Five-Year Evaluation of The Hass Avocado Board's Promotion Programs: 2018 – 2022

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Executive Summary

The Hass Avocado Board was created in 2002 following passage of federal authorizing legislation and approval of a referendum by domestic producers and importers with 86.6% voting in support. This report represents the fourth five-year evaluation of the promotion programs conducted under the auspices of the Hass Avocado Board (HAB), encompassing the period from 2018 through 2022.

Following a brief review of the history and legal foundations of the HAB, section 3 of the report provides a summary and assessment of recent trends in domestic and import shipments, consumption, and prices of fresh avocados in the United States. Section 4 contains an overview of major factors impacting food marketing in the United States during the review period, followed by a descriptive analysis and qualitative evaluation of the expenditures and the nature of promotions conducted by each of the member associations participating in the HAB's programs: the California Avocado Commission (CAC), the Chilean Avocado Importers Association (CAIA), the Colombian Avocado Board (CAB), the Mexican Hass Avocado Importers Association (MHAIA) and its partner organization, Avocados from Mexico (AFM), and the Peruvian Avocado Commission (PAC). Section 5 develops and estimates an econometric model of fresh Hass avocado demand in the United States using monthly retail scanner data over the review period for 8 regional market areas in the United States. Section 6 utilizes the results of the econometric analysis to develop and calibrate a simulation model of the U.S. fresh Hass avocado market to derive estimates of benefits and costs to California growers and importers from the promotion programs conducted under the auspices of the HAB for the five-year review period.

The United States has experienced substantial growth in per capita consumption of fresh avocados since the creation of the HAB. Fresh avocado consumption was relatively flat, averaging 1.6 lbs. per capita, during the decade of the 1990s. The first five-year review of the HAB's promotion programs covered 2003 – 07, and annual fresh avocado consumption averaged 3.1 pounds per capita during that period. The average increased to 4.3 pounds during the second five-year period, 2008 – 12, and then increased further to 6.7 pounds during the 2013 – 17 review period. During the five years encompassed in this review, fresh avocado consumption increased again to 8.3 pounds per capita. In total, fresh avocado consumption in the United States has risen by 260% over the 20-year life of the HAB. By contrast, total consumption all fresh fruits in the United States has risen by only 9% over this same period. Reflecting the rapid demand growth for fresh Hass avocados that has occurred over the 20-year life of the HAB, real (inflation adjusted) prices received by both importers and California growers have increased on average during this period despite the rapid expansion of shipments into the U.S. market.

The U.S. market was gradually opened to imports of Hass avocados from Mexico beginning in 1997 and culminating with full market access in 2007. Mexico has gradually come to dominate the U.S. market over the ensuing years. It averaged a 79.4% share of the market for fresh Hass avocados during this review period, roughly equivalent to its share over the previous five years, 2013 – 17. Shipments from California comprised 12.4% of the market on average, while Peru further expanded its share, comprising 7.2% on average compared to 4.5% in the previous review period. Chile and Colombia each supplied less than 1% of the U. S. total over the review period.

Qualitative Evaluation

Turning to the market support and promotion programs conducted by HAB and its member associations, HAB increased annual expenses to conduct market and promotion research from $4.74 to $5 million on average. It funded nutrition research with $2.5 million on average to leverage science and create unique, consistent, and simple messages that educate industry stakeholders, key influencers, and consumers to grow the demand for fresh avocados through the retail and foodservice channel. Recognizing the need to take control over the avocado industry's sustainability story, HAB established the Hass Avocado Sustainability Center that serves as the premier provider of sustainability research, data, and information for the avocado industry.

The CAC continues to augment its rebate funds from HAB with an assessment on revenues from its members, although these assessments have continued to decrease throughout the last five years, amounting to 1.5% at the end of the review period. CAC spent an average of $9.33 million annually on its marketing and promotion programs to position California avocados as the most desired and highest quality avocados for which consumers in the Western United States are willing to pay price premiums. CAC's promotions stress local and responsible production and short supply chains, especially when targeting affluent consumers in California's major metropolitan markets.

CAIA expended on average $825 thousand on its U.S. marketing campaigns over the review period, and significantly reduced its imports and expenditures during the last two years of the review period. Chile's market window is counter seasonal to California's, and CAIA also targets western U.S. markets. Its messaging links Chilean avocados to the natural beauty and allure of Chile, and a continued collaboration with pro golfer Joaquin Niemann complements this brand identity, while reinforcing the message that consuming fresh avocados contributes to a healthy and active lifestyle. However, significant fluctuations in supply and financial resources continue to challenge Chile's previously established retail partnerships.

CAB joined HAPRIO in 2020 and is slowly increasing its imports and marketing expenditures. An initial review of its expenditures suggests that CAB is on track towards developing a brand identity and establishing partnerships to increase sales of Colombian avocados via retail and foodservice channels.

The lion's share of promotion expenditures for the review period were made by AFM, reflecting Mexico's increasing share of shipments and, hence, assessment revenue. AFM's efforts are further supported by an additional revenue stream from assessments levied on members of MHAIA's partner organization APEAM. AFM spent an average of $49.1 million annually during the review period. AFM continues to promote avocados from Mexico at major televised events, most prominently the Super Bowl, to reach more general audiences than other associations. AFM also significantly expanded its digital and social media marketing, established brand leadership in e-commerce, and introduced new programs to reach consumers via the foodservice channel. AFM communicates a brand promise of goodness via a triad of "Healthy, Tasty & Fun" and the "Mexicanity" of its brand that is designed to appeal both to Hispanic and broader audiences.

PAC further increased its imports and expenditures to pursue a multifaceted and well-coordinated integrated brand promotion strategy. Expenditures doubled and amounted to $6.3 million during the last year of the review period. Peruvian Hass avocados are on the U.S. market in summer months, and PAC's largest campaign to date captured consumers' attention with a Tesla Summer Giveaway. PAC's efforts target diverse consumer demographics and aim at integrating sustainability into its brand identity by communicating that consuming avocados from Peru provides benefits to the body and the environment.

Quantitative Evaluation

The quantitative evaluation of promotion programs conducted under the HAB's auspices involved constructing a panel model of retail sales data encompassing eight U.S. regions as defined by the data provider IRI/Circana over 60 months, comprising 480 observations in total. Summary statistics reveal a wide variation in per capita consumption across the regions. The West region consumes the most Hass avocados, with mean per capita monthly consumption of 0.75 avocados, more than twice the rate of consumption in the lowest region, Great Lakes with 0.33 avocados, and roughly double the rates in the Midsouth, Northeast, and Plains regions. The average monthly sales price also varied considerably across regions, ranging from a low of $0.92 in the South Central region to a high of $1.33 in the Northeast.

The econometric model specified monthly per capita consumption of fresh Hass avocados in a region as a function of (i) the total promotion expenditures made by the HAB-affiliated country associations in each region and monthly time period, (ii) average monthly price per avocado in the region, and (iii) fixed effects variables for year (2018 – 22) and month. The year fixed-effect variables are included to account for secular growth in demand over time, while the month fixed-effect variables are included to account for the seasonality in fresh avocado consumption that has been observed in prior evaluations. The econometric model was estimated in both linear and nonlinear (logarithmic) form.

Key results from the econometric analysis are that average sales price in a market area during the month is strongly negatively correlated with sales volume, while promotion expenditures are strongly positively correlated with sales volume. Both the linear and double log models yielded comparable estimates for the price elasticity of Hass avocado demand: -0.77 for the logarithmic model and -0.73 for the linear model, meaning that a 10% decrease in average sales price in a month is associated with 7 – 8% increase in sales for that month. The estimated elasticity of demand with respect to promotion expenditures in the double log model is 0.088 and is statistically significant. The promotion elasticity is 0.06 in the linear model evaluated at the data means and is statistically significant for one of the two methods for computing standard errors. These results indicate that an expansion of monthly promotion expenditures in a region by 10% expands total avocado sales by 0.6 – 0.9% in that region.

Benefit-Cost Analysis

The final component of the quantitative analysis is the simulation model constructed in section 6 based upon results from the econometric model. This model specifies supply and demand functions for fresh Hass avocados in the U.S. market and simulates a small expansion of the HAB's

promotion program to assess impacts on grower/importer costs (reflected as a shift in the supply function) and on demand (reflected as a shift in the demand function of magnitude based upon the econometric analysis). Equilibrium sales and grower/importer price before and after this hypothetical program expansion are derived and compared to measure grower/importer costs and benefits from the promotion program. Depending on model specification, benefit-cost ratios range from 1.85 to 3.34, with the preferred estimate at 2.47, strong evidence that the promotion programs conducted under the auspices of the HAB were successful during the review period in increasing profits to California producers and importers of Hass avocados.

These benefit-cost ratios are generally consistent with the conclusions of the three prior reviews of Hass avocado promotions conducted under the auspices of the HAB. Fresh avocado consumption in the United States has risen dramatically during the 20-year life of the Hass Avocado Board, and promotions conducted under its authority have played a key role in the success of the industry.

Table of Contents

List of Tables

List of Figures

Five-Year Evaluation of The Hass Avocado Board's Promotion Programs: 2018 - 2022

1. Introduction

This report evaluates the impacts of fresh Hass avocado promotions in the United States conducted under the auspices of the Hass Avocado Board (HAB) from 2018 - 22. It represents the fourth quinquennial review of promotion activities conducted under the aegis of the HAB.

Hass is the dominant variety of avocado grown and consumed in the United States, comprising over 97% of retail sales.[1] Growth in U.S. consumption of fresh avocados since the creation of the HAB in 2002 has been quite remarkable. Fresh avocado consumption was relatively flat, averaging 1.6 lbs. per capita, during the decade of the 1990s. The first five-year review of the HAB's promotion programs covered 2003 – 07, and fresh avocado consumption averaged 3.1 pounds per capita during that period. The average increased to 4.3 pounds during the second five-year period, 2008 – 12, and then increased to 6.7 pounds during the 2013 – 17 review period. During the five years encompassed in this review, fresh avocado consumption increased again to 8.3 pounds per capita. In total fresh avocado consumption in the United States has risen by 260% over the 20-year life of the HAB. By contrast, total fresh fruit consumption in the United States has risen by only 9% over this same period.

The first evaluation of the HAB's promotional activities was conducted by Carman, Li, and Sexton (2009). These authors found that advertising and promotion funded under the HAB increased the demand for fresh avocados and yielded a favorable rate of return to avocado

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[1] The mission of the HAB pertains specifically to Hass avocados. Most public data sources such as the U.S. Department of Agriculture and the United Nations do not separate fresh avocado production and consumption by variety. In these cases, we report statistics for the entire fresh avocado category, recognizing that the error from doing so is small, given the dominant market share of the Hass variety in the United States. Our own statistical analysis, however, focuses specifically on sales of Hass avocados because the retail scanner data we employ does have separate UPC and PLU product codes for the Hass variety.

producers and importers who fund the program via assessments. The second five-year review, conducted by Carman, Saitone, and Sexton (2013), evaluated HAB-funded promotion activities for the period 2008 – 2012. These authors also found that the HAB's promotion programs were successful in expanding demand for fresh avocados in the United States and yielded a very favorable return to producers and importers. Most recently, Ambrozek, Saitone, and Sexton (2018) evaluated HAB promotion activities for the period 2013 – 17. They estimated benefit-cost ratios to producers and importers ranging from 1.64 to 3.62, thus reinforcing findings from the prior two reviews and providing strong evidence that the promotion programs conducted under the auspices of the HAB were successful in increasing profits to California producers and importers of Hass avocados.

Our evaluation of the 2018 – 22 period faced some unique challenges relative to the predecessor studies. Perhaps most important among them is that the COVID-19 pandemic occurred in the middle of the review period and drastically changed food consumption patterns in the United States. Consumption of food away from home was significantly reduced due to mandated shutdowns of restaurants and cafeterias and peoples' concerns about congregating in public places.[2] Fresh avocados are a party staple for many consumers in the United States, with notable demand peaks associated with the Super Bowl, Cinco de Mayo, Independence Day, and other celebratory occasions. Curtailment of such in-home gatherings during the pandemic no doubt also impacted fresh avocado consumption.

Evidence of the pandemic's impact is that fresh avocado consumption peaked in the United States at 8.7 pounds per capita in 2020 and declined to 7.9 pounds in 2021, before recovering somewhat in 2022. To account for the possible impacts of the pandemic on Hass avocado

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[2] The U.S. Bureau of Labor Statistics estimates that spending on food away from home decreased 32.0% in urban areas 44.9% rural areas in 2020 relative to 2019.

consumption in the United States, we separated the review period into two time periods pre-COVID-19, encompassing 2018 and 2019 and COVID19 and aftermath, encompassing 2020, 2021, and 2022.

A second complicating factor for this evaluation is the changing nature of Hass avocado promotions conducted by the country associations affiliated with the HAB. Section 4 of this report provides details on the nature of promotion activities conducted by each country association. This review period saw increasing use of digital and social media messaging, with correspondingly less reliance on messages targeted to local markets using radio, television, billboards, in-store displays, etc. Promotions that are targeted to local markets create a type of "natural experiment" wherein a "treatment group" (market areas receiving promotions in a given time period) and a "control group" (market areas not receiving promotions at the same time) exist, and changes in sales in treatment vs. control can be estimated.

By their very nature digital promotions are widely available across geographic market areas, making it challenging to isolate their impacts by location. Furthermore, price promotions (e.g., coupons, price-off deals, rebates), were increasingly utilized by most associations during this review period to balance consumer perceptions of value-added and increased price sensitivity. Accordingly, the econometric approach utilized in this study, as discussed in detail in section 5, differs somewhat from that employed in the prior review by Ambrozek, Saitone, and Sexton (2018).

In what follows, section 2 of this report briefly reviews key background information regarding the HAB. Section 3 then discusses major factors impacting the fresh avocado market. We then turn to analysis of avocado promotion programs conducted under the HAB's auspices during the 2018 – 2022 period. Section 4 describes and evaluates qualitatively the expenditures, programs, and activities undertaken by HAB's member organizations. Section 5 describes our

statistical approach to conducting a quantitative analysis of demand for fresh Hass avocados in the United States and presents estimates of the overall impacts of promotion expenditures and price on demand over the full five-year review period and for the two sub-periods to account for the COVID-19 pandemic.

The results of this analysis are utilized in Section 6 to construct a simulation model that is used to estimate benefits and costs to domestic producers and importers from funding promotions. Our bottom-line conclusion is that promotions conducted during this review period were very successful, yielding benefit-cost ratios in the range of 1.85:1 to 3.34:1 depending upon model specification.

2. Background and History of the Hass Avocado Board

The Hass Avocado Promotion, Research, and Information Act was signed into law on October 23, 2000. The Act established the authorizing platform and timetable for the creation of the Hass Avocado Promotion, Research and Information Order (HAPRIO) that was approved in a referendum of producers and importers with an 86.6% affirmative vote on July 29, 2002.

The Hass Avocado Board was created at this time to administer the activities authorized under the HAPRIO. The Board consists of a maximum of 12 members representing domestic producers and importers of Hass avocados into the United States. Board members are appointed by the U.S. Secretary of Agriculture based on industry nominations. Regulations promulgated to implement the Act specify that "producers and importers shall be allocated to these positions so as to assure as nearly as possible that the composition of the 12-member Board reflects the proportion of domestic production and imports supplying the United States market." [3] Like all U.S.

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[3] The rules and regulations governing the HAB are available on the Board's website:
https://hassavocadoboard.com/wp-content/uploads/2019/01/Hass-Avocado-Board-ActAndOrder-1-15-19.pdf.

commodity promotion boards, the HAB operates subject to oversight exercised by the U.S. Department of Agriculture, Agricultural Marketing Service.

Mandatory program assessments of 2.5 cents per lb. on all Hass avocados sold in the U.S. market commenced effective January 2, 2003, as authorized under the HAPRIO. This assessment rate has been maintained throughout the life of the HAB. The assessment is collected by first handlers for California production and by the U.S. Customs Service for imports, with revenues forwarded to the HAB.

The HAB uses 15% of the assessment revenues to fund generic activities including nutrition research, marketing focused on the nutritional benefits of fresh avocado consumption, market research and information programs, and administration. The remaining 85% of assessment revenues are rebated in proportion to revenue generated to the California Avocado Commission (CAC) and the four certified importer associations: the Chilean Avocado Importers Association (CAIA), the Colombian Avocado Board (CAB), the Mexican Hass Avocado Importers Association (MHAIA), and the Peruvian Avocado Commission (PAC). These associations utilize the funds to promote Hass avocado consumption in the United States.

Assessment income to HAB totaled $98.67 million during the first quinquennium, $148.47 million during the second, $248.69 million for the third, and $323.96 million in this five-year period. The growth in available income reflects the growth in sales volumes over the life of the HAB, given the constant assessment rate of 2.5 cents per lb. on fresh Hass Avocados. Total expenditures made by the country associations during this review period are indicated below in Table 1. The average total expenditure across the five years was $50.2 million.

