What Value-Added Management Programs Are Enhancing Cattle Producer Revenues?
Tina L. Saitone

As the quality attributes that consumers’ demand from animal-based food products have expanded, ranchers have responded by marketing their cattle with an increasingly diverse array of value-added management programs. Yet, the additional revenue generated by producing cattle tagged with these programs is uncertain and highly variable. This paper analyzes the premiums/discounts associated with the most common programs utilized by ranchers in 2018.

Today’s consumers are demanding an expansive and dynamic suite of quality attributes from their food products. This is especially true when making selections among product options derived from animals. More now than ever before, buyers have expanded their considerations beyond conventional product-quality characteristics and are increasingly interested in how animals are raised, what they are fed, the supplements, implants, or antibiotics that were given, and the provision of animal welfare broadly defined.

These downstream demands have driven cattle ranchers to diversify the attributes of their cattle and document the value-added management (e.g., cattle raised without hormones, cattle raised on operations that are animal welfare certified) and marketing programs they utilize. While ranchers are keenly aware of the costs associated with incorporating these programs on their operations, the additional revenue from participation is uncertain and highly variable. This adds substantial ranch-level complexity for cattle producers who are tasked with determining which programs and practices will maximize profit given that the premiums associated with these programs are unknown prior to sale.

While many studies suggest that consumers are willing to pay more for product characteristics they deem to be important (e.g., natural, organic, grass fed, etc.), there is little information about how these premiums paid at retail transmit upstream to cattle ranchers. This paper uses data from a satellite video auction in the Western United States, Western Video Market (WVM) Auction, to estimate the premiums/discounts associated with value-added management and marketing practices used by ranchers selling their cattle in 2018. These results provide ranchers with information on the potential payoff associated with their program choices while also providing beef consumers with information on how their purchases of differentiated beef products in grocery stores and restaurants transmit through the supply chain to the ranch level.

Western Video Market Auction
Western Video Market (WVM) Auction is the second largest satellite video auction in the United States, serving as a sales outlet for 14 western states. This type of auction format operates much like a traditional auction except that buyers can bid on cattle from remote locations (i.e., via phone or over the internet). Thus, these auctions can provide cattle producers with a larger base of potential buyers. Cattle being sold via video auction remain on their home ranch until the buyer arranges transportation. This format eliminates the cost and stress of cattle traveling to an auction yard for sale.

Cattle are sold in groups, referred to as lots, based on the average weight
of the animals comprising the lot at the time of delivery. The sales catalog available to buyers using video auctions provides sellers with an opportunity to communicate a tremendous amount of information about their cattle (e.g., what they have been fed, what vaccines they have received, available delivery date, and much more). In 2018, more than 272,500 head were sold through 12 auctions held throughout the calendar year.

Calf and yearling sales were analyzed using separate models. Calves were classified based on the average anticipated weight of the lot being between 450 and 650 lbs. in order to focus on price effects at time of weaning. Yearling lots had average anticipated weights at time of delivery in the 750 to 950 lb. range. In total, 961 lots of calves and 682 lots of yearlings were analyzed.

A hedonic regression model was used to analyze the 2018 auction data in order to estimate how different lot-level sales attributes influenced sales price. Price, expressed in dollars per hundredweight (cwt.), is the dependent variable (i.e., variable we are attempting to explain) in both of the statistical models. As a result, all of the estimates reported can be interpreted as the incremental premium/discount for that attribute or program in dollars/cwt. terms.

Across the 12 sales conducted by WVM in 2018, the average price for calves was $166.25/cwt., while the average price for yearlings was $143.43/cwt. Yet, these averages do little to communicate the price dispersion observed for lots of cattle sold in a given month, or even at a given auction. For example, the average sale price for calves at WVM’s January 2018 auction was $159.78/cwt. In that same month, lots of calves sold for as little as $143.50/cwt. and for as much as $203.75/cwt. Large price differences are influenced by both cattle characteristics and management and marketing programs, all of which are controlled for in the model, such that attribute-specific price impacts can be isolated.

