.6518	-0.2171	-3.0911	-0.1957	-2.5179	-0.2053	-2.3831	-0.1685	-1.7590	-0.1347	-1.2489
ZDIV7	-0.1847	-2.9723	-0.1463	-2.3737	-0.1674	-2.4459	-0.1584	-2.1020	-0.1389	-1.6644	-0.1795	-1.8944
ZDIV8	-0.1593	-2.2405	-0.0615	-0.9379	-0.0801	-1.0950	0.0092	0.1133	0.0625	0.6814	0.1272	1.2039
ZDIV9	-0.0658	-0.9641	0.0341	0.5926	0.0685	1.0816	0.1505	2.1619	0.1496	1.9430	0.1664	1.8963
PRWHOLE1	-2.6363	-111.5820	-2.6992	-106.3500	-2.7301	-97.3601	-2.7870	-88.2876	-2.8982	-78.0255	-3.0502	-68.0912
HFOODEXP	0.0734	14.3875	0.0798	15.6004	0.0830	14.5373	0.0851	13.4054	0.0755	10.4311	0.0769	9.0371
DFRU1	1.5261	19.8355	1.4659	18.4259	1.5614	17.2341	1.5683	15.8512	1.6029	14.3900	1.4566	11.5454
DFRU2	1.6998	23.5989	1.6023	21.2923	1.6816	19.4318	1.6703	17.7554	1.7325	16.3008	1.6160	13.5386
DFRU3	1.9155	27.2857	1.8070	24.6742	1.8892	22.2945	1.8888	20.4488	1.8927	17.9975	1.7185	14.3809
DFRU4	2.8972	47.4432	2.7774	43.9320	2.8583	38.2286	2.8365	34.8160	2.8103	30.1345	2.6413	25.2505
WASAWARE	1.2430	34.2928	1.2652	34.3427	1.3210	32.4771	1.3205	29.9111	1.3827	27.5369	1.2974	22.1681
Obs.=	95933		83832		71722		59678		47499		35504	
Positive Obs.=	14744	15.37%	12051	14.38%	9886	13.78%	8186	13.72%	6170	12.99%	4466	12.58%
% Cor. Pred=	0.9677		0.9702		0.9714		0.9725		0.9756		0.9770	
Periods	2013:2-2020:12		2013:2-2019:12		2013:2-2018:12		2013:2-2017:12		2013:2-2016:12		2013:2-2015:12	

Appendix B.2: Market Intensity (Ordered Probit) Model estimates over time.