Table 1. Promotion Expenditures by the HAB Member Associations: 2018 – 22 ($)

Year	2018	2019	2020	2021	2022
California	9,612,755	6,731,188	10,661,812	10,750,358	8,905,379
Chile	1,189,673	1,357,350	380,706	261,834	76,250
Mexico	40,810,291	33,444,430	38,288,489	36,401,238	29,478,305
Peru	3,204,345	3,275,365	2,747,167	3,150,104	6,291,862
Colombia			6,764	89,595	219,372
Total Expenditures	54,817,064	44,808,333	52,084,938	50,653,129	44,971,168

3. The U.S. Market for Avocados: Trends and Current Status

From 1970 – 89 fresh avocado consumption in the United States averaged 1.2 lbs. per capita, with nearly all of the production emanating from California and Florida. Imports accounted for only about one percent of total supplies during this period.

The market share of imported fresh avocados into the United States began to expand rapidly in the 1990s, first due mainly to product entering from Chile and the Dominican Republic. Mexico gained access to portions of the U.S. market in 1997, and the share of the market comprised by imports expanded rapidly, as Mexico was able to incrementally access increasing segments of the U.S. market. The final stages of liberalization of the U.S. market for Mexican avocados were reached in 2005 when Mexico gained year-round access to all states except California and Florida and in 2007, when access was granted to all states.

Figure 1 shows the total supply of fresh avocados to the U.S. market from 2004 – 22. Some major trends are apparent. First, although supplies have been flat across some years, fresh avocados supplied to the U.S. market have on balance continued to increase over this period. Second is the increasing dominance in the U.S. market of avocados imported from Mexico, while California's and Chile's shares have declined. Over this five-year review period, Mexico supplied 79.4% of Hass avocados to the U.S. market.

Third is the emergence of Peru as an important player in the market in the most recent

years. Peru began exporting significant volumes of Hass avocados to the U.S. in 2011 and the PAC became a USDA-certified importer association under the HAPRIO in 2011. Peru is now the third largest supplier of Hass avocados to the U.S. market with a 7.2% market share over this review period, following Mexico (79.4%) and California (12.4%). Chile and Colombia each supplied less than 1% of the U.S. total over the review period.[4]

Figure 1. Fresh Avocados Supplied to the U.S. Market, 2004 - 2022

Source: Hass Avocado Board, Shipment Data.
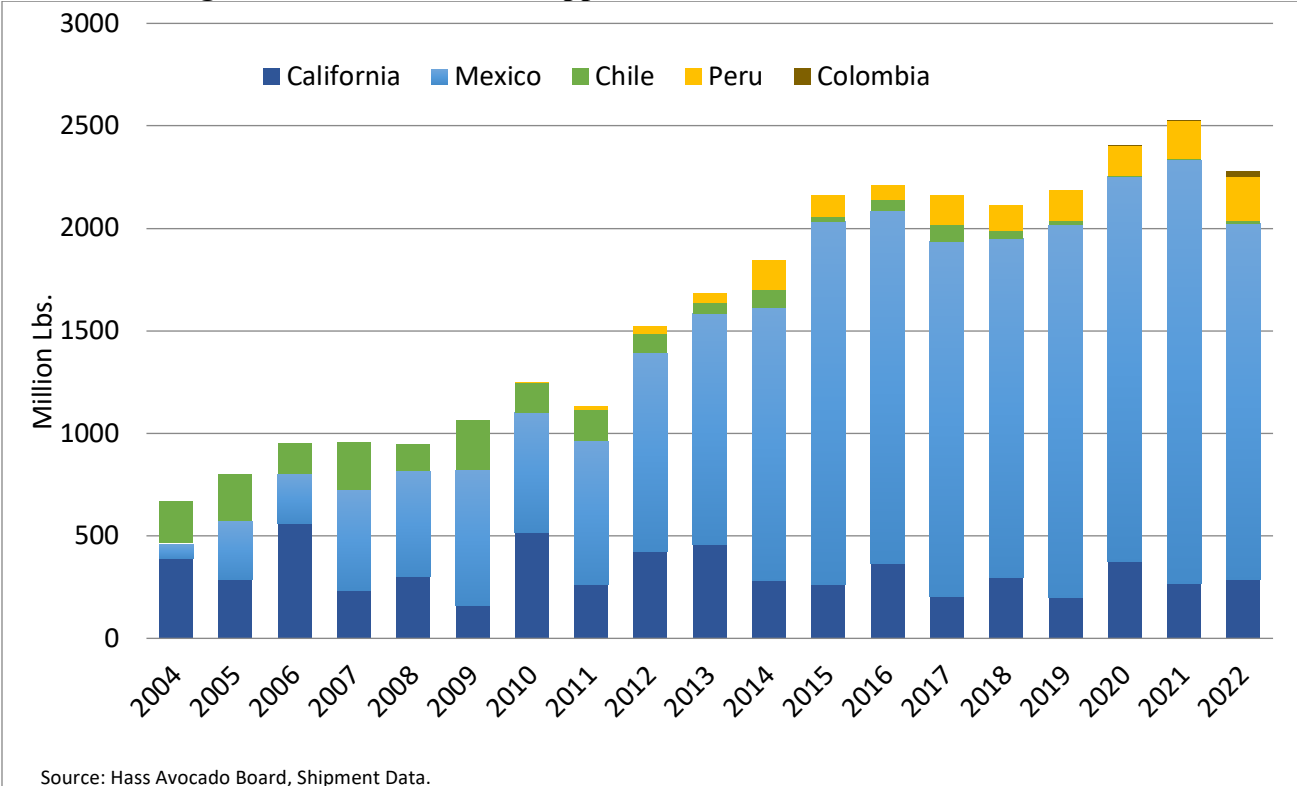
Figure 2 shows the average weekly distribution of fresh avocado shipments for the HAB member associations for 2018 – 22. Mexico supplies Hass avocados year around to the U.S.

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[4] Chilean avocado production has been relatively stable over this review period. The decline in Chilean avocado exports to the United States reflects decisions of Chilean marketers to focus on exports to the European Union and avoid head-to-head competition with Mexican imports in the U.S. market. Total avocado production in Colombia has increased rapidly, more than doubling over the review period, with its worldwide exports rising threefold.

market, but a distinct lull in Mexican shipments occurs during the summer months coinciding with seasonal peaks in California's (early summer) and Peru's (late summer) shipments.

Figure 2. Seasonal Avocado Shipments from HAB Member Associations, 2018 - 22 Avg.

Source: Hass Avocado Board, Shipment Volume Data.
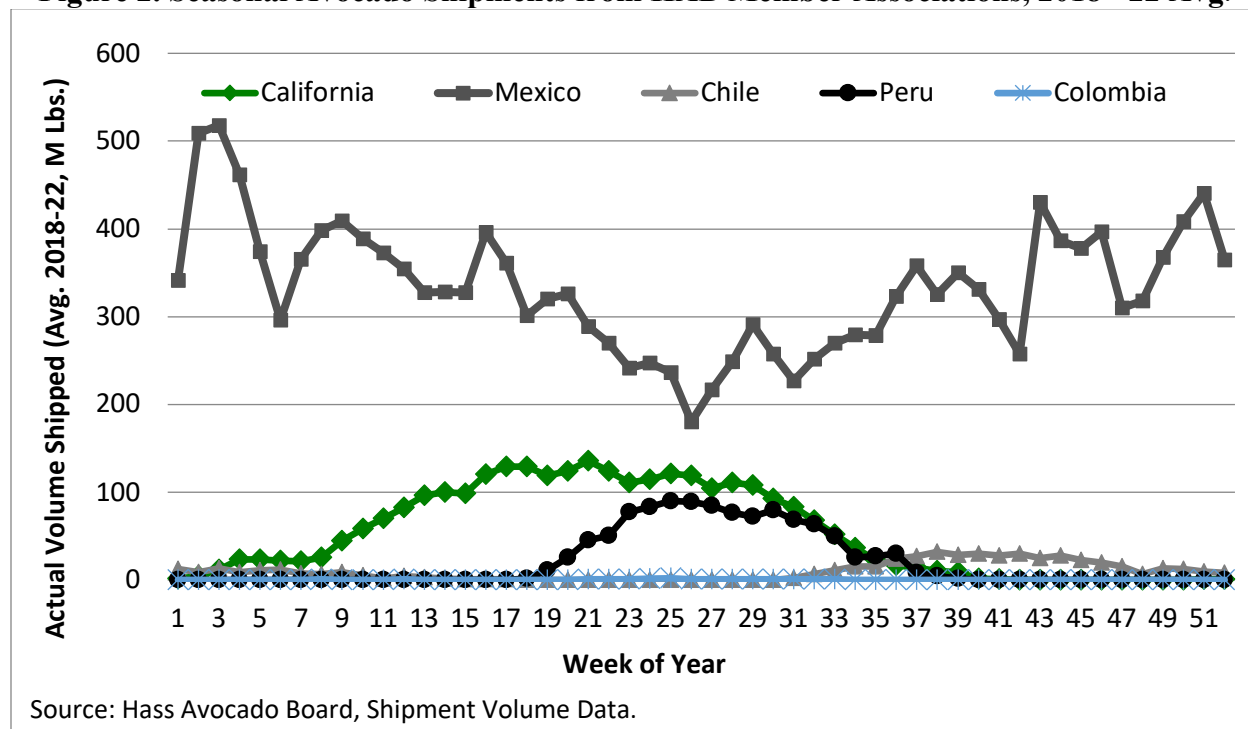
3.1.   *Fresh Avocado Prices*

One key measure of the strength of the market for fresh avocados is the prices attained by the different participants in the market chain—producers, importers, and retailers. Sales growth achieved while maintaining or increasing prices on an inflation-adjusted (real) basis reflects true growth in demand.

The evidence on prices contained in figures 3 and 4 indicates quite conclusively that the expansion of sales in the U.S. market has been achieved primarily through rising demand for avocados in the United States. Figure 3 depicts annual per capita consumption of fresh avocados in the United States (blue bars), along with the California producer price in real (2022) terms. The linear trend line shows that real grower prices, despite considerable year-to-year volatility, have

increased on average over the life of the HAB at a rate of 1.16 cents per year. Rising consumption

and constant or rising real prices can only be achieved through demand expansion.

Figure 3. Per Capita Consumption and California Producer Price
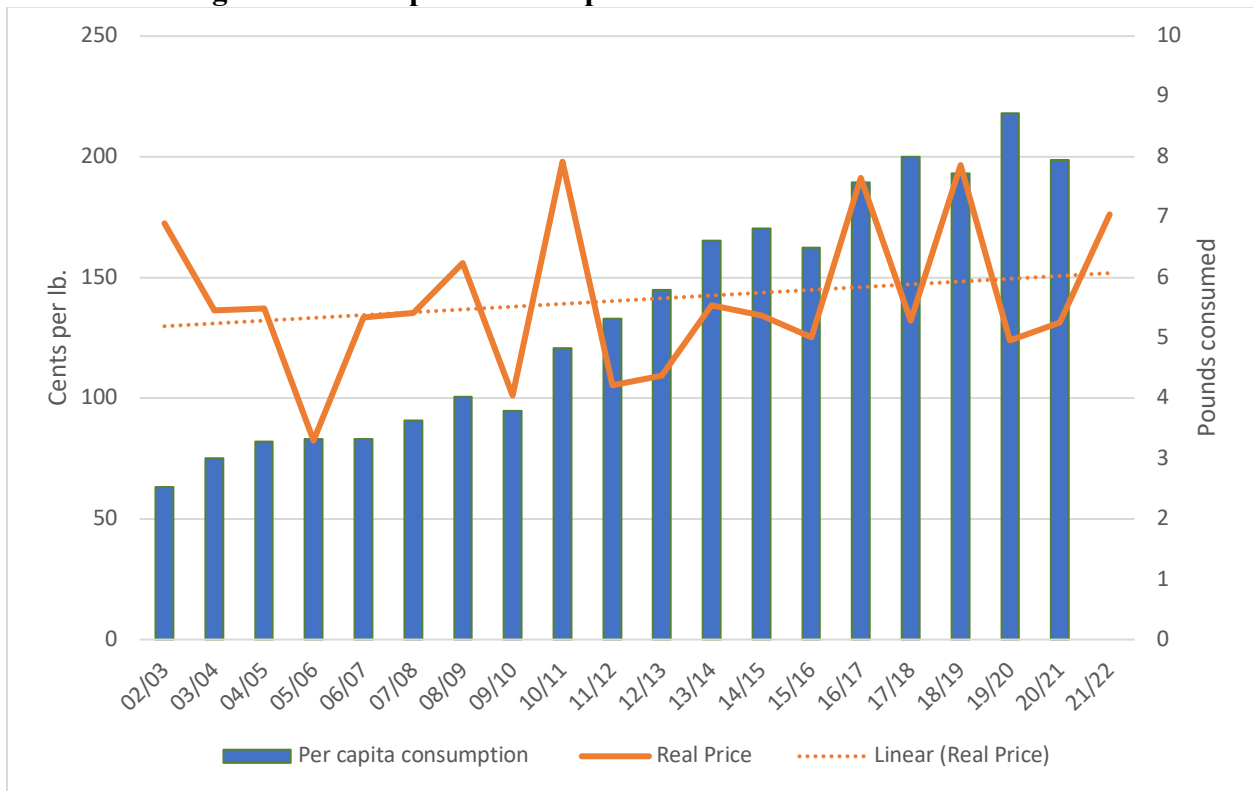
Source: Per capita consumption data from USDA; price data from California Avocado Commission; price deflated by U.S. Consumer Price Index (2022=100), Bureau of Labor Statistics.

Figure 4 depicts the average real (2022 base) price received by importers of fresh avocados

at the U.S. ports of entry from 2003 – 2022. The trend line depicted in the figure again shows a

real price that is increasing on average over the life of the HAB at a rate of 2.61 cents per year.

Figure 4. Importer Price and Trend, 2003 - 2022

3.2. *Fresh and Processed Avocado Imports*

Although the HAB collects assessments only on the sales of fresh avocados and, accordingly, directs its activities towards the fresh segment of the market, the processing segment also deserves brief mention. Processed avocados are substitutes for some uses, and it is likely that the processed segment of the market benefits from promotions conducted under the auspices of the HAB. Most processed avocado products consumed in the United States are imported from Mexico, and U.S. imports of processed (prepared or preserved, with additives) avocados have increased consistently since the advent of the HAB, but the rate of import growth in the processed segment over the 2003 to 2022 period has been considerably slower than in the fresh-market segment, as shown in figure 5.

Figure 5. Fresh and Processed Avocado Imports
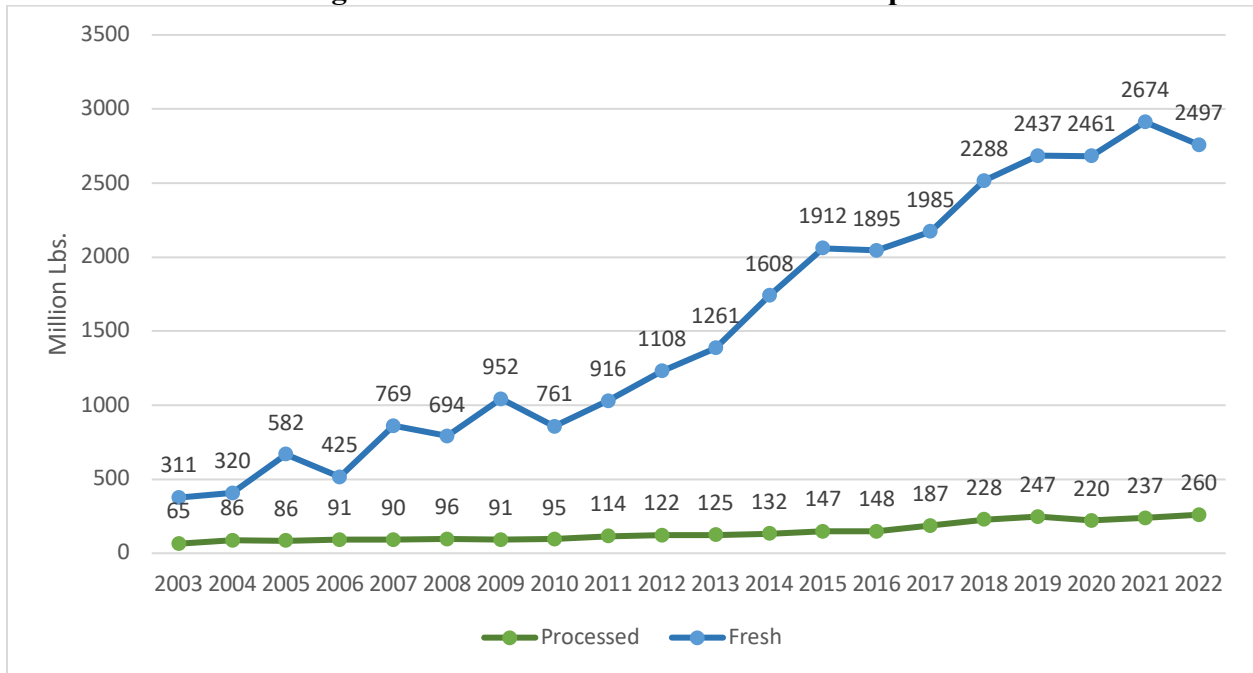
Source: USDA, Economic Research Service, Trade History.