Lot-level cattle characteristics (e.g., breed, sex, weight, frame score, etc.) are included in the models to control for how these factors influence price, while catalog descriptions were used to determine the specific management and marketing programs associated with each lot of cattle sold. Several of these basic lot-level factors are common across the calf and yearling models, including:

- **Weight**, expressed in cwt., is the anticipated average weight of the cattle in the lot at time of delivery;
- **Heifer** is an indicator (i.e., yes or no) variable for a lot consisting of only heifers;
- **Split Load** is an indicator variable that identifies lots of cattle that include both steers and heifers; and
- **Miles to Omaha, NE** is used to measure spatial dispersion of lots of cattle sold, expressed in driving distance (100s of miles) from the primary processing region in Omaha, Nebraska. Prior research has shown that cattle located increasingly far from the primary processing regions in the U.S. (proxied in the model by location of the lot relative to Omaha) receive price discounts associated with higher expected transportation costs.

Variables are also included in the model to control for how prices are impacted by the breed of the cattle in the lot, as well as within-lot variability in size (e.g., frame scores and flesh scores).

### Value-Added Management and Marketing Programs

A proliferation of value-added management and marketing programs utilized by ranchers marketing their cattle through WVM was noted nearly ten years ago. In the intervening years, research has documented that participation and returns associated with these programs have varied considerably. The programs available for consideration, based on sales through WVM in 2018, include:

- **Age and Source Verified** indicates that the cattle in the lot are enrolled in one of two U.S. Department of Agriculture programs (Process Verified Program or Quality System Assessment Program). This designation is needed for buyers that are targeting beef sales in export markets where traceability is required.
- **Natural** is a designation that means cattle have never been fed or injected with any antibiotics, never fed ionophores, not implanted with synthetic hormones, nor given any feed or supplements containing animal byproducts. Ranchers can participate in one of two natural programs: i) owner-certified via signed affidavit (WVM Natural) or ii) a third-party verified program (Verified Natural).
- **Non-Hormone Treated Cattle (NHTC)** indicates that lot is participating in a third-party certified program that ensures that cattle are not given hormonal growth promotants. NHTC is often also required for export markets and, thus, is typically paired with Age and Source Verified.
- **Global Animal Partnership (GAP)** is a designation that communicates participation in a third-party certified animal-welfare program.
- **Organic** signifies that cattle have been raised in a manner that complies with USDA Organic Standards.
- **Non-GMO** denotes lots of cattle that are not fed GMO feeds and indicates compliance with the voluntary GMO labeling system.

Cattle ranchers also utilize a variety of vaccination programs to maintain and enhance the health and well-being of their cattle. Some ranchers have
opted into self-certified or third-party certified vaccination programs and document these protocols when selling their cattle. These programs are included in the statistical models but the results are omitted herein for the sake of brevity (see further readings for details).

Results

Figure 1 shows the results from the calf (shown in blue) and yearling (shown in red) models for the basic lot-level characteristics that influence cattle prices. Each dot represents the estimated average premium or discount for that characteristic, while the lines extending from the dot depict the 95% confidence interval or the range in which we can be certain, with 95% confidence, that the true value falls. If the confidence interval includes zero (red vertical line), we cannot be certain that the premium/discount is not zero.

All premiums/discounts are reported on a per hundredweight (cwt.) basis. The dot should be considered the best estimate of the true average value of the characteristic/attribute and the length of the line should be considered a measure of the precision of the estimate. The default lot, to which all results should be compared, is a lot comprised of only steers that have little (i.e., even) within-lot size variability.

As one would anticipate, the relationship between price and the average weight of cattle in a given lot is negative. Calf prices decrease by $14.00 for every additional 100 lbs. of weight expected at time of delivery. As an example, consider two lots of steers, each consisting of 100 head, sold for delivery in the same month. The lots only differ by the average weight at delivery with one lot delivered at 550 lbs. (lot A) and the second lot delivered at 450 lbs. (lot B). In this example, the additional 10,000 lbs. of weight sold in lot A would only generate an additional $1,400 (i.e., 14 cents per lb.).