Ordered Probit Market Intensity	Ending Dec. 2020 Per=167 Coef.	Ending Dec. 2020 Per=167 t-Values	Ending Dec. 2019 Per=155 Coef.	Ending Dec. 2019 Per=155 t-Values	Ending Dec. 2018 Per=143 Coef.	Ending Dec. 2018 Per=143 t-Values	Ending Dec. 2017 Per=131 Coef.	Ending Dec. 2017 Per=131 t-Values	Ending Dec. 2016 Per=119 Coef.	Ending Dec. 2016 Per=119 t-Values	Ending Dec. 2015 Per=107 Coef.	Ending Dec. 2015 Per=107 t-Values
C	-10.81200	-38.43250	-11.99531	-31.18694	-11.9188	-28.8205	-11.9118	-27.0503	-12.1107	-23.5451	-11.3798	-19.4584
ZINC2	0.02478	1.01132	0.03868	1.42351	0.0418	1.3892	0.0623	1.8713	0.0966	2.5097	0.0419	0.9347
ZINC3	0.10971	3.98132	0.10743	3.49615	0.0975	2.8589	0.0821	2.1601	0.0943	2.1089	-0.0222	-0.4191
ZINC4	0.13883	4.94008	0.15192	4.85251	0.1562	4.5025	0.1752	4.6373	0.1660	3.8432	-0.0258	-0.5096
ZINC5	-0.11286	-1.83649	-0.03247	-0.49835	-0.0213	-0.2967	-0.0117	-0.1499	-0.0831	-0.9774	-0.1173	-1.3089
ZEDU2	-0.07527	-2.94752	-0.03719	-1.29335	-0.0212	-0.6579	0.0204	0.5683	0.0561	1.3658	0.0671	1.4285
ZEDU3	-0.02649	-0.80686	0.01330	0.36252	0.0034	0.0824	0.0634	1.3887	0.1301	2.4250	0.2030	3.1935
ZEDU4	-0.01965	-0.17348	-0.01410	-0.11585	0.0933	0.6809	0.1164	0.7534	0.1362	0.8080	0.1798	0.8728
ZRACE1	-0.11942	-3.23015	-0.16522	-4.04078	-0.1689	-3.7483	-0.1381	-2.7534	-0.1301	-2.2568	-0.2323	-3.5950
ZRACE2	0.03573	0.87979	0.03008	0.67166	0.0536	1.0892	0.0609	1.1098	0.0829	1.3212	0.0354	0.4997
ZRACE3	0.00006	0.00139	-0.05871	-1.28883	-0.0821	-1.6304	-0.0674	-1.2061	-0.0624	-0.9855	-0.0645	-0.9182
ZRACE4	0.18563	4.11715	0.12910	2.52738	0.1360	2.4065	0.1597	2.5445	0.1414	1.9521	0.1336	1.6341
ZAGE2	-0.02932	-1.16501	-0.02772	-0.98921	-0.0085	-0.2728	-0.0050	-0.1469	-0.0089	-0.2291	-0.0373	-0.8457
ZAGE3	-0.14527	-4.16116	-0.11648	-2.98276	-0.1046	-2.4173	-0.1036	-2.1011	-0.0431	-0.7555	-0.0284	-0.4324
ZAGE4	-0.23441	-7.06572	-0.21621	-5.85887	-0.2034	-4.9757	-0.1932	-4.3418	-0.1762	-3.3855	-0.1262	-2.1223
ZCAL1	-0.05160	-1.63541	0.03600	1.07817	0.0257	0.6967	0.0329	0.8139	0.0164	0.3497	-0.0207	-0.3693
ZCAL2	-0.04087	-1.33452	0.01353	0.44320	0.0138	0.4097	0.0185	0.4972	0.0090	0.2060	-0.0018	-0.0339
ZCAL4	0.03370	1.22825	-0.05844	-1.73496	-0.0642	-1.7142	-0.0701	-1.6972	-0.0354	-0.7364	-0.0142	-0.2607
ZCAL5	0.05387	1.79589	-0.05575	-1.60668	-0.0787	-2.0415	-0.0562	-1.2926	-0.0180	-0.3518	-0.0167	-0.2826
HWD	0.79824	17.75530	0.84729	16.89899	0.8058	14.5014	0.7819	12.7226	0.7874	11.0884	0.7303	8.9459
ZMTH2	0.03750	0.77532	-0.01616	-0.29944	0.0090	0.1512	0.0463	0.6955	0.1049	1.3039	0.2198	2.3677
ZMTH3	0.15123	3.16523	0.12138	2.28705	0.1321	2.2528	0.1706	2.6092	0.2487	3.1559	0.2597	2.8095
ZMTH4	0.06687	1.44594	0.06596	1.29147	0.0596	1.0437	0.0711	1.1139	0.1591	2.0494	0.1933	2.1344
ZMTH5	0.12223	2.64360	0.09539	1.85546	0.1101	1.9222	0.1615	2.5368	0.2387	3.1070	0.2395	2.6451
ZMTH6	0.18247	4.04735	0.14229	2.83902	0.1695	3.0524	0.1990	3.2204	0.2584	3.4548	0.2374	2.6823
ZMTH7	0.16963	3.71487	0.13232	2.60540	0.1559	2.7671	0.1798	2.8571	0.2748	3.5988	0.2942	3.2675
ZMTH8	0.13264	2.87344	0.11626	2.26370	0.1205	2.0923	0.1333	2.0762	0.2104	2.7239	0.2421	2.6999
ZMTH9	0.15476	3.33425	0.14311	2.78065	0.1701	2.9612	0.2081	3.2648	0.2708	3.4803	0.2488	2.7198
ZMTH10	0.10729	2.23485	0.09776	1.81817	0.1023	1.6922	0.1323	1.9428	0.1991	2.4581	0.2303	2.3992
ZMTH11	0.10915	2.28479	0.10056	1.89411	0.1015	1.7050	0.0974	1.4538	0.1309	1.6353	0.1334	1.4230
ZMTH12	0.11362	2.41636	0.06191	1.18116	0.0534	0.9076	0.0665	1.0140	0.0862	1.0966	0.1105	1.1610