4. Qualitative Evaluation

Table 2 reports funding received by the HAB from California shippers and U.S. Customs for each year in the review period and the dissemination of funds to the member associations under the 85% rebate. Given the constant 2.5 cent per pound assessment rate, revenues are directly proportional to shipment volume. The table shows rising assessment revenues through the first four years of the review period that were on track to reach $70 million in 2022, but then a decline of about $4 million in 2022 below the 2021 total.

Table 2. HAB Assessments and Rebates to Member Associations

	HAB Assessments Collected ($)				
	2018	2019	2020	2021	2022
California	7,522,551	4,874,198	8,553,427	5,759,056	6,343,961
Customs	54,415,798	57,492,191	57,595,249	62,930,284	58,368,437
Other Income	-	72,160	12,924	-	21,677
Total	**61,938,349**	**62,438,549**	**66,161,600**	**68,689,340**	**64,734,074**
	HAB Rebates to Member Associations ($)				
California	6,390,177	4,119,360	7,268,444	4,895,151	5,385,571
Mexico	41,266,460	44,166,322	45,253,730	49,259,872	42,755,937
Chile	1,135,899	781,608	75,772	186,833	339,025
Peru	3,714,623	3,769,212	3,427,127	3,778,070	5,430,566
Colombia	-	-	149,043	139,487	888,444
Total Rebates	**52,507,158**	**52,836,501**	**56,174,116**	**58,259,413**	**54,799,544**

In 2020, the USDA announced that the application for the Colombia Avocado Board (CAB) to operate under HAPRIO was accepted, and CAB became the newest certified importer association. CAB began to receive 85% of the assessments paid on Colombia Hass avocados to the HAB to conduct programs to promote Colombian Hass avocados in the U.S. market.

Member associations may choose to supplement the revenues they receive from HAB rebates with additional sources of funding. For instance, the California Avocado Commission (CAC) levies an ad valorem assessment on revenue from sales of California avocados. This assessment amounted to 2.3% in 2018-19 and steadily decreased over the review period. It was reduced to 2% in 2019-20, 1.75% in 2020-2021 as well as 2021-2022, and was further reduced to 1.50% in 2022-2023.

MHAIA partners with the Avocado Producer and Exporting Packers Association of Mexico (known as APEAM--its Spanish acronym) to jointly comprise Avocados from Mexico (AFM). APEAM also collects additional funds from its members under a voluntary levy in Mexico. These funds are pooled with revenues rebated to MHAIA from the HAB to comprise the resources available to AFM to promote sales of Mexican Hass avocados in the United States.

The majority of funds used to promote Hass avocado consumption in the United States are generated through HAPRIO, and it is impossible to separate the impacts of promotions funded by HAB-rebate revenues from impacts funded by additional revenue streams. Our strategy in the econometric analysis, described in the subsequent sections, is to evaluate the impacts of promotions by HAB, CAB, CAC, CAIA, AFM, and PAC regardless of the funding source.

In this section we first outline the major factors that in our view are shaping food consumption and food markets in the United States. We then report the promotion expenditures and discuss marketing support and promotion efforts pursued by the HAB and each member association separately. Our aim is to highlight expenditures and efforts during this review period we believe to have been especially effective. We hope our review and discussion can support HAB and its member associations in designing marketing campaigns and promotion programs that continue to jointly grow the volume and dollar sales of fresh Hass avocados, while allowing each association to strengthen its unique brand identities.

4.1. *Key Considerations Driving U.S. Consumer Demand*

An important aspect of commodity promotion evaluation is to consider whether an organization's promotional activities are well calibrated and effectively drive consumer demand in the U.S. market for its members' products. As a starting point and important foundation of our evaluation, we discuss key determinants of consumer behavior and emerging food-consumption trends. An understanding of key determinants of food purchases via retail and foodservice channels, unique challenges faced during the last five years, and longer-term developments can aid HAB and its member associations, as well as their marketing agents, in designing and executing effective marketing and promotion programs.

Total U.S. food sales fluctuated significantly throughout this review period, ranging from $1.8 trillion in 2020 to $2.36 trillion in 2022 (USDA, ERS 2023). The vast majority of foods in the United States are purchased via supermarkets, warehouse club stores, supercenters, restaurants, fast-food establishments, and institutions. Although consumers bought more foods directly from farms and via direct-to-consumer (DTC) outlets throughout this review period, overall market shares remain tiny and amount to less than 1% of total food expenditures.

On average, consumers spent 11.3% of their disposable incomes on food in 2022. In general, food budget shares in the United States have been relatively stable since the 1980s, and fluctuations in recent years are largely a result of a sudden fall and somewhat slower recovery in food away from home purchases during the COVID-19 pandemic. Food away from home purchases decreased dramatically during the early months of the pandemic and sales lost due to restaurant closures and stay-at-home orders were only partially offset by higher expenditures for food-at-home consumption. General inflation and specific supply-chain challenges continue to contribute to overall higher food prices and food budget shares.

Other than during the disruptive first months of the pandemic, the food budget shares continue to be divided almost equally between food at home and food away from home (5.62% and 5.64%, respectively, in 2022). Although, some consumers improved their cooking and baking skills and experimented with new recipes during the pandemic, convenience remains the primary determinant of the food choices we make as all of us return to our busy lifestyles.

It is further important to note that although higher-income households spend a smaller share of their disposable income on food than households in other income groups, these households spend significantly more overall on food—three times as much or $15,713 annually in the highest income quintile compared to $5,090 spent by the lowest income quintile (USDA, ERS 2023).

Especially middle-to-high income consumers continue to be willing to pay a premium for value-added foods that either directly communicate health benefits (e.g., beneficial nutrients or overall nutritional value) or utilize production processes perceived to be more sustainable by consumers (e.g., avoidance of pesticides, organic production, local production).[5] Consumers have become more concerned about where, by whom, and how their foods are produced, although actual food purchases don't always reflect these stated preferences.

Agricultural economists have studied stated and revealed preferences for value-added foods extensively, and research generally shows that consumers are willing to pay substantial premiums for environmentally or animal friendly products, and products with certifications such as Fairtrade.[6] However, many of these newer quality attributes can be classified as "credence attributes;" differences in product quality that cannot be verified or directly experienced by consumers. These value-added attributes increasingly considered by consumers need to be communicated via labels and claims that address significant information asymmetries between consumers and producers in most retail environments. Numerous studies suggest that consumers prefer labeled products and are willing to pay more for products that brand themselves as healthier or more sustainable (Wilson et al. 2020). What is less well understood is which messages both resonate with consumers and result in increased sales. Few studies have analyzed actual purchases and almost none account for increased product differentiation and a multitude of claims and labels included on packages, as well as strategic pricing and multi-category optimization pursued by retailers (Villas-Boas et al. 2020).

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[5] The USDA broadly defines value-added products as foods that are differentiated and branded based on a change in the physical state or form of the product (e.g., guacamole) that enhances its value to consumers, or on differences in production methods (e.g., organic or local production) and physical segregation along the supply chain that generate additional value to consumers (AMRC 2023).

[6] See Saitone and Sexton (2017) for a summary of this work.

Importantly, consumers' decisions can be a result of deliberate cognitive processes or dictated by more immediate emotional reactions. Time as well as income constraints further limit consumers' consideration sets and attention focus. Consumers are rationally inattentive to much of the advertisements, promotional efforts, and vast amounts of information they are inundated with on an everyday basis (Mackowiak et al 2023), and empirical evidence of resulting behavioral hazards, and the influence of personal beliefs and experiences on consumer behavior is mounting (Kiesel et al 2023).

Perceived health benefits remain an important purchase driver, but food-safety concerns, increased price sensitivity, and a desire to try something new or indulge (the latter especially in restaurant settings) can either reinforce health messaging or compete for consumers' limited attention. The pursuit of multiple objectives coupled with cognitive time, and income constraints can explain frequently documented differences between stated and revealed consumer preferences or the often-called "vote-buy gaps" found when analyzing actual consumer purchases.[7] Consumers often state that they value accurate information provision and increased transparency. However, they also need to invest time and effort to process available information, make connections, and draw conclusions that improve their choices going forward. Consumers can vary significantly in their subjective information processing depending on their prior knowledge and lived experiences (Malmendier 2021). As a result, they are often more responsive to easily accessible but less accurate claims that make simple statements which can be intuitively understood or that promise benefits that can be directly experienced (e.g., nutrition claims that invoke taste perceptions) rather

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[7] The vote-buy gap refers to settings where consumers' stated preferences diverge from their shopping behavior. Animal welfare provides a good example. Consumers voted overwhelmingly in support of California's Proposition 12, which, among other things, mandated that shell eggs sold in California come from hens raised in cage-free environments. However, when given the choice to purchase cage-free eggs at a substantial price premium over conventional eggs in supermarkets, few consumers elect to do so.

than to labels based on comprehensive standards or additional more complex guidelines (e.g., nutrition facts and guidelines).[8]

Relatively little is still known about how to effectively promote credence qualities, but what is clear is that not all can be communicated directly via claims made in retail settings, or even well-designed advertisements. Longer-format educational campaigns and inspirational storytelling that clearly communicate scientific findings can negotiate or re-negotiate consumer perceptions and enable consumers to update their beliefs. Embedding informative and educational messages in stories consumers can personally relate to and referencing their own experiences have been shown to be most effective in the marketing research literature.

Consumers tend to choose products that capture their attention via price promotions or by highlighting specific, intuitively understood benefits when making split-second decisions about what to buy in retail settings. A more deliberate evaluation of longer-term goals, expert advice or messages communicated repeatedly to consumers by key influencers and brand ambassadors via traditional, digital, and social media can result in pre-commitments and alter their consideration sets and attention focus in these situations, however. For instance, partially due to the pandemic and collectively experienced losses, U.S. consumers became more concerned than ever with the safety of the foods they eat, while continuing to seek out products that offer health benefits. Food-safety concerns at least temporarily crowded out sustainability concerns regarding packaging. As a result, consumers were seeking out rather than avoiding additional plastic packaging throughout the review period and bagged produce was perceived to offer added value by many consumers compared to produce in bulk.

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[8] For instance, Kiesel and Villas-Boas (2013) find differences in consumer perceptions and purchase responses depending on which and how many nutrition claims are displayed on food products. Kiesel et al (2011) summarize findings regarding consumer behavior and the effectiveness of nutrition labeling more generally, and Villas-Boas et al (2020) further discusses which nutrition information will and will not be provided via branded messages.

Avocados have a lot of health benefits to offer.[9] They are nutrient dense and come with an abundance of vitamins C, B5, B6, E, and K, potassium, folate, and healthy fats. Six of the eight grams of carbohydrates in a 100-gram serving are fiber, qualifying avocados as a low-carb food. Marketing agents have been able to tell a compelling story about the health benefits of avocado consumption, a fact reflected in the remarkable growth experienced in per capita avocado consumption to date. But solely focusing on health benefits will not be enough to drive general avocado demand and build brand loyalty going forward.

The expansion in avocado sales volumes and increased consumption has led to a closer scrutiny of production processes. Some consumers and advocates have voiced concerns about water usage and potential negative environmental and socio-economic impacts of avocado production on the communities where avocados are grown. While many of these concerns are not unique to avocado production and singling out avocado producers might not be justified, even misguided beliefs can have significant effects on food purchases. Effective marketing efforts and promotion programs pursued by HAB and its member associations need to look for innovative ways to address these challenges and continue to inspire and educate consumers to be able to alter consumer perceptions of negative externalities of increased avocado production.

In the discussion that follows we will take a closer look at which messages communicated by HAB and its member associations have been most effective in communicating to consumers that frequent avocado consumption is synonymous with living an active and healthy lifestyle that feels good and is aligned with their values.

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[9] Hass avocado nutrition facts are summarized here: https://loveonetoday.com/nutrition/avocado-nutrition-facts-label/

4.2.   Hass Avocado Board Direct Promotion Programs

U.S. commodity boards have historically funded production research among their activities. While such research can improve production methods and benefit producers by lowering costs, lowered production costs can also translate into increased supplies and lower producer prices. Furthermore, it is difficult or impossible to prevent production methods from being disseminated to producing regions and countries that did not support the research funding, causing a free-rider problem and putting further downward pressure on price.

Many U.S. commodity boards have refocused their research activities and invested in consumer research to effectively position their products in the market and promote unique benefits. HAB-funded research offers marketing and promotion support materials to its members with the ultimate purpose to "provide a unique, flavorful eating experience that contributes to human health, the environment, societal benefits, and economic prosperity" (2022 Business Plan and 2021-2025 Strategic Plan).[10] The Board's commitment to fund nutrition research and disseminate findings widely began in earnest in 2011 when nearly $1 million were allocated to support nutrition research. Expenditures more than doubled in 2012 before settling into a pattern of spending close to $1 million per year. During this review period, HAB increased its expenses once more, spending $2.5

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[10] HAB amended its mission in 2021 to reflect its commitment to sustainability and fulfilling today's needs without compromising future generations.

million annually on average. Table 3 reports these and other key expenditures by major category since 2008.

Table 3. HAB Expenditures by Category: 2008-2022

Year	Rebates	Promotion/Market Research	Nutrition Research	Information	Admin	Total
		Thousands of Dollars				
2008*	21,991	3,005	0	590	1,676	27,262
2009	21,194	4,444	202	262	1,782	27,884
2010	24,955	5,363	544	101	1,530	32,493
2011	23,126	2,569	986	97	1,297	28,075
2012	31,879	2,104	2,115	229	1,243	37,570
2013	35,810	4,037	732	542	1,608	42,729
2014	39,100	3,577	978	697	1,014	45,365
2015	45,439	5,143	1,073	842	1,190	53,687
2016	46,421	5,908	946	759	1,187	55,221
2017	43,938	5,015	1,218	852	1,208	52,232
2018	52,507	3,763	2,628	817	1,386	61,101
2019	52,836	4,394	3,050	692	1,502	62,474
2020	56,171	4,649	2,135	613	1,287	64,855
2021	58,259	6,265	2,257	568	1,141	68,490
2022	54,799	5,986	2,491	670	1,602	65,548

*Includes 14 months of data, Nov. and Dec. 2007 plus calendar 2008 when HAB shifted from crop year to calendar year.

HAB's investments in promotion and market research combined with its investments in nutrition research continue to allow HAB and its member associations to effectively leverage science and create unique, consistent, and simple messages that drive long-term growth in Hass avocado demand and add value for the consumer.

The Love One Today® theme and resources provided under this positioning theme continued to provide consumers with a clear call to action and trusted messaging of health benefits. It communicated care and positivity during the personally and collectively challenging and uncertain times of this review period.

HAB emphasized four key health benefits when consuming fresh Hass avocados: heart health, weight management, type 2 diabetes, and healthy living at every age. Specific messaging

further narrowed these nutrition benefits to feature no more than two (e.g., nutrient dense, heart healthy) coupled with simple tips and usage ideas that save time.

We agree that HAB's renewed commitment and focus on health and nutrition research is consistent with key purchase motivations in today's retail markets. It is also consistent with the benefits sought by the target market identified in HAB's promotion and market research. It indicates that 90% of avocados in the United States are purchased by food- and wellness-oriented female consumers in the 25 – 65 age demographic. This market segment already consumes three or more avocados a month and many of the efforts described in the provided materials are focused on further increasing consumption of this target demographic.

HAB has divided its support of nutrition research into three components throughout this review period: Growing the number of contracted and independent research projects and strengthening the nutrition-research pipeline; distributing HAB-funded research findings to key audiences, including scientists, regulatory agencies, professional organizations, and the Hass avocado industry; and advocating for and establishing policies for maintaining transparency and independence of the nutrition research pipeline from internal and external influence. It built a comprehensive and trustworthy body of nutrition science and expanded its toolbox of marketing and communications resources that support nutrition messages approved by the USDA and tested on target consumers.

These materials are available for HAB's own uses and shared with member associations and strategic partners. HAB has maintained its web presence and expanded its social media messaging. HAB also intensified its efforts to reach Hispanic populations, creating Hispanic-inspired recipes with nutrition labels in both Spanish and English and forming strategic partnerships with social media influencers (e.g., hispanickitchen.com) that promote weight loss and heart-health benefits of consuming fresh avocados.