Similarly, yearling prices decrease by $7.04/cwt. as the average weight of the lot increases. This price-weight relationship exists because smaller animals have greater potential to gain weight, and thus buyers have a higher willingness to pay for lighter-weight animals, with other conditions remaining the same.

Heifer-only lots sold at an average discount of $19.48/cwt. for calves and $9.03/cwt. for yearlings. Split loads, lots consisting of both steers and heifers, are priced on a dollar per cwt. for steers and dollar per cwt. for heifers (i.e., the lot is associated with two prices, one for each sex). Thus, the coefficient on Split Load should be interpreted as the average discount for both prices (steers and heifers) in a lot comprised of both sexes. This means that these mixed lots are discounted, relative to what they would have brought on sale day if they had been sold in same-sex lots, by $5.89/cwt. for calves and $3.17/cwt. for yearlings.

Because buyers anticipate that their future sales prices will be reduced due to transportation costs (based on distance, anticipated shrink, and mortality risk) as cattle are sold downstream through the supply chain to feedlots and eventually to processors, they will rationally reduce the price that they are willing to pay to compensate for these anticipated future discounts. And, thus, the Miles to Omaha, NE variable is inversely related to price. In the calf regression, the price of each lot is, on average, discounted nearly $0.76/cwt. for every 100 miles that lot is away from Omaha, NE. For example, if a lot of cattle were sold and delivered originated in Redding, CA (1,642 road miles from Omaha, NE), the estimated discount would be $12.48/cwt. For a lot of calves with the same characteristics but originating in North Platte, NE (280 road miles from Omaha), the discount is estimated to be only $3.58/cwt.

There is a $3.94/cwt. premium associated with calves being weaned from their mothers for 30 or more days. Buyers are willing to pay this extra amount to ensure that the stress of weaning, as well as any secondary illnesses caused by this stress, have occurred prior to delivery. Sellers are increasingly advertising longer weaned periods prior to shipping (e.g., 45 days, 90 days). Statistical tests indicated that there was no difference in the premium paid by buyers for extended weaned periods, compared to the 30-day period reported herein.
Figure 2 reports the estimates related to the value-added management and marketing programs employed by ranchers in 2018. Age and Source Verification did not generate premiums that were statistically different from zero for sellers of calves or yearlings in 2018. Calves sold carrying the Global Animal Partnership certification sold for a premium of $4.55/cwt. For yearlings selling with the same certification, the premium is not statistically different from zero. Yearlings marketed with the Non-Hormone Treated certification received a premium of $6.71/cwt.

Yearlings raised in accordance with U.S. Department of Agriculture’s organic standards sold for a premium of $11.95/cwt. Calves raised according to organic standards sold for a premium of $4.56/cwt., although this point estimate is not statistically different from zero. Yearlings marketed with the Non-GMO specification earned premiums on sale day of $5.29/cwt., while calves raised in the same fashion sold for a premium of $4.14/cwt. (not statistically different from zero). Finally, the premiums earned for cattle sold with the Natural designation, whether owner-certified or third-party certified, were very similar. In the case of yearlings, the owner-certified natural premium was $5.73/cwt., while the third-party certified alternative premium was $5.60/cwt. Given that the third-party certification has higher costs than the owner-certified option, ranchers were better off self-certifying their production practices.

For the first time in 2018, ranchers marketed their cattle as “China market ready.” In technical terms, this meant that cattle had to be Age and Source Verified and Non-Hormone Treated. Thus, to get the value of this export market-specific designation, you can simply add the two premium estimates. For example, for calves in 2018, China market ready would have increased the price of a lot by $2.13/cwt. ($0.83/cwt. for Age and Source Verified and $1.30/cwt. for Non-Hormone Treated).

Implications

Ranchers who market through WVM are often at the forefront of differentiating their cattle through a variety of value-added management and marketing programs. And, while these programs add complexity and cost at the ranch level, these factors are known ex ante. The revenue that a rancher will generate when selling calves or yearlings is not easily predicted and is highly variable over time. This paper seeks to fill this void by estimating the average premiums paid for specific value-added management programs in 2018.