ZEXPR1	0.09880	1.89816	0.09470	2.87742	0.0650	1.7563	0.0218	0.5285	-0.0496	-1.0142	-0.0113	-0.1906
ZEXPR2	0.06438	1.81384	0.05336	1.84906	0.0421	1.3117	0.0157	0.4367	0.0051	0.1198	-0.0236	-0.4599
ZEXPR4	0.04220	1.65239	-0.01380	-0.36520	-0.0436	-1.0483	-0.0797	-1.7399	-0.0689	-1.3177	-0.0327	-0.5692
ZEXPR5	0.10388	3.60564	0.05723	1.09499	0.0363	0.6445	0.0160	0.2647	-0.0102	-0.1560	0.0099	0.1428
ZEXER1	0.01737	0.42590	0.02825	0.85293	0.0245	0.6648	0.0349	0.8495	0.0515	1.0565	0.1175	1.9757
ZEXER2	-0.04412	-1.15551	0.04738	1.46095	0.0024	0.0682	0.0306	0.7705	0.0131	0.2814	0.0268	0.4771
ZEXER4	0.04354	1.50175	-0.00168	-0.04100	0.0117	0.2596	0.0297	0.5970	0.0128	0.2279	0.0598	0.9571
ZEXER5	0.03145	1.08057	0.03842	0.88422	0.0182	0.3862	0.0457	0.8806	0.0535	0.9232	0.0764	1.1824
ZHLTH1	0.05472	1.04462	0.14826	4.12442	0.1893	4.6962	0.2353	5.2743	0.2435	4.6380	0.1933	2.9737
ZHLTH2	0.02068	0.56345	0.03796	1.29927	0.0710	2.1758	0.1037	2.8368	0.0788	1.8362	0.0850	1.6665
ZHLTH4	0.03741	1.45416	0.01935	0.50227	0.0042	0.0998	0.0360	0.7732	0.0678	1.2931	0.0881	1.5352
ZHLTH5	0.11960	3.79459	0.07128	1.31403	0.0926	1.5756	0.0936	1.4464	0.1265	1.7933	0.1875	2.4539
ZFRVG1	0.01337	0.22406	0.07437	2.13816	0.0542	1.3926	0.0615	1.4182	0.1108	2.1396	0.1275	2.0028
ZFRVG2	-0.05377	-1.33193	0.07503	2.49407	0.0590	1.7437	0.0596	1.5662	0.1150	2.5260	0.0849	1.5548
ZFRVG4	0.04820	1.82536	-0.08076	-1.93742	-0.0711	-1.5715	-0.0622	-1.2541	-0.0263	-0.4789	-0.0277	-0.4634
ZFRVG5	0.04790	1.57566	0.01977	0.34360	0.0517	0.8357	0.0578	0.8789	0.0569	0.8069	0.0877	1.1744
ZLABELS1	0.18266	3.47856	0.08615	2.58354	0.0776	2.0767	0.0844	2.0105	0.1215	2.4404	0.0625	1.0346
ZLABELS2	0.09156	2.31639	0.03245	1.04474	0.0161	0.4606	0.0413	1.0515	0.0448	0.9637	-0.0084	-0.1494
ZLABELS4	0.03698	1.35490	0.02664	0.64766	0.0312	0.6986	0.0453	0.9196	0.0337	0.6168	0.0128	0.2115
ZLABELS5	0.08983	3.06874	0.09492	1.83630	0.0962	1.7189	0.1121	1.8600	0.1191	1.8266	0.0833	1.1745
ZHLTH_BP	0.01753	0.65855	0.01311	0.43928	0.0121	0.3669	0.0021	0.0571	-0.0185	-0.4313	0.0368	0.7557
ZHLTH_DB	0.07511	2.63264	0.04979	1.55791	0.0760	2.1369	0.0869	2.1902	0.0691	1.5006	0.0198	0.3684
ZHLTH_CL	0.01390	0.50747	0.02787	0.90822	0.0090	0.2637	0.0025	0.0649	0.0179	0.4041	-0.0184	-0.3604
ZHLTH_AG	-0.02199	-0.80505	-0.00464	-0.15019	-0.0220	-0.6341	-0.0148	-0.3823	-0.0026	-0.0585	-0.0353	-0.6883
ZHLTH_OB	-0.05392	-1.88068	-0.03863	-1.20755	-0.0434	-1.2121	-0.0327	-0.8206	0.0050	0.1066	-0.0148	-0.2776
ZHLTH_MB	0.06394	1.96121	0.04382	1.20621	0.0425	1.0496	-0.0017	-0.0376	-0.0039	-0.0726	-0.0300	-0.4858
ZHLTH_SI	0.00334	0.10328	0.01393	0.38268	0.0466	1.1504	0.0719	1.5865	0.0740	1.4051	0.0316	0.5235
ZDIV2	0.04766	0.95307	0.00762	0.13669	0.0244	0.3853	0.0535	0.7494	0.0642	0.7936	0.0445	0.4700
ZDIV3	-0.05319	-1.03346	-0.05853	-1.02225	-0.0480	-0.7365	-0.0434	-0.5921	0.0143	0.1727	-0.0162	-0.1668
ZDIV4	-0.00476	-0.07576	-0.00851	-0.12169	-0.0248	-0.3120	-0.0133	-0.1502	-0.0517	-0.5008	-0.1014	-0.8643
ZDIV5	0.08231	1.68612	0.03422	0.62589	0.0443	0.7100	0.0365	0.5200	0.0665	0.8435	-0.0006	-0.0065
ZDIV6	0.07665	1.19128	0.04222	0.58573	0.0258	0.3194	0.0116	0.1292	0.0634	0.6323	0.0403	0.3504
ZDIV7	0.05573	1.05828	-0.01297	-0.21976	-0.0458	-0.6791	-0.0433	-0.5675	-0.0164	-0.1919	-0.0604	-0.6043
ZDIV8	0.00883	0.15519	-0.00146	-0.02314	0.0115	0.1590	0.0332	0.4066	0.0534	0.5651	0.0439	0.3971
ZDIV9	0.03654	0.73153	0.01930	0.34665	0.0194	0.3060	0.0344	0.4841	0.0471	0.5861	0.0226	0.2400