Yet, final consumers are only a secondary target audience for HAB. The Board primarily seeks to educate and inform health professionals, its member organizations, industry stakeholders, and strategic partners regarding the avocado research pipeline. It further provides resources for health professionals on how to communicate nutritional and health benefits to consumers. HAB communicates indirectly through strategic outreach and public relations (PR) efforts that engage influencers and media personnel who then communicate health and nutrition benefits to consumers.

Of particular value in our view is a key insight developed as a result of significant expenditures in market and promotion research ($5.01 million annually on average during this review period). Consumers trust health professionals more than industry or government representatives. As a result, they can more effectively deliver new information or ask consumers to question their perceptions and change their habits. HAB uses health professionals and dietitians as key influencers and brand advocates that can offer expert advice to consumers and effectively communicate the health and wellness benefits to consumers.

Table 3 also indicates that HAB continues to allocate significant amounts of its retained assessments to provide market information and business support tools such as information on shipments, retail sales and prices at the local, regional, and national level. Access to this information was perhaps more important than ever during this review period and allowed the industry to adjust and react to the many supply challenges faced in a timely fashion. HAB also implemented a new Hass Avocado Industry Board Leadership Development Program (known by the acronym BOLD), designed to develop emerging leaders in the industry. Participants are exposed to the challenges faced by the industry, and this year-long training program equips motivated future leaders with the necessary tools to meet those challenges in creative and innovative ways.

Finally, although not separated out in Table 3, it is important to note that HAB has broadened its research and promotion efforts to explicitly include sustainability as an additional priority starting in 2021. Prior to 2021, HAB had already invested in strategy and program development to design and communicate the industry's sustainability story going forward. In 2021 expenditures allocated to promotion, research, and information programs prioritizing sustainability increased by 73%, and HAB established a Hass Avocado Sustainability Center that can serve as the premier provider of sustainability research, data, and information for the avocado industry. In 2022, these expenditures increased once more, to a total of $ 651,654. We view these expenditures essential to ensure that consumers' perceived association between Hass avocado consumption and the environmental, societal, and economic impact of avocado production will not be negative and become a significant barrier to achieving HAB's vision.

Although we do not consider many of HAB's expenditures as directly pertaining to product marketing, the Board's continued commitment to research investments and PR efforts are key to HAB's long-term promotion strategy that requires educating, informing, and inspiring health professionals, consumers and industry leaders. Based upon our experience, HAB's commitment to provide a promotion and marketing toolkit, market information and leadership training is unparalleled. These expenditures no doubt have considerable value to HAB members and other actors in the supply chain engaged in the buying and selling of Hass avocados and ensure annual increases in the value of avocados consumed on a per capita basis. We also view HAB efforts as synergistic complements with the programs undertaken by its member associations. The Board's efforts provide a strong foundation for more targeted promotion and marketing efforts of its member organizations evaluated below and allow the industry to speak with one voice when creating top-of-mind brand recognition.

4.3.   California Avocado Commission Promotion Programs

Revenues accruing to the CAC from HAB rebates and its own ad valorem assessment are reported in Table 4, along with CAC's aggregate annual promotion expenditures.

Table 4. CAC Assessment Revenues, HAB Rebates, and Promotion Expenditures ($)

	2018	**2019**	**2020**	**2021**	**2022**
	California Avocado Commission				
State / CAC Assessment Revenue	8,660,863	8,364,916	8,077,521	5,693,840	8,399,945
HAB Rebate Revenue	6,385,531	4,135,923	7,005,515	5,159,076	5,386,470
Marketing Program Expenditures[a]	9,612,755	6,731,188	10,661,812	10,750,358	8,905,379

[a] Includes expenditures on foodservice promotion events.

With the exception of 2021, CAC's own assessment revenue remained relatively stable over the entire review period, despite significant fluctuations in shipments and prices. Assessments are collected as an ad valorem fee and significantly higher prices compensated for a relatively low harvest in 2019 due to wildfires that severely impacted some growers. In contrast, 2020 was a year with an unusually high California harvest, but lower retail prices. Since HAB's rebate revenue is collected on a per lb. basis, the rebate revenue reported in Table 4 directly reflects these fluctuations in shipments. Other than during 2020, total CAC revenues declined over the review period from $15,046,394 in 2018 to 13,786,415 and reflect decreases in state assessments and a

lower market share of California avocados. Marketing and promotion expenditures fluctuated throughout the review period and were lower in 2022 compared to 2018.

The CAC's overarching marketing strategy during the review period has been to promote California avocados as "the world's most-valued and desired" avocados. CAC's efforts to position California avocados as a premium product aim at optimizing value-added and increasing revenue streams to market participants across the entire supply chain. CAC has continued to implement a multifaceted marketing strategy in pursuit of the following objectives:

- Increasing California avocado perceived value, preference, and loyalty among consumers.

- Retaining or increasing the high awareness of the California avocado growing region.

- Aspiring to maintain price premiums and higher-than-average consumer prices.

A key first pillar is to directly promote superior freshness, health, and sustainability benefits of California Hass avocados to consumers in the Western United States with a particular emphasis on California's major metropolitan retail markets (e.g., San Diego, Los Angeles, and San Francisco). An established preference for avocados grown in California by affluent consumers in these markets directly translates into a willingness to pay premium prices when they are in season. Strategic partnerships that stress branding opportunities emphasizing local and responsible production, as well as short supply chains, further lead to increased profitability for retailers, foodservice operators, and wholesalers. CAC continues to utilize a wide range of traditional and digital media to communicate its "grown in California" messages.

Although CAC continues to provide in-store displays and promotional programs to participating retailers when California avocados are in season (spring through early fall), CAC shifted its focus towards promoting messages via traditional and digital media with a pulsing media schedule. CAC intensifies its efforts during the summer month, continuing to feature its 10-year

tradition of celebrating June as California avocado month, while maintaining a presence and premium-quality messaging year-round.

CAC's own content creation favored video, website maintenance, search engine optimization, and direct social media messaging. CAC's investments that expand its data gathering and analytic capabilities further support its aim to maintain high levels of year-round California avocado awareness.

Efforts to reach target audiences directly are supported by a second pillar of collaborations with key influencers such as artisan chefs, registered dietitians, and food bloggers who serve as brand advocates. These key influencers, many of whom maintain active social media accounts, effectively communicate advantages of California avocados to premium consumers and can reach younger audiences as well. Throughout the review period, CAC hosted exclusive events and interactive tutorials for long-time partners (e.g., Brandon Matzek of *Kitchen Konfidence*) and newly recruited social media influencers during which attendees experienced first-hand what it takes to grow California avocados. Having picked California avocados directly from the tree, observed different growth stages of the trees, watched a grafting demonstration, and learned about grower sustainability practices as well as packing house processes, these brand advocates can authentically communicate these practices and innovate delicious dishes featuring California avocados.

These first two pillars aren't always clearly distinguishable and there is significant overlap and synergies between both. They are further supported by efforts and programs that define the third pillar—CAC's engagement with food merchandisers primarily via its foodservice and chain promotion program introduced in 2000. These collaborations and long-term contracts build high-value distribution and marketing opportunities for California avocado producers, while strengthening consumer perceptions of added value of California avocados.

The share of CAC's marketing budget devoted to each of these pillars remained relatively stable over the review period. The largest share, 73.5% of the promotion budget, was devoted to consumer marketing through the various media and PR efforts, ranging from a low of 61.6% in FY 2018-19 to a high of 78.1% in FY 2021-22. Foodservice and chain promotions comprised the second most important expenditure despite significant fluctuations ranging from 23.4% in 2018-19 to 10.9% in 2020-21 and slowly increasing in 2021-22 to 13%. Less than 10% of CAC's promotion budget has been allocated to retail promotions.

In our view, CAC is pursuing a very sensible marketing strategy that is complementary to the types of expenditures being made by the HAB. It reflects a significant increase in digital direct-to-consumer messaging overall. The observed adjustments and relatively greater allocation of funds to the first and second pillars of its marketing efforts (consumer marketing and consumer PR) are justified by CAC's own consumer research and evaluation of select digital campaigns.

One challenge all associations promoting avocados via the foodservice channel faced during the review period is that these marketing efforts were significantly disrupted during the first months of the pandemic. Consumer changing perceptions of freshness throughout the pandemic further resulted in a shift of what they prioritized in food-away-from-home purchases. They began looking for new and inspiring items that allowed them to indulge and take a break from preparing more meals at home. Nevertheless, we view maintaining its third pillar as essential to CAC's effective messaging and value proposition. CAC's foodservice promotions and chain program that emphasized short supply chains and encouraged featuring of new and innovative menu items were likely especially effective during this review period. Participants continued to display the CAC logo and provide materials on their websites and menus, at sponsored events, or when featuring items. Well-established and long-term contractual relationships helped solidify handler

commitment to California avocados and tailored programs for foodservice operators and chain restaurants with a sizable and loyal consumer base.

We conclude that CAC was able to effectively leverage and encourage foodservice operators, brand advocates, influencers, and fans to share their experiences and communicate the "why-California Avocado" messages that increased awareness, purchase consideration and preference for California avocados among premium California consumers. Despite experiencing harvest reductions and supply-chain challenges, CAC's marketing and promotion programs likely increased demand for California avocados.

4.4. Chilean Avocado Importers Association Promotion Programs

CAIA and its marketing partners have faced the challenge that Chilean Hass avocado exports to the United States have varied widely over the review period. Chilean imports and, accordingly HAB rebate revenues to CAIA, declined dramatically in 2020 before slowly increasing once more in the following years. Annual revenues from HAB rebates and member assessments are summarized in Table 5, along with CAIA's total marketing expenditures for each year.

Table 5. CAIA Rebates from HAB Rebates and Promotion Expenditures ($)

	2017/18	2018/19	2019/20	2020/21	2021/22
HAB Rebate Revenue	N/A	1,311,655	572,194	42,645	364,677
Marketing Program Expenditures	N/A	1,490,339	1,271,092	323,777	217,061

Note: 2017/18 data not available.

CAIA reduced its marketing expenditures in the United States significantly over the review period, especially during the last two years. Nonetheless, CAIA continued to pursue a diversified marketing strategy that consists of collaborations with brand ambassadors, content creation and seasonal messaging via its website and social media platforms (e.g., Facebook, Twitter, Instagram, and Pinterest), as well as trade marketing that implements retail-specific programs to generate increased in-store presence in select markets where avocados from Chile are available on a consistent basis. CAIA defines metropolitan cities in the Western United States (e.g., Los Angeles, San Diego, Sacramento, San Francisco, Seattle, Portland, San Jose) as its primary markets. Select cities on the Eastern and West Central United States (e.g., Philadelphia, Newark, Buffalo, Rochester, Boston, Denver, Phoenix, and Salt Lake City) serve as a secondary market.

CAIA has continued its partnerships with leading retail chains operating in these regions and metropolitan areas for in-store displays, demonstrations, volume/promotion incentives, as well as dissemination of recipes. Its presence at the Global Produce and Floral Show organized by IFPA (previously Produce Marketing Association Summit) helps maintain partnerships and contracts with retailers in these markets, although supply challenges and fluctuations in funding have meant that the number of partner retailers has varied over the review period.

A consistent theme in CAIA's promotion activity is to create a Chilean brand that capitalizes on the natural greenery and beauty of the country, emphasizing the theme "Chile. The land of avocado." The messaging creates a strong brand identity by emphasizing that Chilean

avocados come from "a land rich in soil, sunshine and spirit." This messaging is also reinforced through a new strategic partnership initiated in 2018 with Chilean pro golfer Joaquin Niemann and renewed throughout the review period. Nieman has become the face of Chilean avocados and is featured in TV ads and social media campaigns. These efforts further establish an underdog mentality that turns challenges into opportunities and celebrates successes via inspirational messages like "Avocados from Chile. Fuel for the Game" that complements invoking Chile's natural beauty, while reinforcing the message that consuming fresh avocados contributes to a healthy, fun, and active lifestyle.

CAIA has faced significant challenges, especially during the last two years. Nonetheless, through its strategic sponsorship with Niemann and consistent messaging, focusing on creating high-impact, geo-targeted messages during a clearly specified time window, point of sale displays, and promotions, CAIA has likely been able to capture consumers' attention during the relatively short marketing season in select retail environments. We also believe that it has successfully reached its target audience of adults aged 25-54 who embrace a foodie/healthy lifestyle in these select markets.

However, Chilean supplies to the U.S. continue to vary widely from year to year. Reliability as a supplier is integral to success as a produce marketer and partner in promotions in the United States. If CAIA continues to periodically retrench from promotion partnerships due to low supplies of product and limited funding, established relationships are likely to be challenged.

4.5.   Colombia Avocado Board Promotion Program

The application submitted by the Colombia Avocado Board (CAB) to operate under HAPRIO was approved by the USDA in early 2020. CAB became the newest certified importer association and began receiving rebate revenues during the same year. Table 6 documents a rising revenue stream from 2020 to 2022 and steadily increasing marketing support expenditures exceeding $200,000 in 2022.

Table 6. CAB Rebates from HAB and Promotion Expenditures ($)

	2018	2019	2020	2021	2022
	Colombia Avocado Board				
HAB Rebate Revenue	-	-	149,043	139,487	888,444
Marketing Program Expenditures	-	-	6,764	89,595	219,372

While CAB's expenditures primarily covered administrative costs, website development, the design of a logo, they also increased CAB's presence at trade shows and its active participation in industry associations like the New York Produce Show and the International Fresh Produce Association (IFPA).[11] CAB also began creating ads for produce industry publications like the *The*

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[11] In January 2022, the Produce Marketing Association and United Fresh merged to create one an entirely new organization to supersede both.

Packer and *Produce News*. These efforts will allow CAB to build strategic retail and foodservice partnerships going forward and design marketing campaigns that can communicate a unique positioning theme to specified target markets and consumers. Our assessment is based solely on the review of marketing expenses provided and we conclude that CAB is moving in this direction. One suggestion for CAB is to submit additional marketing materials that allow taking a closer look at specific activities in the next review period.

4.6.   Mexican Hass Avocado Importers Association/Avocados from Mexico Programs

Table 7 indicates the revenue streams flowing to AFM/MHAIA from HAB and AFM's aggregate promotion expenditures during the review period.[12] AFM's revenues and marketing expenditures continued to increase each year, except for 2022, reflecting a decrease in imports to the United States that year. AFM's promotion budget continues to exceed the combined budgets of CAC, CAIA, PAC, and CAB, as well the non-rebated revenues retained by the HAB.

Table 7. Avocados from Mexico Revenues and Marketing Program Expenditures ($)

	2017/18	2018/19	2019/20	2020/21	2021/22
	Avocados from Mexico				
HAB Rebate Revenue	39,217,889	42,384,330	42,605,604	50,204,353	42,807,090
Marketing Program Expenditures	43,891,988	47,688,173	47,397,152	53,703,566	52,871,401

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[12] We received no information on the voluntary assessment income generated from APEAM members. Expenditures in Table 7 exceed HAB rebate revenues, reflecting AFM's additional revenue sources.

These substantial financial resources, as well as the year-around availability of avocados from Mexico, enables AFM to explore unique marketing opportunities but also creates a unique dual responsibility. AFM understands that it is uniquely positioned to "Build brand equity for Mexico and drive general avocado demand." Its efforts throughout the review process are aimed at strengthening its brand recognition and ensuring that AFM continues to capture the largest share of the expanded volume going forward.

Older, more affluent female consumers are identified as AFMs primary target consumer. In retail promotions, AFM pursues a share-of-wallet growth strategy that focuses on these active, medium and heavy avocado consumers, but, unlike other member associations, AFM is able to reach mainstream America more generally as well. AFM continued to establish and reinforce the synergy between guacamole and football via its TV presence. As the only produce brand that advertises during the Super Bowl, it leverages the passion for the Super Bowl—still the most watched TV event in the United States—as a catalyst for AFM's brand equity and campaigns like "Avocado Nation" that guide message creation and data collection.[13]

A second, clearly specified communication goal for AFM is to ensure that Hispanics don't lose their emotional connection to avocados and that avocado consumption remains relevant in their acculturation processes. AFM continues to allocate significant expenditure ($3 to $4 million annually) to Hispanic markets. AFM and MHAIA were severely impacted by the COVID-19 pandemic and quickly pivoted during the early months of the pandemic, defining the safety of their people as their primary focus. AFM reassessed its budget, implemented a savings plan to minimize losses and increased communications with importers and clients. For instance, AFM had to pivot and reallocate planned promotions during Cinco de Mayo, one of its major marketing events, to "make the best out of Cinco (at home)." While AFM pursued a reactive strategy in 2020, it came

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[13] AFM promotes Mexican Hass avocados at several other high-profile live television events as well.

back strong with a revised proactive strategy that included much expanded, volume-driven retail promotion programs, the first national bag promotion, and an updated education campaign that focused on hygiene & extended preservation.