When supplies are tight and very few cattle with specific attributes are available, the premiums are often substantial. Yet, as more producers begin supplying these characteristics, premiums are eroded. Beyond these supply and demand considerations, larger macro considerations (e.g., national cattle supplies, drought, etc.) create substantial year-to-year variability in cattle prices and premiums paid for value-added management and marketing programs. Thus, programs that were profitable for a producer in one year may not be profitable the next due to changes in market conditions.

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Author’s Bio

Tina L. Saitone is a UC Cooperative Extension associate specialist in the ARE Department at UC Davis focused on livestock and rangeland economic issues. She can be contacted at saitone@primal.ucdavis.edu.

For additional information, the author recommends:

Saitone provides updates and more in-depth analysis of these data and other livestock and rangeland related topics in her blog: https://livestockecon.ucdavis.edu/

Maintaining the Long-Term Viability of the Humpback Chub in the Grand Canyon

Pierce Donovan and Michael R. Springborn

The humpback chub is a native fish of the Colorado River that is vulnerable to extinction. Rainbow trout, initially introduced near the Glen Canyon Dam to serve recreational anglers, now thrive downstream and prey on the humpback chub. The U.S. Geological Survey is currently investigating strategies for controlling the trout population that ensure sufficient humpback chub numbers for future survival. We summarize how a new modeling approach provides both management guidance and reveals the implied existence value of the endangered species.

The humpback chub is named for the large hump on its forehead, which provides stability in whitewater and makes it harder to eat.

—Photo by George Andjreko, Arizona Game & Fish

What is another California condor worth to us? Or an additional flutter of Mission blue butterflies? How valuable are healthier populations of endangered species in general? While managing such species to avoid extinction involves weighing these benefits, extinction is a non-incremental change that is exceedingly difficult to value. Still, extensive resources have been spent on species recovery, demonstrating that their existence is valuable to us. Today, many conservation projects move forward despite the lack of carefully estimated benefits. However, conservation management cannot escape the fact that managers face finite resources and difficult tradeoffs.

It is much easier to value commercially targeted species, like Californian salmon or sturgeon, by using observed market prices, which reflect our willingness to pay. We can weigh the benefits of today’s harvest against the option to harvest tomorrow in order to determine how large a fish stock should be.

But where exactly does the value lie in preserving endangered species that are unlikely to be commercially harvested? Sometimes they play a pivotal role in their ecosystem, and we can measure these services via the value of the affected species; wild bees provide much of the pollination services in California agriculture, for example. Other species generate interest (and subsequent value) with their charisma, behavior, or looks; polar bears, sea turtles, and orangutans are regularly featured in zoos and documentaries. But such direct or indirect use values for vulnerable species—by definition low in number—are likely to be small in general and ultimately fail to fully capture what is lost with extinction.

Conservation management is often framed as recovery of a vulnerable population to a chosen target level. For example, biologists might estimate the number of breeding pairs of the northern spotted owl that are needed to achieve a healthy state. An economic approach might then seek to meet this target at the lowest possible cost. Conservation costs might include direct costs of managing the owl, like captive-breeding, or indirect costs, like the foregone stumpage value to the timber industry. The tradeoff of interest is between the cost of stricter management and the change in the likelihood of species survival, often called species viability. The probability of survival stands in for the missing [dollar] benefits when we do not already know the value of a species. Thus, in this environment, instead of managing for profit from commercial use, the focus shifts to managing for viability.

But what is species viability worth, per se? In recent analysis, we consider this question for the humpback chub in the southwestern U.S. This species yields no commercial value—it isn’t harvested for food, and is not a target of recreational anglers or tourists. But the Endangered Species Act stipulates that such species must be conserved, creating an implied valuation which we can assess. Below, we summarize how our recently developed modeling approach uncovers both the implied existence value of the humpback chub population and a cost-effective policy to sustain it.