Appendix B.2: continued

WPRICE	-0.76520	-41.62930	-0.79155	-37.82707	-0.7832	-33.7422	-0.8381	-31.9826	-0.8552	-28.0391	-0.8892	-24.2841
ZPRICE	0.50990	35.59090	0.56885	28.74519	0.5648	26.6925	0.5566	24.7505	0.5488	20.8012	0.5238	17.4068
ZCOLOR	0.51714	33.38160	0.57776	27.70526	0.5756	25.6323	0.5592	23.3768	0.5467	19.5882	0.5199	16.2809
ZSIZE	0.53616	34.30830	0.58775	28.01863	0.5777	25.6359	0.5684	23.6604	0.5823	20.7148	0.5811	18.0285
ZORGANIC	0.52487	32.23790	0.57837	26.65897	0.5706	24.4499	0.5651	22.7825	0.5647	19.5586	0.5297	15.7955
ZCOOL	0.53366	28.52760	0.58650	24.55049	0.5824	22.5843	0.5805	21.0217	0.5839	18.3741	0.5313	14.3522
ZSTORE	0.49498	28.77470	0.53962	24.15915	0.5332	22.0335	0.5453	20.9187	0.5424	17.8957	0.5039	14.2856
ZADVER	0.51194	23.72920	0.57214	21.37527	0.5781	19.7497	0.5728	18.4321	0.5852	16.4541	0.5374	12.7675
ZFRESH	0.52507	37.16010	0.58747	29.99344	0.5866	27.9944	0.5755	25.8601	0.5876	22.5075	0.5762	19.4470
ZPACKG	0.51117	26.71420	0.55261	22.65137	0.5503	20.8842	0.5506	19.5536	0.5437	16.5226	0.5314	13.6927
ZRIPE	0.53565	37.78950	0.59966	30.48623	0.5929	28.1213	0.5797	25.8976	0.5774	22.1202	0.5656	19.1373
ZAROMA	0.52601	31.21860	0.59805	27.07230	0.5945	24.9634	0.5922	23.2352	0.5865	19.8151	0.5719	16.4960
ZAPPEAR	0.50674	34.66670	0.55898	27.89303	0.5672	26.3846	0.5566	24.3148	0.5673	21.1314	0.5635	18.3669
ZQUALITY	0.57538	40.25410	0.62740	31.74794	0.6197	29.2712	0.6039	26.8226	0.5996	22.6785	0.5682	18.7257
HFOODEXP	0.06097	15.72550	0.06296	14.31684	0.0634	12.8186	0.0662	12.0269	0.0656	10.3179	0.0673	8.8106
DFRU1	0.12384	0.90775	0.19316	1.30258	0.2198	1.3323	0.1035	0.5751	0.0211	0.1026	-0.1070	-0.4687
DFRU2	0.06551	0.50449	0.13836	0.97436	0.1653	1.0407	0.1691	0.9822	0.1747	0.8840	0.1571	0.7214
DFRU3	0.00834	0.06582	0.11227	0.80802	0.1584	1.0148	0.1224	0.7228	0.0940	0.4802	0.0700	0.3236
DFRU4	0.22480	1.88900	0.29293	2.23611	0.3100	2.1000	0.2824	1.7625	0.2541	1.3647	0.2228	1.0935
WASAWARE	0.36790	17.09740	0.35499	14.86654	0.35358	13.3866	0.35244	12.2093	0.37742	11.3591	0.31125	7.9930
IMILLS	0.36511	19.15650	0.38235	18.45164	0.3641	16.0938	0.4036	16.1955	0.3964	14.2056	0.3881	12.2873
MU2	0.68044	53.57220	0.69591	49.26361	0.6968	44.9144	0.6575	39.5990	0.6072	32.7628	0.6546	29.2761
MU3	1.27763	83.76690	1.29842	76.63173	1.2902	69.3309	1.2378	61.6051	1.1908	52.2283	1.2636	46.3530
MU4	1.56997	96.84180	1.59256	88.37203	1.5832	79.8950	1.5299	71.3366	1.4914	61.0134	1.5792	54.0108
MU5	1.88161	109.05800	1.90733	99.28267	1.8872	89.4043	1.8205	79.7828	1.7936	68.6844	1.9120	60.8244
MU6	2.11925	116.76500	2.13888	105.86762	2.1164	95.3125	2.0521	85.3608	2.0323	73.6764	2.1561	64.7542
MU7	2.34797	122.53100	2.36104	110.74718	2.3383	99.7513	2.2708	89.4913	2.2547	77.2892	2.3985	67.5671
MU8	2.38599	123.30500	2.39941	111.41969	2.3769	100.3696	2.3107	90.1031	2.2952	77.8227	2.4424	67.9389
MU9	2.48890	125.13300	2.50711	113.02176	2.4898	101.8957	2.4211	91.5618	2.4051	79.0805	2.5662	68.7556
MU10	2.51719	125.57000	2.53551	113.37562	2.5152	102.1825	2.4495	91.8823	2.4362	79.3868	2.6036	68.9349
MU12	2.75609	127.91000	2.77706	115.13537	2.7493	103.7681	2.6904	93.6032	2.6812	80.8453	2.8837	69.0299
MU13	2.87056	128.19700	2.89111	115.21338	2.8657	103.8651	2.8073	93.7915	2.7854	80.9498	2.9986	68.4538
Obs.	14744		12051		9886		8186		6170		4466	
Scaled RSq.	0.4508		0.4643		0.4674		0.4749		0.4772		0.4586	
Whole mangos												
0	19.97%		20.65%		21.37%		22.03%		22.80%		22.82%	
1	16.18%		16.65%		16.84%		15.94%		14.64%		15.97%	
2	18.39%		18.50%		18.20%		17.71%		17.70%		18.81%	
3	9.05%		8.99%		8.89%		8.87%		9.14%		9.61%	
4	8.91%		8.80%		8.43%		8.10%		8.43%		9.05%	
5	5.94%		5.63%		5.55%		5.67%		5.82%		5.62%	
6	4.88%		4.62%		4.61%		4.62%		4.65%		4.66%	
7	0.73%		0.71%		0.72%		0.76%		0.76%		0.74%	
8	1.85%		1.88%		1.96%		1.97%		1.94%		1.93%	
9	0.48%		0.46%		0.41%		0.48%		0.52%		0.54%	
10	0.00%		0.00%		0.00%		0.00%		0.00%		0.00%	
11	0.00%		0.00%		0.00%		0.00%		0.00%		0.00%	
12	0.00%		0.00%		0.00%		0.00%		0.00%		0.00%	
13	8.61%		8.27%		8.24%		8.86%		8.75%		5.84%	