The consistent vibrant, positive, and magnetic communication style of AFM's messaging purposefully reinforces the "Mexicanity" of its brand. Its messages focus on health benefits and positivity by making an appealing brand promise of goodness via a triad of "Healthy, Tasty & Fun" that is "always good." The shift from "always in season" to "always good" and messages like "You had me at good fats" reflect AFM's updated positioning strategy that emphasizes an overall feel good party attitude and emotional benefits. AFM and MHAIA are also an impressive presence at the Global Produce and Floral Show and maintain many retail collaborations.

Furthermore, AFM actively engages in the trade foodservice channel to distribute educational materials and understands the need to inspire consumers by offering new recipes featured across all communication channels. AFM wants to become the number one source of avocado culinary inspiration. These efforts are aligned with a revision of its marketing and promotion in the foodservice channel that target foodservice decision makers. In 2022, AFM added a patron program that focused on delivery and pick-up solutions for fresh, hygiene, and extended preservation by distributing practical tips via foodservice influencers and brand ambassadors.

In the aftermath of the early months of the pandemic, AFM fully committed to being on the forefront of produce available via E-Commerce and increased its shopper marketing budget over the entire review period from just over $10 million in 2018 to over $15 million in 2021. Its trade and retail promotions also increased from $4.3 million to $7.3 million. These changes mirror a general trend toward increases in sales promotion in food retail during the review period and reflect AFM's efforts to balance price/value considerations. The largest share of its expenditures ($25 million or around 50% on average) funded consumer marketing and innovation efforts,

however. Although expenditures did not fluctuate much, AFM continuously increased digital marketing expenditures and increasingly favors mass personalization of messages that allows it to add sustainability messages, as well the economic impact of avocado production with select audiences.

Over the review period AFM more than doubled its expenditure (from less than $1 million in 2018 to $2.2 million in 2021) on research analytics and engaged in its own assessments that continue to inform the strategies it pursues. More generally, AFM has achieved what few commodity promotion organizations have been able to accomplish. It has been able to generate sufficient funds to directly target consumers through national campaigns via traditional media channels and personalized digital messaging to establish a well-recognized produce brand. AFM's promotions continue to capitalize on the consistent availability of Mexican avocados and highlight fresh Hass avocados as a versatile and fun food for special occasions and everyday consumption.

Given the large and growing Hispanic population segment in the United States and the strong cultural identity embraced by most Hispanics, AFM's targeted messaging for Hispanic populations, celebrating and popularizing the "Mexicanity" of the brand more broadly strikes us as a potentially very effective marketing strategy. AFM further understands that promotions via the foodservice channel can create meaningful and authentic experiences that allow consumers to develop long-lasting habits. Finally, AFM's increased shopper marketing and trade retail promotions likely reinforced brand loyalty and captured consumer attention at point of sale. In conclusion, we expect that AFM's marketing and promotion efforts have had a significant impact on the favorable benefit-cost ratios reported in this review.

A thorough evaluation of AFM's many marketing efforts would require a strategically timed (for analytic purposes) rollout of campaigns and sharing of digital as well as social media data. We urge AFM to provide more detailed materials of the content of specific programs and

initiatives like their national bag campaign and patron program to enable analysts to describe and assess its efforts in more detail. However, it is also important to note that media metrics and key performance indicators developed for digital and social media marketing (e.g., reach, impressions, engagement) cannot be directly linked to increased sales and a discussion of appropriate metrics and evaluations is currently ongoing.[14]

4.7. ***Peruvian Avocado Commission Promotion Programs***

The rebate revenues received by PAC from HAB and PAC's annual marketing program expenditures for the review period are provided in Table 8. PAC Rebates from HAB and Promotion Expenditures ($)**Error! Reference source not found.**. Peru's Hass avocado shipments to the United States and its rebate revenue consistently increased over the review period.

Table 8. PAC Rebates from HAB and Promotion Expenditures ($)

	2018	2019	2020	2021	2022
	Peruvian Avocado Commission				
HAB Rebate Revenue	3,714,623	3,769,212	3,427,127	3,778,070	5,430,566
Marketing Program Expenditures	3,204,345	3,275,365	2,747,167	3,150,104	6,291,862

Avocados from Peru typically enter the U.S. market in late May, with the season continuing in most years through August. Accordingly, PAC has marketed Peruvian avocados as the "summer

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[14] Reach can be understood as a measure of the number of people reached, while impressions indicate how often a message was seen (on apps, websites, etc.). Finally, engagements measure clicks, likes, comments and shares on social media.

avocado." Traditional core markets have been in the Eastern United States: Boston, Baltimore, New York Philadelphia, and Washington, DC, but a large number of "expansion markets" have been identified, which include major cities across the United States. PAC's primary focus on the Eastern U.S. market is intended to limit head-to-head competition with California avocados, which share a similar marketing season and focus on the Western United States

With imports and rebate revenues rising, PAC continues to diversify its marketing strategy. PAC invests in five key areas: Event sponsorships that can create unique experiences in the sports, fitness and entertainment sectors, exclusive foodservice partnerships (e.g., Chipotle), traditional media and outdoor messaging, digital and social media messaging, and retail programs that include in-store demos and the distribution of ripening bags. PAC also maintained its presence in the trade press via targeted press releases.

Throughout the review period PAC placed ads on FOX 5 WTTG, a television station in Washington DC, and partnered with NBC and Telemundo to run tagged TV spots that also featured its retail partners during the 2021 Tokyo Olympics. In order to reach an even broader audience, PAC ran magazine ads (e.g., Vogue), featured on Bus Wraps and customized bus stops. Its increased digital and social media presence is well integrated with these efforts and once more tags its retail partners (e.g., Costco, Grocery Outlet, Sam's Club, Walmart, etc.). PAC partners with Colette Dike, the founder and editor in chief of Food Deco, a website dedicated to all things food and style, prominent YouTuber, and Instagram influencer who published *The Ultimate Avocado Cookbook with 50 Modern, Stylish & Delicious Recipes to Feed Your Avocado Addiction*.

PAC also partnered with Chicory, a leading contextual commerce advertising platform that reaches 123 million high-intent grocery shoppers and transforms recipe content into shoppable grocery lists to promote its own cookbook and recipes. PAC placed ads on Hulu and Sling, jointly sponsored music listening on Spotify and Pandora with select retailers, as well as placed ads on

food, sailing, rowing, Olympics, health, fitness, and LGBTQ podcasts. These ads feature educational messages like "How to know when your avocado is ripe" and the PAC logo. Finally, these efforts are linked to in-store and foodservice promotions than ran on key holidays and activities during the summer months (e.g., Memorial Day Weekend, 4th of July Holiday, summer grilling, World Avocado Month in June, World Guacamole Month in July, back to school, and Labor Day).

PAC utilizes coupons as well as educational messaging that feature its logo to increase sales. PAC further implemented the first marketing support program for organic avocados in 2021. Finally, one noticeable campaign is its new "Eat Healthy, Live Green" campaign executed in 2022. It effectively communicated PAC's commitment to health, social responsibility, and the environment and was motivated by projections of imports expected to increase by 40% compared to the year prior. The featured summer Tesla giveaway is another example of strategic partnerships pursued by PAC meant to encourage healthy and sustainable living. In its own words: "Consuming avocados from Peru provides benefits to the body and the environment – just as electric vehicles cut down on pollution and carbon emissions."

PAC's forward-looking integrated brand promotions executed throughout this review period coupled with its pricing strategy (Peruvian avocados are offered at a lower price than avocados imported from elsewhere) allowed Peruvian importers to reach large and diverse consumer demographics. Many of its messages resonate with all ages, including younger audiences. Its creative approaches and shared practical ideas created brand loyalty and grew avocado demand.

5. Panel Econometric Model of Fresh Hass Avocado Sales in Regional U.S. Retail Markets

This section presents analysis of demand for fresh Hass avocados at retail utilizing monthly scanner data aggregated to the regional level. The country associations also promote fresh Hass avocados to the foodservice sector. Because we lacked sufficient data to analyze sales to foodservice, we focus exclusively on the retail market and drop from the analysis any promotions targeted specifically to foodservice.

Data for the econometric analysis include retail scanner data provided by IRI/Circana and accessed through the HAB and expenditures to promote fresh Hass avocados made by the member associations.[15] Information on Hass avocado promotional expenditures was collected from each of the five member associations--AFM, CAB, CAC, CAIA, and PAC. Expenditures made by the HAB itself also build demand for Hass Avocados by, for example, revealing and publicizing their health benefits, but given the long-term focus of these expenditures we did not include them in this analysis.

In what follows, we first discuss the process of constructing the dataset and aggregating expenditures across the country associations. We then discuss the econometric model designed to estimate the retail demand for fresh Hass avocados and identify the impact of Hass avocado promotions on sales in the various regions.

5.1   Construction of the Promotion Variable

The changing nature of promotions conducted by the country associations necessitated some changes in the approach taken by this review relative to the prior five-year review conducted by Ambrozek, Saitone, and Sexton. These authors were able to obtain sufficiently disaggregated data

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[15] Information Resources Inc. (IRI) merged in August 2022 with the NPD Group. The combined company renamed and rebranded itself as Circana. We use the term IRI/Circana because IRI name is widely known and familiar.

from the member associations to conduct an analysis at the level of the metropolitan areas and using weekly data. Few promotions were targeted to specific metropolitan areas during this review period, with increasing reliance instead on digital promotions that are national in scope and promotions targeting broader geographic regions.

Although some country associations reported promotion expenses by week in some categories or by listing specific dates for promotions, such reporting was not consistent or systematic. Lacking sufficient information to construct a weekly promotion variable, we instead aggregated expenditures across associations to the month level, where reporting by the associations was more uniform. For promotions that took place in multiple months, the total expenditures were distributed evenly across the different months. This imputation method was adopted based on consultation with personnel at the country associations.

The retail sales data compiled by IRI/Circana and accessed through the HAB include total weekly retail sales in value and volume for fresh Hass avocados (aggregated across all relevant product codes) in 45 distinct local market areas and eight regions and spanning the five years, 2018 – 22, that encompass the review period. These data represent an aggregation of retail outlets that includes grocery, mass merchandisers, club stores, drugstores, dollar outlets and military commissaries. An average price or unit value is computed in each market and each week by dividing sales value by the number of fresh Hass avocados sold.

Population data for each market area were provided by IRI/Circana on an annual basis and were utilized to convert sales volume to a per capita basis in each region. In this manner the analysis controls for changes in demand due to changing population levels within the metropolitan areas and regions.

The eight regions and major metropolitan areas within them are as follows:[16]

- California: Los Angeles, Sacramento, San Diego, San Francisco.

- Great Lakes: Chicago, Cincinnati/Dayton, Columbus, Detroit, Grand Rapids, and Indianapolis.

- Mid-South: Baltimore/Washington, Charlotte, Louisville, Nashville, Raleigh/Greensboro, Richmond/Norfork, and Roanoke.

- Northeast: Albany, Boston, Buffalo/Rochester, Harrisburg/Scranton, Hartford/Springfield, New York, New England, Philadelphia, Pittsburgh, and Syracuse.

- Plains: St. Louis.

- South-Central: Dallas/Ft. Worth, Houston and New Orleans/Mobile.

- Southeast: Atlanta, Jacksonville, Miami/Ft. Lauderdale, Orlando, South Carolina, Tampa/St. Petersburg.

- West: Boise, Denver, Las Vegas, Phoenix/Tucson, Portland, Seattle/Tacoma, Spokane.

Hass avocado promotions conducted by the member associations can be broadly classified as digital or offline. The digital category includes posts on social media, websites, blogs, or involving influencers such as brand ambassadors. Offline promotions include print, radio, television, billboards, event sponsorships, retailer campaigns, trade marketing, retail communications, and recipe development.

Given the manner in which member associations compiled and provided data on their promotional activities, we worked exclusively with promotions and Hass avocado sales data aggregated to monthly levels and to the aforementioned eight regions. This approach required allocating member-association promotion expenditures across the eight regional markets. Not all

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[16] IRI/Circana data scientists have developed methods to aggregate and impute sales information so that the reported regional sales data represent a comprehensive measure of product movement within each region.

reported promotion expenses had regional variation. Any expenses that were digital or did not specify a region were classified as national in scope. This designation was again made following consultation with personnel affiliated with the associations reporting such expenses. National expenses were distributed across all regions in proportion to the region's population as reported by IRI/Circana. Population weights were calculated for each year of the review period.

An additional issue in aggregating expenses to the regions reported by IRI/Circana is that the country associations do not always use these same regional designations, instead using designations of their own construction such as "East," "Central," "Midwest," and "South." In those cases, we distributed the promotional expenses evenly across the IRI/Circana regions that seemed to encompass the regions designated by the associations. Expenses designated to specific cities were allocated to the IRI/Circana region where the city was located. Lastly, any expenses that did not vary either over time or across geographical regions were dropped from the econometric analysis but included in the calculation of the cost – benefit ratio.[17]

5.2   Summary Statistics

Table 9 and Table 10 provide summary data on fresh Hass avocado sales in the metropolitan areas and the regions for the 2018 – 22 review period. The summary data include mean population, mean and standard deviation (SD) of monthly per capita fresh Hass avocado sales quantity, mean and standard deviation of average selling price (ASP), and mean and standard deviation of per capita monthly retail sales value. The average per capita monthly retail sales of fresh Hass avocados nationally during the five-year review period was 0.48, with an average price of $1.16 per avocado, giving an average monthly per capita sales value of $0.55. Notably ASP in this review period is

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[17] Unless a promotion expenditure varies either over time or across regions, it has no value in identifying the impact of promotional expenditures on sales.

less than the $1.20 average reported in the 2013 - 17 review by Ambrozek, Saitone, and Sexton. Adjusting the 2018 – 22 average price for inflation, using the Consumer Price Index at the midpoints of the two data periods yields a real 2018 – 22 average price in 2013 – 17 dollars of $1.053, or a 12% decline in real terms.

Table 9. Summary Statistics for U.S. Metropolitan Areas: 2018 - 22

Market	Mean	Mean [SD]	Mean [SD]	Mean [SD]
	Population (millions)	Per capita avocados sold per month	Ave. sales price (cents)	Per capita retail sales value (cents/month)
Albany	1.15	0.45 [0.10]	119 [17]	52.99 [13.69]
Atlanta	5.58	0.54 [0.10]	106 [15]	56.78 [12.23]
Baltimore/Washington	8.79	0.43 [0.08]	137 [12]	58.55 [11.52]
Boise	0.74	0.61 [0.12]	128 [19]	78.17 [16.39]
Boston	5.85	0.44 [0.09]	145 [14]	63.36 [13.14]
Buffalo/Rochester	2.48	0.30 [0.06]	124 [13]	36.74 [7.60]
Charlotte	3.01	0.43 [0.09]	126 [16]	53.97 [11.07]
Chicago	9.12	0.38 [0.08]	138 [23]	52.04 [10.71]
Cincinnati/Dayton	3.06	0.40 [0.08]	111 [18]	44.34 [9.53]
Columbus	2.19	0.46 [0.09]	107 [16]	48.66 [10.24]
Dallas/Ft. Worth	7.38	0.82 [0.15]	88 [15]	72.08 [14.24]
Denver	4.30	0.91 [0.16]	117 [18]	106.10 [20.40]
Detroit	4.88	0.38 [0.07]	113 [16]	43.12 [8.38]
Grand Rapids	1.77	0.40 [0.09]	142 [19]	56.58 [11.76]
Harrisburg/Scranton	4.58	0.31 [0.07]	116 [13]	36.02 [8.40]
Hartford/Springfield	3.26	0.43 [0.09]	141 [13]	59.78 [12.58]
Houston	6.97	0.68 [0.15]	88 [16]	58.17 [10.61]
Indianapolis	2.39	0.43 [0.08]	107 [16]	45.43 [9.67]
Jacksonville	1.84	0.48 [0.09]	115 [18]	54.33 [10.53]
Las Vegas	2.26	0.68 [0.13]	109 [15]	73.38 [14.23]
Los Angeles	17.87	0.66 [0.12]	123 [16]	81.60 [16.47]
Louisville	1.32	0.38 [0.07]	109 [15]	41.61 [8.33]
Miami/Ft. Lauderdale	6.13	0.59 [0.13]	118 [19]	68.25 [14.74]
Nashville	2.07	0.56 [0.10]	105 [16]	58.58 [12.30]
New Orleans/Mobile	3.15	0.41 [0.08]	100 [16]	40.80 [7.92]
New York	20.27	0.37 [0.08]	139 [16]	50.54 [10.74]
Northern New England	3.42	0.59 [0.12]	125 [15]	73.25 [15.34]
Orlando	3.76	0.56 [0.12]	113 [19]	62.43 [12.00]
Philadelphia	6.71	0.35 [0.08]	125 [16]	43.51 [9.12]
Phoenix/Tucson	5.50	0.96 [0.18]	90 [16]	85.38 [16.56]
Pittsburgh	2.51	0.20 [0.04]	122 [15]	24.85 [5.35]
Portland	3.51	0.75 [0.15]	127 [18]	94.75 [18.41]
Raleigh/Greensboro	3.76	0.44 [0.09]	121 [15]	52.65 [10.27]
Richmond/Norfolk	3.01	0.42 [0.09]	112 [14]	46.78 [9.73]

Table 9 Continued

Market	Mean	Mean [SD]	Mean [SD]	Mean [SD]
	Population (millions)	Per capita avocados sold per month	Ave. sales price (cents)	Per capita retail sales value (cents/month)
Roanoke	2.38	0.31 [0.06]	107 [14]	33.40 [6.90]
Sacramento	3.11	0.64 [0.12]	142 [18]	90.67 [16.82]
San Diego	3.31	0.64 [0.13]	127 [18]	80.80 [17.22]
San Francisco	6.62	0.53 [0.09]	148 [16]	78.38 [14.67]
Seattle	3.96	0.57 [0.11]	154 [20]	86.48 [16.68]
South Carolina	5.66	0.35 [0.07]	116 [16]	40.08 [8.82]
Spokane	0.70	0.46 [0.09]	133 [19]	61.36 [11.96]
St. Louis	2.64	0.31 [0.06]	114 [17]	35.23 [7.18]
Syracuse	1.16	0.30 [0.06]	123 [13]	36.27 [7.81]
Tampa	3.98	0.56 [0.11]	112 [18]	62.05 [11.59]
West Texas/New Mexico	4.15	0.88 [0.17]	95 [16]	83.00 [17.13]
Total United States	328.86	0.48 [0.09]	116 [15]	55.30 [10.48]

Note: Values in square brackets are standard deviations.