Case Study: The Humpback Chub

The humpback chub (scientific name *Gila cypha*) is a threatened minnow native to the Colorado River. Large for a minnow (at 20 inches fully-grown), this fish evolved a few million years ago with little predatory pressure. They would thrive in the historic, undammed river, one that was warmer and more turbid, since those historic conditions provide for better spawning and protection from sight predators.

The humpback chub became protected in 1973 under the Endangered Species Act. Historically limited to a few
hard-to-reach sections of the Colorado River, the fish has only been studied in depth fairly recently. Their largest aggregation is at the confluence of the Little Colorado River (where most spawn), and the Colorado River mainstem (where most compete for food and are preyed upon by emigrating rainbow trout), located within Grand Canyon National Park, downstream of Lake Powell and the Glen Canyon Dam (see Figure 1). The humpback chub is currently designated as threatened throughout all of its range, and the possibility of extinction in the future increases without precautionary management action.

The Grand Canyon Monitoring and Research Center of the U.S. Geological Survey (USGS), science provider to the Glen Canyon Adaptive Management program, seeks to evaluate and revise management actions as their understanding of the ecology downstream of the Glen Canyon Dam improves.

One core objective of this research is to guarantee adequate survival of juvenile humpback chub that enter the mainstem from the Little Colorado River, therefore maintaining reproductive potential. This involves both protecting the Little Colorado spawning grounds and establishing an appropriate habitat in the mainstem.

The rainbow trout originate from a sport fishery just downstream of Lake Powell and the Glen Canyon Dam. As a non-native species, they disrupt Grand Canyon habitat when they migrate downstream by competing for food and preying on resident juveniles, like the humpback chub.

At present, the leading management option for controlling the rainbow trout is the use of electrofishing trips intended to reduce the population of downstream émigrés to the humpback chub habitat in the Colorado/Little Colorado confluence. These trips take roughly a week and consist of drifting down the river while stunning and removing a significant amount of adult rainbow trout.

The humpback chub is an interesting case study because both the conservation goal and the conservation means have already been established by the Grand Canyon Monitoring and Research Center. Heavy investment in natural science research in the Colorado River watershed has created opportunities to improve management. It is a critical economic and environmental zone, with overlapping and competing concerns from electricity generation to tourism that weigh against conservation objectives, like that of the humpback chub.

Managing for the Long-Run Survival of the Humpback Chub

Our conservation goal is to maintain a healthy humpback chub abundance over time, so that the likelihood of dropping below a minimum viable population threshold is acceptably small. Specifically, we seek to ensure that the population near the confluence does not fall below 4,000 individuals at any point over the next 20 years, with 90% confidence. Meeting this target is a necessary step towards species recovery.

Of course, we would like to do this as cheaply as possible. So, for any population size of humpback chub or rainbow trout, we want to determine the lowest amount of management effort required to meet the conservation goal. We are also interested in knowing the existence value of the humpback chub implied by this policy and how high we should keep the population in order to keep the probability of extinction acceptably small.

Figure 2 shows the ideal number of electrofishing trips needed, depending on how many humpback chub and rainbow trout are in the management
area. Dark green signifies that the maximum possible effort is needed (six trips in a year), while gray indicates trips should be suspended (see color bar key on the right). Not surprisingly, more trips are ideal when there are few humpback chub or many rainbow trout; guidance centers on how effort should respond as the populations move away from this extreme.

At present, after years of rainbow trout management, humpback chub and rainbow trout populations are estimated to reside in the upper-northwest of Figure 2, where immediate action is not prescribed. This suggestion is in agreement with the current USGS strategy. However, the humpback chub population is sensitive to ecosystem shocks, such as temperature, turbidity, food availability, and rainbow trout abundance, so the population is not yet considered to be safely self-sustaining. Should the situation degrade in the future, Figure 2 prescribes the number of electrofishing trips needed to maintain viability of the species cost-effectively.