Appendix B.3. Model Estimates using the National Mango Board expenditures instead of awareness.

	Probit Coef.	Probit t-value		Ordered Probit Coef.	Ordered Probit t-value
Intercept	-2.6063	-14.4255	Intercept	-11.2572	-36.3061
ZINC2	-0.0313	-1.2678	ZINC2	0.0201	0.8213
ZINC3	0.1096	3.8734	ZINC3	0.1201	4.3574
ZINC4	0.1142	3.9813	ZINC4	0.1414	5.0314
ZINC5	-0.0527	-0.9195	ZINC5	-0.1076	-1.7515
ZEDU2	-0.0116	-0.4527	ZEDU2	-0.0731	-2.8631
ZEDU3	0.1546	4.5890	ZEDU3	-0.0147	-0.4491
ZEDU4	0.1030	0.8409	ZEDU4	0.0095	0.0836
ZRACE1	-0.2356	-5.6140	ZRACE1	-0.1340	-3.6241
ZRACE2	0.0159	0.3344	ZRACE2	0.0398	0.9804
ZRACE3	-0.0027	-0.0569	ZRACE3	0.0087	0.2120
ZRACE4	0.1874	3.5250	ZRACE4	0.1771	3.9284
ZAGE2	-0.2475	-8.7868	ZAGE2	-0.0379	-1.5049
ZAGE3	-0.6724	-18.8201	ZAGE3	-0.1834	-5.2479
ZAGE4	-0.9362	-27.5137	ZAGE4	-0.2597	-7.8095
ZCAL1	-0.1411	-4.7274	ZCAL1	-0.0553	-1.7540
ZCAL2	-0.1058	-3.5841	ZCAL2	-0.0381	-1.2438
ZCAL4	0.0828	2.9617	ZCAL4	0.0528	1.9266
ZCAL5	0.1553	4.8671	ZCAL5	0.0886	2.9586
ZMTH1	-0.0200	-0.4189	HWD	0.8245	18.3397
ZMTH2	-0.0027	-0.0600	ZMTH2	0.0597	1.2185
ZMTH4	0.0289	0.6486	ZMTH3	0.1670	3.4885
ZMTH5	-0.0137	-0.3066	ZMTH4	0.0684	1.4774
ZMTH6	0.1340	3.0596	ZMTH5	0.1401	3.0052
ZMTH7	0.2653	5.7705	ZMTH6	0.2176	4.7607
ZMTH8	0.3446	7.1024	ZMTH7	0.2396	4.9675
ZMTH9	0.1721	3.7329	ZMTH8	0.2265	4.4605
ZMTH10	0.1604	3.4450	ZMTH9	0.2210	4.5352
ZMTH11	0.2196	4.5284	ZMTH10	0.1514	3.0929
ZMTH12	0.1280	2.8065	ZMTH11	0.1895	3.6840
HWD	0.2863	6.0448	ZMTH12	0.1520	3.1959
ZEXPR1	0.0009	0.0197	ZEXPR1	0.1008	1.9370
ZEXPR2	-0.0943	-2.9284	ZEXPR2	0.0623	1.7556
ZEXPR4	0.0537	2.1512	ZEXPR4	0.0498	1.9512
ZEXPR5	0.2122	7.2866	ZEXPR5	0.1220	4.2341
ZEXER1	-0.1467	-3.9171	ZEXER1	0.0103	0.2526
ZEXER2	-0.1396	-3.8750	ZEXER2	-0.0412	-1.0779
ZEXER4	-0.0307	-1.0459	ZEXER4	0.0518	1.7862
ZEXER5	-0.2256	-7.8346	ZEXER5	0.0247	0.8465
ZHLTH1	0.0646	1.3297	ZHLTH1	0.0511	0.9758
ZHLTH2	-0.0333	-0.9790	ZHLTH2	0.0090	0.2465
ZHLTH4	0.1390	5.4854	ZHLTH4	0.0466	1.8100
ZHLTH5	0.2579	7.7828	ZHLTH5	0.1444	4.5835
ZFRVG1	0.2671	4.9447	ZFRVG1	0.0258	0.4322
ZFRVG2	0.1231	3.3168	ZFRVG2	-0.0523	-1.2945
ZFRVG4	0.0289	1.1335	ZFRVG4	0.0545	2.0640
ZFRVG5	0.1014	3.2864	ZFRVG5	0.0636	2.0935
ZLABELS1	0.2022	4.1974	ZLABELS1	0.1907	3.6318
ZLABELS2	0.1340	3.5527	ZLABELS2	0.0873	2.2083
ZLABELS4	-0.0798	-2.9787	ZLABELS4	0.0416	1.5239
ZLABELS5	-0.1854	-6.2924	ZLABELS5	0.0942	3.2172