Table 10. Summary Statistics for U.S. Regions: 2018 - 22

Market	Mean	Mean [SD]	Mean [SD]	Mean [SD]
	Population (millions)	Per capita avocados sold	Ave. sales price (cents)	Per capita retail sales value (cents/month)
California	39.43	0.63 [0.11]	130 [16]	81.64 [15.56]
Great Lakes	47.52	0.33 [0.06]	118 [16]	39.46 [7.89]
Midsouth	40.21	0.38 [0.08]	119 [13]	45.44 [9.11]
Northeast	57.03	0.38 [0.08]	133 [14]	49.74 [10.35]
Plains	21.72	0.37 [0.07]	113 [17]	42.08 [8.32]
South Central	40.89	0.59 [0.12]	92 [16]	53.91 [10.34]
Southeast	45.24	0.45 [0.09]	111 [16]	49.36 [9.88]
West	36.82	0.75 [0.14]	113 [16]	84.31 [16.03]
Total United States	328.86	0.48 [0.09]	116 [15]	55.30 [10.48]

Note: Values in square brackets are standard deviations.

Notable in both tables is the variation across regional and metropolitan market areas in both per capita sales and ASP. Figure 6 illustrates differences in per capita consumption by region.

The West region consumes the most Hass avocados, with mean per capita monthly consumption of 0.75 avocados, more than twice the rate of consumption in the lowest region, Great Lakes with 0.33 avocados, and roughly double the rates in the Midsouth, Northeast, and Plains regions.

Figure 6. Monthly Average Per Capita Sales by Region: 2018 - 22
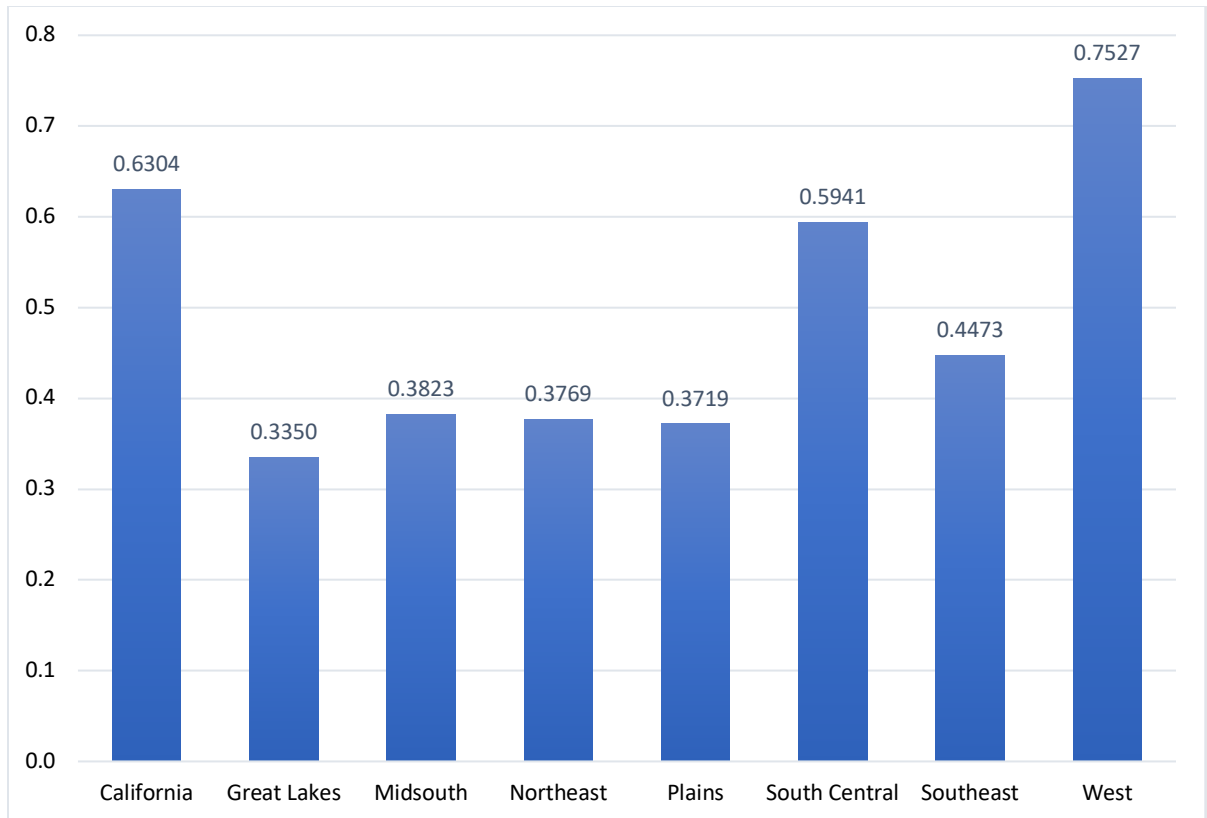
Similar variation in per capita consumption occurs across the metropolitan areas. Phoenix averages nearly one Hass avocado consumed per capita per month, while some metropolitan areas in the East and Midwest consume a third of an avocado or less per month, with Pittsburgh 0.2, Syracuse 0.3, St. Louis 0.31, Philadelphia 0.35, and New York City 0.37 representing key examples of low-consuming metropolitan areas.

The standard deviations reported in square brackets for each table indicate the average deviation from the mean across months in the 2018 – 22 review period. One way to think about these deviations is their magnitude relative to the mean—what statisticians call the *coefficient of*

variation or CV, i.e., CV = SD/mean. The coefficient of variation in monthly fresh Hass avocado consumption is remarkably stable across regions and metropolitan areas. For example, CV for the entire United States is 0.09/0.48 = 19%. The CV for the high-consuming West region is also 19%, while it is 18% for the low-consuming Great Lakes region.

The same pattern applies to the metropolitan areas. CV for high-consuming Phoenix is 0.18/0.96 = 19%, and for low-consuming New York City, it is 0.08/0.37 = 22%. The message is that fresh Hass avocado consumption in the United States continues to retain a strong seasonal component, and the relative month-to-month variation in consumption is very similar across regions and metropolitan areas. We look in more detail at the specific month-to-month variation in consumption as part of the econometric analysis.

Variability in retail prices is also noteworthy, both in terms of differences in mean prices across regions and metropolitan areas and month-to-month variation in prices within areas. In general, the retail price of fresh Hass avocados is more stable than the per capita sales. For example, for the entire United States, the CV of ASP is 15/116 = 13%.

ASP varies considerably across regions, ranging from a low of $0.92 in the South-Central region to a high of $1.33 in the Northeast. Given that fresh Hass avocados are either produced domestically in California or imported through southern ports, it makes sense that price would be greater in the northern regions due to higher shipping costs. Inspection of the tables demonstrates, however, that this pattern does not always hold. Hass avocados, for example, tend to be relatively expensive in California, with an average sales price of $1.30 during the 2018 – 22 study period. The Northern California cities of Sacramento and San Francisco have among the highest average sales prices among all metropolitan areas. Hass avocados are least expensive in the South Central and Southwest, with Dallas-Fort Worth and Houston at $0.88 and Phoenix at $0.90 representing the least expensive metropolitan locations.

5.3   Model Specification

The dataset used in the econometric analysis represents a panel because it combines both a cross section of data, namely the eight regional market areas included in the analysis, and a time series of data, namely 60 monthly observations across the five-year review period. We seek to explain monthly per capita consumption of fresh Hass avocados in each region as a function of the ASP faced by consumers in each region and month and the total amount of promotion expenditure directed to consumers in a region and month.[18]

Other factors besides price and promotion can impact fresh Hass avocado sales as well but are not of immediate interest for this study. However, these factors cannot be ignored because their omission from the econometric model could bias estimates of impacts for the variables of interest. One approach is to try to identify these factors, obtain data on them, and include them in the econometric model. The more common and preferred approach, however, is to account for factors outside of the primary model using *fixed effects*.

We introduced two types of fixed effects into the econometric model to handle seasonality in demand for avocados and growth in the demand over time. A fixed effect was introduced for each month of the year, which took a value of 1.0 for observations for each market area in that month and a value of zero for every other month. These variables account for the seasonality that is a significant factor in Hass avocado demand, and they also account for holiday effects, which

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[18] We could also consider lagged variables for promotions and price. For example, promotional expenditures in June may impact sales in June but also in July, and so on. This specification is not possible for our model due to the manner in which monthly promotion expenditures were constructed, as described in this section. The need to allocate expenditures equally across months in a multi-month campaign means that the value of promotion expenditure in any given month and its value in the preceding month are often the same. This creates a severe *multicollinearity problem* in the sense that the current and lagged values of promotion expenditures are highly correlated, making it impossible to attribute separate and distinct sales impacts to them. Because Ambrozek, Saitone, and Sexton utilized weekly data in their 2013 – 17 study, they also included the one-week lag of prices as an explanatory variable in their model. This accounted for what marketers call a "rebound effect" from price promotions. They found that higher sales from price promotions of Hass avocados in a given week were offset by about one-third by reduced expenditures the following week. Given that we are working with monthly data, this type of rebound effect is not an issue in this study.

previous reviews of HAB promotion programs have found to be important. For example, the fixed-effect variable for May will capture a demand spike due to Cinco de Mayo and Mother's Day and the July variable will account for a demand surge due to Independence Day celebrations.

We also introduced year fixed effects to account for changes in demand from year to year. This is accomplished by defining a variable for each year in the five-year review period and assigning a 1.0 to all observations during that year and a value of zero for all observation outside of that particular year.[19] Year fixed effects are particularly important for this review period, which encompasses the 2020 – 21 period most commonly associated with the COVID-19 pandemic, which affected food consumption in significant ways, most notably by severely curtailing food consumption away from home due to lockdowns and the peoples' concern about exposure to the virus in public places.

A concern with using fixed effects is that they capture explanatory power in the model that otherwise would accrue to the variables of interest—promotion expenditures and average sales price in our context. In principle, a researcher could explain all variation in a variable of interest, per capita Hass avocado consumption in our analysis, by specifying enough fixed effects. In our context, country associations might rationally promote more aggressively during months of high per capita consumption. In this case, separate fixed-effect variables for each month in the econometric model will capture month-to-month differences in per capita consumption that should be attributed to promotion expenditures. For this reason, a model with month fixed effects can be considered to yield a lower bound on the impact of promotions.

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[19] It is necessary to omit one variable from each set of fixed effects to avoid a multicollinearity problem known as the "dummy variable trap." Thus, one month (January) and one year (2018) were omitted from the model. Results are invariant to which fixed effect is omitted. The omitted variable implicitly has a value of zero and all other variables in that category are interpreted relative to the omitted variable.

A similar argument could be made regarding the eight U.S. regions included in the dataset. We could also specify region fixed effects variables that would involve creating variables that would have a value of 1.0 for an observation emanating from each region and a zero for all other observations. As the qualitative evaluation in section 4 revealed, marketers often rationally target promotions to high-consuming regions and demographic segments because they have the greatest potential to expand sales. Region fixed effects variables would capture such sales expansion that should be attributable to the promotion expenditures. By including month fixed effects, but excluding region fixed effects, we seek to strike the right balance in terms of specification of fixed-effect variables.

A final choice involves the functional form to utilize for the demand equation. We follow the approach of Ambrozek, Saitone, and Sexton in the prior five-year review and estimate the model using the two functional forms most widely used by economists to conduct demand analysis, linear and double log. In the linear model a linear relationship is assumed to hold between the dependent variable (retail volume of per capita fresh Hass avocado sales) and the explanatory variables (average sales price, promotion expenditures, and the fixed effects). In the double log model all variables except the fixed effects are converted to their natural logarithms. The double log model presumes a nonlinear (convex) relationship between fresh Hass avocado sales at retail and price and promotion.

In mathematical notation, our two models take the following form:

Linear model: $PCC_{i,t} = \alpha + \beta_1 ASP_{i,t} + \beta_2 Promo_{i,t} + \sum_{m=1}^{11} \gamma_m Month_m + \sum_{j=1}^{4} \delta_j Year_j + \varepsilon_{i,t}$,

Double log model: $\ln(PCC_{i,t}) = a + b_1 \ln(ASP_{i,t}) + b_2 \ln(Promo_{i,t}) + \sum_{m=1}^{11} c_m Month_m + \sum_{j=1}^{4} d_j Year_j + \mu_{i,t}$,

where $PCC_{i,t}$ denotes per capita consumption of fresh Hass avocados in region i = 1, ... ,8 and month t = 1, ... ,60, $ASP_{i,t}$ is average sales price per unit in cents in region i at time t, $Promo_{i,t}$ is

monthly promotion expenditure measured in millions of dollars in region i at time t, $Month_m$ is the fixed-effects variable for month m =1, …, 11, with a 12th month, January, omitted, and $Year_j$ denotes the fixed effects variable for year j, for j = 2019 – 22, with 2018 dropped. The coefficients to be estimated in the linear model are $\alpha, \beta_1, \beta_2, \gamma_m, \delta_j$. In the double log model, per capita consumption, average sales price, and promotion expenditure are represented as natural logs. Coefficients to be estimated in the double log model are a, b_1, b_2, c_m, d_j. Random error terms are denoted by $\varepsilon_{i,t}$ and $\mu_{i,t}$ in the two models.

A final econometric modeling decision is how best to specify the uncertainty inherent in any statistical model. In a well-specified statistical model, the reported coefficient for each explanatory variable represents an unbiased estimate of the unknown, true value. The statistical package will report the precision of the coefficient estimate for any variable in the form of a *standard error* of the estimate. However, standard errors can be computed according to various methods, and the analyst must choose the appropriate method.

Standard errors that are small relative to the magnitude of the coefficient indicate coefficients estimated with precision, whereas large standard errors indicate imprecisely estimated coefficients. A typical test is to compute the t statistic, which is equal to the estimated coefficient divided by its standard error. A t value of 1.645 or greater indicates with at least 90% confidence that the true value of the coefficient is not zero. A t value of 1.96 or greater indicates that the true value is not zero with at least 95% confidence. A common way to present this information that we adopt in this report is to provide what are called *p values*. The p value represents the probability that the true value of a coefficient is zero, so, for example, a t value of 1.96 that indicated 95% confidence that that the true value was not zero would yield a p value of 0.05. Low p values indicate high confidence in the accuracy of a parameter estimate, while high p values indicate low confidence.

One common approach is to report what are known as "robust standard errors." This method corrects the standard errors for any violations of the standard assumptions underpinning the linear regression model. A second approach is to cluster standard errors. In our panel model, one option for clustering is by region because the estimation errors may be correlated within region but uncorrelated across regions. One reason for correlation at the regional level is because per capita consumption varies rather widely across the regions. A second candidate for clustering would be by year. Errors may be correlated within years but independent across years for example due to the extraordinary circumstances during the pandemic, which rather drastically impacted how Americans obtained and consumed food.

Clustered standard errors inevitably lead to lower levels of statistical significance because the errors within clusters are not considered to be independent. The scientific literature on clustering emphasizes the importance of having a sufficient number of clusters, with $30 - 50$ often recommended as a minimum number.[20] In that regard clustering standard errors by eight regions or five years is well below the recommended minimum. Our solution was to cluster standard errors by both region and year, in which case we have 8 x 5 = 40 clusters, within the recommended minimum range. In what follows, we present the base model with both robust standard errors and standard errors clustered by region and year. The values of the coefficients are unaffected by this choice, but the significance levels of the coefficients differ, with lower statistical significance associated with the clustered standard errors.