The conservation goal for humpback chub is achievable at current population levels. But this is not the case for all possible levels of humpback chub and rainbow trout. If we ever find ourselves in a position below the light green line in Figure 2, we are less than 90% likely to stay above the 4,000 fish threshold even with maximum effort. This does not mean we give up on controlling the rainbow trout population; this region emphasizes that there exist cases—however unlikely—in which achieving the conservation goal with the desired level of confidence isn’t possible. As the humpback chub population declines, the increasing possibility of dropping below the threshold is what drives the effort to maintain healthier states, i.e., “safety in numbers.”

In contrast to the approach outlined here, conservation programs typically set an ad hoc, inflexible population target to rebuild towards. Rather than trying to maintain a specific population size, we let the implied existence value of the humpback chub reveal how large a population should be in order to keep it safely out of harm’s way. To avoid our minimum viable abundance threshold of 4,000 humpback chub, the policy results in population numbers typically far higher. The region of Figure 2 denoted by the blue circle is where we expect the long-run population to reside around 50% of the time, given our prescribed course of action.

**Where is the Value in Preserving the Humpback Chub?**

In the past, values for humpback chub were estimated through a series of valuation surveys, which estimated marginal values of $1.75 per U.S. household for a 1% increase in humpback chub abundance. While the valuation is substantial, this information is insufficient for the kind of decision making discussed above since the marginal value is not constant but rather increases drastically as the population declines.

Instead, as part of our modeling approach, we first imagine that there is a level of loss incurred when the humpback chub falls below a population threshold for extinction. We then search for a particular value for this loss that is just large enough to motivate enough costly effort to safely avoid the extinction threshold. The loss level identified can be interpreted as an implied existence value (the value of a viable population that is consistent with the conservation goal). This implied existence value is a sort of “shadow” value, i.e., a helpful uncovered value that substitutes for the lack of an explicit market-based value.

The estimated shadow value (implicit existence value) in this case is $380 million. We can then calculate how costly it is to allow the population level to approach this extinction level.
We do so by evaluating the present value of the loss, based on the likelihood and time to an extinction event. For example, if we maintain a humpback chub population within the blue circle of Figure 2, the present value of the loss is only around $100,000 (for reference, each electrofishing trip costs $75,000). If the population is instead near the minimum viable threshold, where the conservation objective becomes more intimidating, then this number is in the tens of millions of dollars. In this way, the conservation objective transforms into an economic measure that incentivizes the ideal management response as populations fluctuate.

In Figure 3, we hold rainbow trout constant at 900 individuals and show how the present value and electrofishing (control) costs vary with the humpback chub population. As conditions for the humpback chub deteriorate, the conservation goal becomes more salient; the present shadow value increases and eventually dominates the actual costs of control. In a relatively safe state, non-viability is not an immediate issue, and the present shadow value is low.

The existence value of the humpback chub is high, and the expected present costs of action are too. This is because the requirements for its conservation are quite restrictive, and many unobserved factors influence the humpback chub stock, making its evolution hard to predict. This finding, which shows just how large existence values can be, is likely to repeat when the model is applied to other species.

Beyond Conservation Objectives
The Endangered Species Act aims to provide a framework to conserve and protect endangered and threatened species and their habitats. While conservation of such species can be highly costly, this legal requirement implies larger social benefits in avoiding extinction.

Policy often emphasizes viability-style goals over requirements of economic optimality. For example, many scientists and policy analysts enthusiastically recommend sufficient greenhouse gas emissions abatement to remain below a temperature threshold (beyond which the risk of catastrophe increases dramatically), rather than identifying some globally-efficient emissions path. Putting the modeling focus on these one-shot, irreversible “tail events” reflects the stated objective.

When we consider how to avoid dire events like massive forest fires, disease outbreaks, or disastrous floods, we face outcomes without easily estimable values, but the willingness to take costly preventative measures implies some revealed preference for safety. By giving attention to a more literal “viable control” paradigm, we can develop rational management approaches and a better understanding of the latent value embedded in policy language.