Appendix B.3. continued

ZORG1	-0.2038	-6.4315	ZHLTH_BP	0.0124	0.4660
ZORG2	-0.1204	-3.9436	ZHLTH_DB	0.0881	3.0880
ZORG4	0.2292	8.3387	ZHLTH_CL	0.0302	1.1039
ZORG5	0.3707	11.8824	ZHLTH_AG	-0.0002	-0.0085
ZHLTH_BP	-0.0594	-2.3352	ZHLTH_OB	-0.0603	-2.1021
ZHLTH_DB	0.1952	7.0918	ZHLTH_MB	0.0836	2.5656
ZHLTH_CL	0.0779	3.0221	ZHLTH_SI	0.0289	0.8946
ZHLTH_AG	0.2350	8.9232	ZDIV2	0.0606	1.2119
ZHLTH_OB	0.0286	1.0736	ZDIV3	-0.0599	-1.1631
ZHLTH_MB	0.1837	6.0897	ZDIV4	-0.0180	-0.2863
ZHLTH_SI	0.1885	6.2531	ZDIV5	0.0840	1.7215
ZDIV2	0.1623	3.2471	ZDIV6	0.0725	1.1275
ZDIV3	-0.1519	-2.9981	ZDIV7	0.0405	0.7697
ZDIV4	-0.1579	-2.6159	ZDIV8	0.0180	0.3173
ZDIV5	-0.0472	-0.9719	ZDIV9	0.0397	0.7937
ZDIV6	-0.2679	-4.3342	WPRICE	-0.8130	-42.2284
ZDIV7	-0.1881	-3.4721	ZPRICE	0.5044	35.2576
ZDIV8	-0.1351	-2.3456	ZCOLOR	0.5084	32.8586
ZDIV9	-0.0448	-0.8889	ZSIZE	0.5291	33.8969
PRWHOLE1	-2.6293	-118.9031	ZORGANIC	0.5220	32.0760
HFOODEXP	0.0783	17.5406	ZCOOL	0.5326	28.4744
DFRU1	1.1181	15.8892	ZSTORE	0.4962	28.8535
DFRU2	1.3207	20.0919	ZADVER	0.5124	23.7395
DFRU3	1.5359	24.0908	ZFRESH	0.5158	36.5919
DFRU4	2.5601	47.2877	ZPACKG	0.5072	26.5179
CCKTOT0	0.1624	8.7678	ZRIPE	0.5252	37.1689
			ZAROMA	0.5216	30.9769
			ZAPPEAR	0.4972	34.0946
			ZQUALITY	0.5678	39.7774
			HFOODEXP	0.0644	16.5872
			DFRU1	0.0470	0.3461
			DFRU2	0.0071	0.0553
			DFRU3	-0.0508	-0.4033
			DFRU4	0.2114	1.7914
			CCKTOT0	0.0753	4.2745
			IMILLS	0.3947	20.6256
			MU2	0.6836	53.5530
			MU3	1.2776	83.6339
			MU4	1.5677	96.6625
			MU5	1.8766	108.8580
			MU6	2.1118	116.5790
			MU7	2.3380	122.3860
			MU8	2.3756	123.1710
			MU9	2.4772	125.0310
			MU10	2.5052	125.4780
			MU12	2.7410	127.9100
			MU13	2.8539	128.2480

Appendix C.1. Cumulative impacts of promotion awareness.