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[20] See for example A Colin Cameron and Douglas Miller, "A Practitioners Guide to Cluster-Robust Inference." https://cameron.econ.ucdavis.edu/research/Cameron_Miller_JHR_2015_February.pdf

5.4 Estimation Results

We estimated the double log and linear models over the full region-month sample and for the pre COVID-19 (2018 and 2019) and COVID-19 and its aftermath (2020 – 22) subsamples. Results from estimation of the full panel econometric model are presented in Table 11. Four models are presented—double log model with robust standard errors (column 1) and with standard errors clustered at the region-year level (column 3) and linear model with robust standard errors (column 2) and standard errors clustered at the region-year level (column 4). As noted, the estimated coefficients are the same in columns 1 and 3 and 2 and 4. Only the reported precision of the estimates differs based upon the calculation of the standard errors.

Consistent with the finding of Ambrozek, Saitone, and Sexton in the prior review, we find that the double log model fits the panel data somewhat better than its linear counterpart, as indicated by the double log having greater explanatory power, as measured by the R-squared statistic at the bottom of each column and by the greater statistical significance of the regression coefficients in the double log model.

Variable	Natural log Hass avocado retail sales per capita (1)	Hass avocado sales per capita (2)	Natural log Hass avocado retail sales per capita (3)	Hass avocados sales per capita (4)
Natural log, average sales price ($)	-0.7733***		-0.7733***	
	(0.000)		(0.000)	
Natural log, promotion exp (million $)	0.0881***		0.0881**	
	(0.000)		(0.022)	
Average sales price ($)		-0.3111***		-0.3111***
		(0.000)		(0.001)
Price Elasticity at data means		[-0.7324]		[-0.7324]
Promotion exp (million $)		0.0767*		0.0767
		(0.051)		(0.192)
Promotion Elasticity at data means		[0.0602]		[0.0602]
February	-0.1295**	-0.0733*	-0.1295***	-0.0733**
	(0.045)	(0.065)	(0.000)	(0.012)
March	0.0730	0.0281	0.0730***	0.0281**
	(0.236)	(0.414)	(0.003)	(0.035)
April	0.0852	0.0333	0.0852**	0.0333*
	(0.167)	(0.327)	(0.013)	(0.056)
May	0.1858***	0.0804**	0.1858***	0.0804***
	(0.003)	(0.026)	(0.000)	(0.001)
June	0.1289**	0.0475	0.1289***	0.0475**
	(0.043)	(0.180)	(0.003)	(0.041)
July	0.1869***	0.0547	0.1869***	0.0547**
	(0.010)	(0.148)	(0.005)	(0.038)
August	0.1439*	0.0283	0.1439**	0.0283
	(0.051)	(0.451)	(0.033)	(0.258)
September	0.0123	-0.0168	0.0123	-0.0168
	(0.858)	(0.638)	(0.784)	(0.413)
October	-0.0666	-0.0418	-0.0666***	-0.0418***
	(0.295)	(0.213)	(0.003)	(0.000)
November	-0.2211***	-0.1055***	-0.2211***	-0.1055***
	(0.001)	(0.001)	(0.000)	(0.000)
December	-0.1219*	-0.0660**	-0.1219***	-0.0660***
	(0.056)	(0.049)	(0.000)	(0.000)
Year 2019	0.0702*	0.0287	0.0702	0.0287
	(0.082)	(0.145)	(0.613)	(0.671)

Table 11 Continued

Variable	Natural log Hass avocado retail sales per capita	Hass avocado sales per capita	Natural log Hass avocado retail sales per capita	Hass avocados sales per capita
Year 2020	0.1312***	0.0665***	0.1312	0.0665
	(0.001)	(0.003)	(0.346)	(0.380)
Year 2021	0.0924**	0.0413*	0.0924	0.0413
	(0.024)	(0.057)	(0.509)	(0.575)
Year 2022	0.1401***	0.0540***	0.1401	0.0540
	(0.000)	(0.006)	(0.301)	(0.425)
Constant	-1.8696***	0.7914***	-1.8696***	0.7914***
	(0.000)	(0.000)	(0.000)	(0.000)
Standard Errors	Robust	Robust	Clustered	Clustered
Number of observations	480	480	480	480
R-squared	0.252	0.200	0.252	0.200

Notes: p-values in parentheses, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Average sales price in a market area during the month is strongly negatively correlated with sales volume. This effect is highly statistically significant in both the linear and double log models regardless of the method used to compute standard errors. Both the linear and double log models yield comparable estimates for the price responsiveness of Hass avocado demand. The price elasticity estimate for the double log model is -0.77, while for the linear model (evaluated at the sample mean values for ASP and per capita monthly demand) the estimate is -0.73.[21] This means, for example, that a 10% decrease in ASP in a month is associated with 7 – 8% increase in sales for that month.

These estimates are somewhat lower than those found by Ambrozek, Saitone, and Sexton in the 2013 – 17 review. Using weekly data, those authors found that Hass avocado demand is quite responsive to price changes, e.g., due to price promotions, but then with a rebound effect of

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[21] Linear model elasticities change as quantities and prices change, so the analyst must pick a "point" on the demand surface for evaluating the elasticity, with the data means representing the point most chosen.

lower sales in a week following promotion. Our use of monthly data nets these effects, resulting in a somewhat lower overall response of sales to price movements.[22] A second factor is that the COVID-19 pandemic may have affected the price responsiveness of retail Hass avocado demand, a consideration we address when discussing the pre-COVID-19 and COVID-19 and aftermath subsamples.

Promotional expenditures also have a strong positive effect on Hass avocado demand. The estimated elasticity of demand with respect to promotion expenditures in the double log model is 0.088 and is statistically significant across both specifications of the standard errors. The estimated impact of promotions in the linear model is similar. Evaluated at the data means, the promotion elasticity is 0.06 and is statistically significant for one of the two methods for computing standard errors. These results indicate that an expansion of monthly promotion expenditures in a region by 10% expands demand by 0.6 – 0.9%. These promotion elasticities are considerably larger than those estimated by Ambrozek, Saitone, and Sexton in the prior review. Their baseline promotion elasticity from the double log model was 0.016.

We expect the difference is due in part to the difference in periodicity of data used in the two analyses—monthly in our case, weekly in theirs. A month time window gives promotions a longer period to impact sales than a weekly window. The difference may also reflect an increase in the overall effectiveness of promotions conducted during this review period. As we have noted, the member associations adapted their promotion strategies in the current review period, for example relying more on digital promotions and social media and increasing their sales promotions such as coupons relative to prior periods.

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[22] To be more specific, Ambrozek, Saitone, and Sexton found that the rebound effect offset about 1/3 of the weekly sales increase due to a price promotion. If we multiply their estimated price elasticity of 1.3 by 2/3 to capture the net sales effect, the resulting price elasticity is -0.87, closely comparable to our estimates.

The coefficients on the fixed effects variables hold interest because they inform us about the seasonality of demand for fresh Hass avocados and the year-by-year growth in demand over time. Figure 7 plots the coefficients from the month fixed-effect variables for the linear model, with January, the omitted month, representing the baseline with an implicit value of zero. Recall that over the sample period the overall U.S. average monthly consumption of fresh Hass avocados at retail was 0.48. February consumption is less than in January by 0.073 avocados, most likely reflecting that February is a short month and that Hass avocado purchases for Super Bowl events depend on the date of the event and often take place at the end of January.

The month fixed effect variables demonstrate that Hass avocado sales at retail continue to follow a strong seasonal pattern, as found in prior reviews. Consumption is high during the spring and summer months relative to fall and winter. The peak month is May, reflecting both Cinco de Mayo and Mother's Day celebrations, followed by July. Hass avocados are least consumed in November. The difference in May vs. November retail per capita consumption is 0.186 Hass avocados, implying that per capita consumption is 39% higher in May than November.

The year fixed effect variables also reveal an interesting pattern. The omitted year is 2018, the first year of the review period. The linear model shows that per capita retail demand in 2019 was 0.029 Hass avocados (6%) greater than in 2018. Retail demand was even higher in 2020, with 0.067 (14%) more Hass avocados sold per capita relative to 2018. Some of this retail demand surge no doubt was due to curtailment of foodservice sales due to the COVID-19 pandemic and resultant. increased food consumption at home. Per capita sales in 2021 and 2022 were also higher than in the early years of the review period, but not as high as in 2020.

Figure 7. Monthly Fixed Effects from the Linear Model with Full Sample
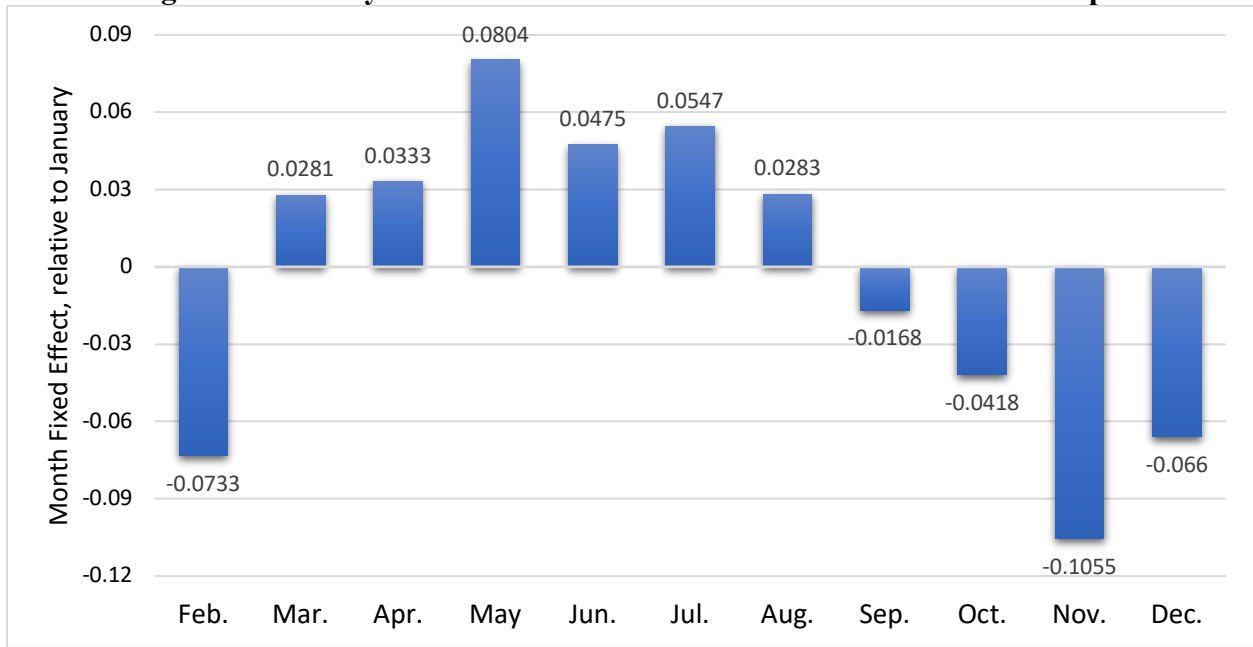
5.5 Pre- COVID-19 *and* COVID-19 *and Aftermath Subsample Analysis*

Given that the COVID-19 pandemic hit the United States in the middle of the five-year review period, it made sense to split the sample into 2018 – 19 (pre COVID-19) and 2020 – 2022 (COVID-19 and aftermath) subsamples to determine the pandemic's impacts on the retail market for fresh Hass avocados. Table 12 contains the estimation results for the linear and double log models. For parsimony we present only the results for standard errors clustered by region and year.

Table 12. Panel Econometric Results Pre COVID-19 and COVID-19 and Aftermath Periods

Variable	Pre COVID-19		COVID-19 and Aftermath	
	Natural log Hass avocado retail sales per capita (1)	Hass avocado sales per capita (2)	Natural log Hass avocado retail sales per capita (3)	Hass avocados sales per capita (4)
Natural log, average sales price ($)	-1.3099***		-0.4957*	
	(0.000)		(0.058)	
Natural log, promotion exp (million $)	0.0894		0.0857*	
	(0.244)		(0.072)	
Average sales price ($)		-0.5020***		-0.2012
		(0.001)		(0.137)
Elasticity of Demand at data means		[-1.3044]		[-0.4447]
Promotion exp (million $)		0.0879		0.0691
		(0.495)		(0.334)
Promotion Elasticity at data means		[0.0678]		[0.0548]
February	-0.1927***	-0.0981	-0.1256***	-0.0724**
	(0.009)	(0.127)	(0.000)	(0.030)
March	0.0458	0.0190	0.0390	0.0116
	(0.139)	(0.200)	(0.387)	(0.663)
April	0.1117***	0.0440**	0.0301	0.0088
	(0.001)	(0.015)	(0.585)	(0.775)
May	0.2340***	0.1014***	0.1192*	0.0513
	(0.000)	(0.002)	(0.071)	(0.179)
June	0.2029***	0.0760**	0.0642	0.0212
	(0.001)	(0.021)	(0.290)	(0.553)
July	0.3153**	0.1153**	0.1259*	0.0276
	(0.018)	(0.037)	(0.099)	(0.344)
August	0.2662**	0.0833	0.0941	0.0066
	(0.048)	(0.113)	(0.246)	(0.819)
September	0.1080	0.0346	-0.0219	-0.0378
	(0.184)	(0.425)	(0.710)	(0.124)
October	-0.0330	-0.0254	-0.0923***	-0.0543***
	(0.369)	(0.184)	(0.000)	(0.000)
November	-0.2155***	-0.0939***	-0.2271***	-0.1133***
	(0.000)	(0.000)	(0.000)	(0.000)
December	-0.0862	-0.0469	-0.1511***	-0.0793***
	(0.202)	(0.167)	(0.000)	(0.000)
Year 2019	0.0925	0.0401		
	(0.499)	(0.548)		

Table 12 Continued

Variable	Natural log Hass avocado retail sales per capita (1)	Hass avocado sales per capita (2)	Natural log Hass avocado retail sales per capita (3)	Hass avocados sales per capita (4)
Year 2021			-0.0494	-0.0294
			(0.719)	(0.714)
Year 2022			-0.0441	-0.0369
			(0.760)	(0.648)
Constant	-1.8488*	0.9894***	-1.6856***	0.7611***
	(0.068)	(0.000)	(0.009)	(0.000)
Standard Errors	Clustered	Clustered	Clustered	Clustered
Number of observations	192	192	288	288
R squared	0.353	0.303	0.167	0.125

Notes: p-values in parentheses; * p<0.10, ** p<0.05, ** p<0.05

Results for the impacts of promotions are highly robust across the two sample periods. In the pre-COVID-19 years, the estimated promotion elasticity from the double log model is 0.089, while it is 0.086 for the COVID-19 and aftermath period. Statistical significance is reduced, however, due to fewer observations and fewer clusters in each subsample. The promotion coefficient in the pre-COVID-19 period has p value of 0.24 in the double log model and 0.07 (significant at 90% confidence) in the COVID-19 and aftermath period. As such, there is no evidence that COVID-19 impacted the effectiveness of promoting Hass avocados to the retail market.

A somewhat surprising result is that COVID-19 seems to have affected the price sensitivity of Hass avocado demand. In the pre-COVID-19 period, the estimated price elasticity of demand in the double log model is -1.31, while it is only -0.50 in the COVID-19 and aftermath period. Whether this change in price sensitivity will persist as the pandemic continues to recede into the background is something the industry will wish to monitor because it has significant impacts for optimal pricing strategies.

6 Simulation Model and Benefit-Cost Analysis

The econometric analysis reported in section 5 presents strong evidence that the promotion of fresh avocados by HAB member associations has worked to increase the retail demand for fresh Hass avocados in the United States. In this section, we ask whether the demand expansion has yielded benefits to California producers and importers from the member countries greater than the money expended to fund the programs.

We estimate benefit-cost ratios (BCR) for the promotion programs funded under the auspices of the HAB. Benefits derive from demand growth created by successful promotions and come in two forms: higher prices and expanded sales. Costs are represented by the assessments themselves—2.5 cents per lb.

BCR for commodity promotion programs can be expressed as an *average benefit-cost ratio* (ABCR) consisting, in our case, of the total incremental profit to producers and importers generated by the program over a specified time interval (one year in our case) divided by the total incremental costs borne by them to fund a program over the same time period. ABCR > 1.0 indicates a successful program in the sense of yielding benefits greater than costs.

Also of interest is the *marginal benefit-cost ratio* (MBCR), which measures whether incremental expenditures on promotion would yield benefits greater than costs. MBCR is important in asking whether a promotion program should be expanded or contracted. For example, a program could be successful in the sense of yielding ABCR > 1 but could have promoted in excess of the optimal amount so that expenditures at the margin were unsuccessful in the sense that MBCR < 1. Both ABCR > 1 and MBCR > 1 imply a successful program that could have profitably been expanded.