Mango Promotion Awareness Model	Promotion	Base	2016	2017	2018	2019	2020
	Awareness	**2013-Mar to 2015-Dec.**	Jan-Dec.	Jan-Dec.	Jan-Dec.	Jan-Dec.	Jan-Dec
Market Penetration	Yes	0.073	0.134	0.154	0.136	0.164	0.199
	No	0.069	0.125	0.146	0.129	0.155	0.189
Market Intensity	Yes	3.224	3.960	3.608	3.389	3.636	3.635
	No	3.056	3.656	3.398	3.211	3.407	3.402
Average Retail Price ($ per retail Mango)		$1.19	$1.34	$1.37	$1.28	$1.36	$1.38
		-millions-	*-millions cumulative-*	*-millions cumulative-*	*-millions cumulative-*	*-millions cumulative-*	*-millions cumulative-*
Household Mangos	Yes	2199	3972	5852	7375	9368	11795
"	No	1970	3500	5172	6547	8310	10470
Implied Increase in Mango Demand		229	472	680	828	1059	1325
Household Expenditures	Yes	$2,559.72	$4,940.43	$7,512.27	$9,443.12	$12,151.73	$15,482.44
"	No	$2,294.43	$4,343.26	$6,630.27	$8,373.34	$10,770.26	$13,733.21
Gains		$265.29	$597.18	$882.00	$1,069.78	$1,381.47	$1,749.22
FOB Equivalent (34.07% Margin)	Yes	$872.10	$1,683.20	$2,559.43	$3,217.27	$4,140.09	$5,274.87
"	No	$781.71	$1,479.75	$2,258.93	$2,852.80	$3,669.43	$4,678.91
FOB $ Difference		$90.38	$203.46	$300.50	$364.47	$470.67	$595.96
NMB Expenditures	$	$17.57	$24.16	$30.28	$37.15	$45.05	$51.68
Impied ROI (starting with March 2013)		5.14	8.42	9.92	9.81	10.45	**11.53**

Appendix D. Relationship between promotion awareness and NMB marketing program expenditures.

```
                Method of estimation = Ordinary Least Squares


Dependent variable: AWARE
Current sample:  2013:12 to 2020:12
Number of observations:  85

       Mean of dep. var. = 8.00810  LM het. test = .439266E-04 [.995]
  Std. dev. of dep. var. = 2.46065  Durbin-Watson = .896807 [.000,.000]
Sum of squared residuals = 384.744  Jarque-Bera test = 30.3433 [.000]
   Variance of residuals = 4.63547  Ramsey's RESET2 = .710932 [.402]
Std. error of regression = 2.15301  F (zero slopes) = 26.7201 [.000]
              R-squared = .243530  Schwarz B.I.C. = 189.224
      Adjusted R-squared = .234416  Log likelihood = -184.782

           Estimated    Standard
Variable  Coefficient     Error       t-statistic   P-value
C         1.28970       1.32052       .976655       [.332]
MA_MKG    19.7776       3.82608       5.16915       [.000]
```

Appendix E. Selected mango demand drivers and their impacts.

	Weighted MP	MI	MI x MP	Distribution
Income				
Under $50,000 (48.3%)	0.07633	3.37649	0.26005	0.48363
$50/75,000 (21.0%)	0.07569	3.48221	0.26594	0.21007
75/$10000 (12.0%)	0.07932	3.63786	0.29114	0.12039
Over $100,000 (12.4%)	0.07984	3.75521	0.30246	0.12401
No Answer (6.1%)	0.07484	3.30463	0.24957	0.06191
Indexed to the Average				
Under $50,000 (48.3%)	0.98873	0.95967	0.94917	
$50/75,000 (21.0%)	0.98047	0.98971	0.97069	
75/$10000 (12.0%)	1.02753	1.03395	1.06265	
Over $100,000 (12.4%)	1.03417	1.06731	1.10399	
No Answer (6.1%)	0.96950	0.93924	0.91093	
Education				
High School or Less	0.07604	3.58581	0.27506	0.20678
College	0.07636	3.48482	0.26843	0.64513
Graduate	0.08182	3.57957	0.29541	0.13583
Other Education	0.07885	3.52710	0.28056	0.01226
Indexed				
High School or Less	0.98497	1.01916	1.00397	
College	0.98909	0.99046	0.97978	
Graduate	1.05982	1.01739	1.07825	
Other Education	1.02144	1.00247	1.02404	
Ethnicity				
White/Non-Hispanic	0.07426	3.31096	0.24809	0.66895
White/Hispanic	0.08107	3.77807	0.30897	0.09223
Black/African American	0.08177	3.53337	0.29147	0.13069
Asian	0.08770	4.01220	0.35489	0.03992
All Others	0.08259	3.68539	0.30706	0.06820
				1.00000
White/Non-Hispanic	0.96195	0.94104	0.90554	
White/Hispanic	1.05012	1.07380	1.12772	
Black/African American	1.05922	1.00425	1.06385	
Asian	1.13604	1.14035	1.29536	
All Others	1.06990	1.04746	1.12076	
Age				
18-24 Years	0.09549	3.60353	0.34777	0.12294
25-44 Years	0.08566	3.57951	0.30992	0.40194
45-54 years	0.07193	3.44408	0.25045	0.16432
55 & overr	0.06265	3.28202	0.20793	0.31080
18-24 Years	1.23691	1.02420	1.26934	
25-44 Years	1.10962	1.01737	1.13121	
45-54 years	0.93179	0.97888	0.91414	
55 & overr	0.81160	0.93282	0.75895	