Our approach is similar to methods utilized in the prior evaluations of the HAB's promotion programs, an approach which is applied widely in commodity promotion evaluation

studies. One key difference is that this review focuses specifically on the retail market (excluding food service) for data reasons noted earlier in this report.

We simulate the impact of a small hypothetical increase in the HAB assessment rate from the current level of $0.025/lb. to $0.03/lb., an increase of one-half cent per pound. The simulation model then "spends" the funds generated from the incremental assessment on marketing programs and fresh Hass avocado promotions. These promotions are assumed to impact monthly retail consumer demand in accordance with the econometric estimates reported in the prior section. We then solve the simulation model to find the hypothetical impacts on importer/producer market price and retail sales of fresh Hass avocados in the United States and estimate the benefits and costs to avocado producers and importers from that assessment expansion based on this information.

The simulation framework is depicted in Figure 8. The model begins with demand and supply functions for fresh avocados that depict the U.S. retail market for a baseline time period, set at $t=0$. Retail demand, DR_0, is total consumer demand at retail for fresh Hass avocados in the baseline period in a representative U.S. region and monthly time period. As shown in section 5, retail demand has increased over the years of the review period. For purposes of the benefit-cost analysis we fix DR_0 at the sample average values of per capita monthly demand—0.48 Hass avocados and retail price--$1.16 per avocado. We fit the monthly retail demand function in linear form so that it passes through the sample mean price and quantity $(Q_0, P_0) = (0.48, 1.16)$, with the same price responsiveness or slope of demand as estimated in the double log regression model. We utilize estimates from the double log model for the benefit-cost analysis because that model fit the data better than its linear counterpart, both in terms of overall explanatory power, as measured by the R squared statistic and in terms of statistical significance of individual

coefficients, as measure by the p values. From Table 11 this coefficient is $\frac{\Delta Q}{\Delta P}$ = -0.320.[23] For

consistency with Figure 8, we invert this slope to create $\frac{\Delta P}{\Delta Q} = \frac{1}{-0.320} = -3.123$.

The next step is to convert the retail consumer demand function to the "derived" demand function facing California producers and importers. We assume Hass avocado handlers and marketers operate on a perfectly competitive basis with constant per-unit costs. The average import prices per lb. and per unit for Hass avocados over the five years of the review period are shown below in Table 13.

Table 13: Import Prices for Hass Avocados: 2018 - 22

Year	Price per pound	Price per unit
2018	$1.31	$0.59
2019	1.13	0.52
2020	0.99	0.45
2021	1.13	0.52
2022	1.03	0.47
Average	1.12	0.51

Source: U.S. Department of Agriculture, Economic Research Service
Note: Per pound prices converted to per-unit prices based on 2.2 avocados = 1.0 lb.

The difference between the sample average price per unit at retail, P_0 = $1.16, and the sample average import price, P_0^I = $0.51, represents the full costs per unit of bringing Hass avocados from port of entry to retail shelves: $1.16 - $0.51 = $0.65. The derived monthly demand, DD_0 lies below the retail consumer demand by $0.65, the estimated handling and marketing costs per unit.

Completing the model requires specification of the supply function for fresh Hass avocados to the U.S. retail market. Supply functions are notoriously difficult to estimate empirically, with the responsiveness of supply to price changes highly dependent upon the time period provided for

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[23] The estimated coefficients from double log model were converted from elasticity form to slope form by multiplying the coefficient (-0.7733) by Q/P, where Q and P are the sample mean values of $1.16 and 0.48.

supply to adjust. For example, over a short time window, supply may be very unresponsive to price changes, but response will increase over time as producers become able to adjust inputs to impact yields, and marketers can reallocate existing supplies across domestic and export destinations.[24]

We follow the procedure utilized in past promotion evaluations for the HAB and consider producer/importer price elasticities of supply of $\varepsilon = 0.5$, 1.0, and 2.0.[25] If the results of the benefit-cost analysis are robust to alternative reasonable choices of supply elasticities, the precise value chosen is unimportant to rendering a conclusion as to whether the promotion programs conducted under the auspices of the HAB were effective in the sense of yielding a positive net return on the investment in promotions. Figure 8 illustrates the baseline importer/producer supply function, S_0, for the supply elasticity $\varepsilon = 1.0$, the value we regard as the best estimate of supply response to price over a short time interval.[26]

The next step is to impose a hypothetical 0.5 cent per lb. (or 0.5/2.2 = 0.227 cent per unit) expansion in the assessment rate. This shifts up the importer/producer supply function by the amount of the incremental assessment rate, denoted as ΔR in Figure 8, capturing the now-higher cost of supplying Hass avocados to the market. The new importer/producer supply function is depicted in figure 8 as S_1, although for visual clarity Figure 8 depicts larger supply and demand shifts than would be caused by an incremental half cent per pound assessment.

The incremental promotion expenditures increase the importer/producer demand for any price level by the change in promotion dollars times the slope of the demand function with respect

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[24] Shippers' ability and willingness to reallocate supply among alternative markets outlets in response to price signals will hinge on many factors such as contractual commitments, ability to access expanded shipping capacity, and availability to access additional product in the home country that meets the specific standards of an importing country.

[25] These elasticities are evaluated at the base price and quantity. The lower bound of these values states that a 10% grower/shipper price increase in year *t* causes a 5% increase in supply, whereas the upper bound posits a 20% supply increase in response to the same price signal.

[26] A mathematical property of a supply elasticity of 1.0 is that the curve intercepts the graph's axis at the origin, as depicted in figure 8.

to advertising dollars (A): $\Delta Q = \frac{\partial Q}{\partial A} \Delta A$. The coefficient reported in Table 11 is an estimate of the advertising elasticity of demand, and we convert it to the demand slope estimate, $\frac{\partial Q}{\partial A}$, required for the calculation by multiplying the coefficient by $\frac{Q}{A}$, where both Q and A are measured at the sample means:

$$\frac{\partial Q}{\partial A} = 0.0881 \frac{Q}{A}.$$

The increase in promotion expenditures, ΔA, enabled by the hypothetical incremental assessment is the total shipments in pounds in an average month multiplied by 0.005, the incremental assessment.[27]

Implementing the hypothetical assessment and spending the funds to promote Hass avocados will shift both the importer/producer supply function and the derived demand function. The new equilibrium grower/importer price per unit and monthly per capita consumption levels are found where demand DD_1 and supply S_1 are equated, i.e., at the intersection of these two functions. In Figure 8 the new equilibrium is denoted by (Q_1, P_1^I). The new equilibrium values of per capita consumption and import price per unit for each choice of importer/producer supply elasticity and for estimates of price responsiveness of demand from the double log models are reported below in Table 14.

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[27] The total shipments in an average month are 0.48 x region population ($\overline{POP}$), at the sample mean. Thus $\Delta A = 0.48 * \overline{POP} * 0.00227$, where $\overline{POP} = 41.11$ million, the mean population across the eight regions studied in the empirical analysis.

Table 14: Results from the Simulated Expansion of Assessment and Promotion

Supply elasticity	Baseline		Estimates from incremental assessment	
	Q_0	P_0	Q_1	P_1
0.5	0.48	0.51	0.4828	0.5161
1.0	0.48	0.51	0.4835	0.5141
2.0	0.48	0.51	0.4839	0.5127

Some key points from Table 14 are that a more price responsive(elastic) producer/importer supply function leads to a greater sales expansion in the U.S. market from the promotion-induced demand shift and a lesser price increase than for a less elastic supply specification. This is due to the straightforward operation of market forces. A demand increase and higher prices in the United States will motivate importers to allocate more Hass avocados to the U.S. market. This supply expansion will limit the extent to which price rises. Thus, the greater the supply response, the less the price increase generated from a promotion-induced expansion of demand, and the lower the resulting benefit-cost ratio.

Figure 8 illustrates these points for the example of $\varepsilon = 1.0$. The price increase, $(P_1 - P_0)$ provides a direct benefit to all sales, Q_0, that would have occurred in the baseline scenario without the incremental promotions. Thus, $(P_1 - P_0)Q_0$ is one component of the gross benefit from the incremental assessment. To obtain the net benefit on sales Q_0 we must subtract the incremental assessment, ΔR, so $(P_1 - P_0 - \Delta R)Q_0$ is the net benefit to producers and importers from the incremental expansion of the promotion program for inframarginal sales, Q_0, and is depicted as the pink-shaded area in figure 8.

The second component pertains to the expanded sales to the U.S. market, $(Q_1 - Q_0)$, that occur due to the demand expansion. These sales also receive price P_1, but incur the incremental cost required to bring the product to the U.S. market. These costs are represented in Figure 8 as

the area under supply curve S_0 between Q_1 and Q_0 that is shaded in gray. These sales will also incur the assessment in the next market period. The result is that the net benefit to producers and importers from the incremental sales is only the small green triangular area in Figure 8. The major portion of benefits from a successful promotion program accrue to sales that would have been made without the promotions but receive a higher price because of them.

The final step in the analysis is to compute the ratio of benefits to costs. The costs of the incremental assessment are simply the change in assessment, $0.5/2.2 = 0.227$ cents per unit, times the baseline per capita quantity of 0.48. As noted, the gross benefits are the increase in price, $(P_1^I - P_0^I)$, for the baseline sales, 0.48, plus the net profit on the incremental sales, $Q_1 - Q_0$. Both benefit components are illustrated graphically in Figure 8, and for the mathematically inclined can be represented by the expression:

$$B = (P_1^I - P_0^I)Q_0 + P_1^I(Q_1 - Q_0) - \int_{Q_0}^{Q_1} S^1(Q)dQ.$$

Figure 8. Simulation Model
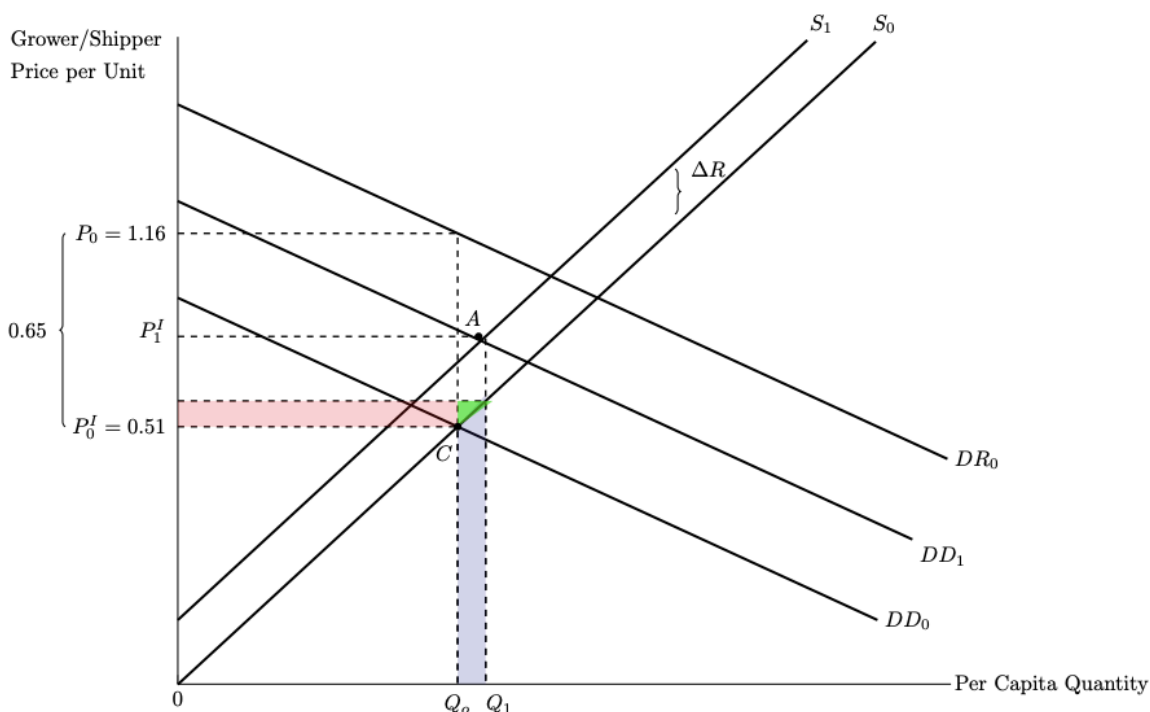
The estimated BCR under the alternative model specifications are provided in Table 15. Results are sensitive to the assumption about the price elasticity of supply to the U.S. market for reasons already noted. For the least elastic specification of supply, the BCR is approximately 3.38, meaning that each dollar expended on promoting Hass avocados in the U.S. market yields a return of $3.38 to domestic producers and importers. The ratio declines to 2.47 when we assume a price elasticity of supply of 1.0 and to 1.85 when we utilize 2.0 as the price elasticity of supply. The declining BCR for the more elastic supply responses is due to the demand shift inducing a greater quantity response and a lesser price response under these specifications. Our preferred estimate is 2.47, based upon the realism of a price elasticity of near 1.0 for the time interval considered.

Table 15: Benefit/Cost Simulation Results Summary

Supply Elasticity	Mean Increase in Grower/Shipper Price	Benefit/Cost Ratio
0.5	1.48%	3.3388
1.0	1.09%	2.4721
2.0	0.82%	1.8481

In all cases the producer/importer benefit-cost ratio is considerably larger than 1.0, meaning benefits from the program substantially exceeded the costs, thus warranting the conclusion that the promotion programs conducted under the auspices of the HAB were successful during the review period in increasing profits to importers and California producers of Hass avocados. Further, the results suggest that expansion of the program at the margin (i.e. by increasing the assessment rate by a small amount above its current $0.025 per lb. value), could increase grower and importer profits if the industry chose to consider such a strategy.

The prior five-year review conducted by Ambrozek, Saitone, and Sexton also concluded that the promotion programs conducted under the auspices of the HAB had been successful, and the BCR ratios reported in their study are closely comparable to those reported here, ranging from 1.6 to 3.6 depending on the assumed value for the price elasticity of supply. As we have noted throughout this report, the nature of promotions conducted by the country associations has changed in the years since the review period studied by Ambrozek, Saitone, and Sexton, with, for example, greater reliance on digital promotions in the current review period. Despite the changing nature of promotions conducted by the member associations, the close similarities in benefit-cost ratios found in our study to those found by Ambrozek, Saitone, and Sexton suggest that the promotion expenditures retained their effectiveness.

The results in section 5 for the pre-COVID-19 and COVID-19 and aftermath subsamples further suggest that the pandemic did not have a significant impact on the effectiveness of Hass avocado promotions. Measured responses of sales to promotions were very similar in these two subsamples.

7 Conclusion

This report represents the fourth five-year review and evaluation of the promotion activities conducted under the auspices of the Hass Avocado Board (HAB). Consistent with prior reviews, this study has found that promotions conducted by the HAB member associations have been highly effective in expanding demand for fresh Hass avocados in the United States. In results reported in Table 11 we found a positive elasticity of retail sales with respect to promotion expenditures in a panel econometric model with eight U.S. regions and 60 monthly observations encompassing the five-year review period (2018 – 22).

We estimate that a 10% increase in Hass avocado promotions in a region and a month is associated with a 0.6 – 0.9% expansion of sales, all else constant. These results are statistically significant at standard levels, i.e., $p \leq 0.10$, in three of the four base models, with the fourth, a linear model with clustered standard errors, narrowly missing the significance cutoff ($p = 0.19$). Analysis of subsamples of the data for the 2018 – 19 pre-COVID-19 period and the 2020 – 22 COVID-19 and aftermath period indicated that the pandemic did not have any significant impact on the effectiveness of retail promotions.

Benefit-cost analysis revealed that the promotion programs conducted under the auspices of the HAB continue to pay off handsomely for producers and importers. Depending on the value chosen for the price elasticity of supply to the U.S. market, we find that the benefit-cost ratio from the promotion program is in the range of 1.85 – 3.34, with a preferred estimate of 2.47, meaning that each dollar expended on promotions yielded an estimated return of 2.47 dollars during the review period.

The success of the Hass avocado industry in expanding demand for Hass avocados in the United States amidst rapid growth in imports is noteworthy and well known within the produce industry. The demand expansion has enabled producer prices to be sustained in real terms, and even increase on average, through the life of the Hass Avocado Board.

Despite the rapid growth in per capita consumption of Hass avocados in the United States, we believe that considerable growth potential remains given the wide regional disparities in per capita consumption, the persistent seasonality in consumption, and the uneven consumption across key demographic groups. Raising per capita consumption in the Great Lakes, Plains, and Northeast region closer to levels achieved in the South Central and West regions, increasing consumption in the Fall and Winter months, and targeting more diverse demographics and younger populations all represent pathways for future growth.

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