Appendix E. Continued

Calories				
Completely disagree	0.07925	3.61161	0.28890	0.21720
Somewhat disagree	0.07894	3.55380	0.28318	0.19488
Neither	0.07812	3.52393	0.27786	0.24401
Somewhat agree	0.07529	3.39247	0.25783	0.16334
Completely agree	0.07446	3.40610	0.25601	0.18056
Completely disagree	1.02664	1.02649	1.05449	
Somewhat disagree	1.02263	1.01006	1.03359	
Neither	1.01193	1.00157	1.01420	
Somewhat agree	0.97526	0.96421	0.94108	
Completely agree	0.96449	0.96808	0.93444	
Experiment with New Foods				
Completely disagree	0.08225	3.61324	0.29980	0.12925
Somewhat disagree	0.07688	3.54094	0.27465	0.20820
Neither	0.07613	3.40667	0.26166	0.32217
Somewhat agree	0.07268	3.39897	0.24926	0.20844
Completely agree	0.07788	3.54368	0.27842	0.13195
Completely disagree	1.06549	1.02696	1.09426	
Somewhat disagree	0.99594	1.00641	1.00247	
Neither	0.98618	0.96824	0.95505	
Somewhat agree	0.94150	0.96606	0.90979	
Completely agree	1.00883	1.00719	1.01622	
Exercise				
Completely disagree	0.07358	3.55217	0.26373	0.24878
Somewhat disagree	0.08003	3.55315	0.28688	0.18073
Neither	0.08231	3.41417	0.28350	0.19583
Somewhat agree	0.07748	3.44233	0.26907	0.14608
Completely agree	0.07547	3.56342	0.27134	0.22859
Completely disagree	0.95318	1.00960	0.96260	
Somewhat disagree	1.03673	1.00988	1.04710	
Neither	1.06625	0.97038	1.03479	
Somewhat agree	1.00360	0.97838	0.98211	
Completely agree	0.97764	1.01280	0.99038	
Healthier				
Completely disagree	0.08221	3.72761	0.30921	0.11962
Somewhat disagree	0.07875	3.45623	0.27464	0.19906
Neither	0.07406	3.39318	0.25363	0.37627
Somewhat agree	0.07449	3.44010	0.25860	0.19455
Completely agree	0.07964	3.53775	0.28432	0.11051
Completely disagree	1.06498	1.05946	1.12861	
Somewhat disagree	1.02007	0.98233	1.00244	
Neither	0.95940	0.96441	0.92573	
Somewhat agree	0.96488	0.97774	0.94387	

Appendix E. Continued

Completely agree	1.03170	1.00550	1.03775	
Eat more Fruits and Vegetables				
Completely disagree	0.07897	3.59480	0.28671	0.13436
Somewhat disagree	0.07657	3.61473	0.27956	0.19725
Neither	0.07470	3.43094	0.25890	0.36052
Somewhat agree	0.07911	3.19295	0.25516	0.18198
Completely agree	0.08279	3.42533	0.28642	0.12588
Completely disagree	1.02296	1.02171	1.04650	
Somewhat disagree	0.99190	1.02738	1.02041	
Neither	0.96767	0.97514	0.94498	
Somewhat agree	1.02480	0.90750	0.93133	
Completely agree	1.07251	0.97355	1.04544	
Organics				
Completely disagree	0.08451	3.47634	0.29628	0.23946
Somewhat disagree	0.08180	3.49284	0.28816	0.18977
Neither	0.07563	3.53698	0.26980	0.23610
Somewhat agree	0.07306	3.55861	0.26221	0.15304
Completely agree	0.07134	3.57431	0.25716	0.18162
Completely disagree	1.09472	0.98804	1.08143	
Somewhat disagree	1.05967	0.99274	1.05178	
Neither	0.97976	1.00528	0.98476	
Somewhat agree	0.94640	1.01143	0.95706	
Completely agree	0.92409	1.01589	0.93863	
Read Labels				
Completely disagree	0.07419	3.63808	0.27263	0.17168
Somewhat disagree	0.07580	3.48168	0.26659	0.19084
Neither	0.07832	3.37851	0.26728	0.25355
Somewhat agree	0.08243	3.42032	0.28474	0.19146
Completely agree	0.08347	3.59351	0.30290	0.19247
Completely disagree	0.96101	1.03402	0.99510	
Somewhat disagree	0.98192	0.98956	0.97306	
Neither	1.01453	0.96024	0.97556	
Somewhat agree	1.06773	0.97212	1.03931	
Completely agree	1.08119	1.02135	1.10560	
Number of Other fruits				
0	0.05198	3.71553	0.19529	0.35201
1	0.05608	3.50128	0.19851	0.10097
2	0.02266	4.11330	0.09455	0.11083
3	0.11350	3.51290	0.40257	0.09871
4+	0.02266	4.11330	0.09455	0.33748
0	0.67335	1.05603	0.71280	
1	0.72642	0.99513	0.72457	
2	0.29352	1.16908	0.34509	
3	1.47022	0.99844	1.46939	
4+	0.29352	1.16908	0.34509	