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Authors’ Bios
Pierce Donovan is a Ph.D. candidate in the Department of Agricultural and Resource Economics and Michael Springborn is an associate professor in the Department of Environmental Science and Policy, both at UC Davis. They can be reached at donovan@ucdavis.edu and mspringborn@ucdavis.edu, respectively.

For additional information, the authors recommend:

The Story Behind Avocados’ Rise to Prominence in the United States

Hoy F. Carman

Rapid growth of U.S. demand for fresh avocados has increased the fruit’s prominence in retail sales and consumer diets. This growth is largely due to California producer and importer-funded research and promotion programs that have changed avocados’ image to that of a healthy super-food. Total California production has decreased slightly over time with the growth in consumption satisfied by imports, primarily from Mexico. U.S. consumers now enjoy year-round availability of avocados with more stable month-to-month prices than previously observed.

U.S. per capita consumption of fresh avocados averaged 1.73 pounds during the 1980s and 1.51 pounds during the 1990s. Given this relative stability and level of consumption for avocados, the recent increase to 8.0 pounds in 2018 is both unprecedented and surprising. While total fresh fruit consumption increased, avocados exceeded all other fresh fruit products. Comparison of 1990–91 with 2016–17 fresh use of all commercially produced fruit reveals an increase from 90.8 pounds to 116.7 pounds per capita or 28.5%, as reported by USDA. Fresh avocados registered the largest increase (405.8%) during this period.

Avocados’ rise to prominence in U.S. produce markets demonstrates the benefits of producer-funded research and promotion programs. There were a number of important factors involved in the substantial increase in consumer demand, with some very obvious and others occurring out of the public eye. This article highlights facts and figures relative to industry adjustments that have contributed to achieving this remarkable growth.

Marketing Issues

Looking back to the early 1990s, avocados faced several marketing issues including product image, the threat of increased imports, and seasonal availability. California avocado growers, working through the California Avocado Commission (CAC), provided the leadership for seeking solutions to each problem. Funded entirely by growers, the CAC collects an assessment on all avocados grown in California to support research and promotion programs designed to increase the demand for California-grown avocados. Annual promotion expenditures from 1962 through 2017 totaled over $568 million in 2017 dollars.

Image: Avocados had a product image problem that persisted through the 1990s; they were regarded as a food high in fat and calories and not particularly desirable on a health or nutrition basis. In 1997, the CAC began to fund nutritional and diet research and to proactively communicate the nutritional and health benefits of avocados to consumers.

Consumer information contained detailed analysis of the composition and nutrient content of avocados, including fatty acids, vitamins, minerals and phytochemicals, as well as their health benefits and effects on disease processes. Avocados soon became a component of “recommended healthy diets,” transforming their image to a heart-healthy, nutrient dense, super-food.

Avocado Imports: California dominated the U.S. avocado market through the 1980s, with fresh imports typically accounting for less than 1% of total consumption. This began to change in the early 1990s when Chile and the Dominican Republic increased avocado shipments to the U.S., and then CAC efforts to block Mexican avocado imports failed in 1997. Avocado imports began to rise substantially when fresh avocados from Mexico were allowed into the U.S. market, with a four-phase opening of the U.S. market extending from 1997 to 2007. Initial imports were to 19 Northeastern and Midwestern states and Washington, D.C. during the winter months. States were added and the time period was extended until all states were open year-round to Mexican avocados beginning in February 2007.

Allowing avocados into markets that tended to be under-served by California, combined with the national public relations program for the health and nutritional benefits of consuming avocados, resulted in a very effective ten-year market development program. Responding to the problem of imports free riding on domestic research and promotion programs, the CAC led industry efforts to secure passage of the Hass Avocado Promotion, Research and Information Act of 2000, which established the Hass Avocado Board (HAB). On January 2, 2003, the HAB began collecting an assessment of $2.5 cents per pound on all domestically produced and imported Hass avocados sold on the U.S. market. The assessment is collected by first handlers for California production, and by the U.S. Customs Service for imports and forwarded to the HAB.

The HAB rebates 85% of domestic assessments to the CAC and to importer associations to use for U.S. promotion programs. Importer associations are currently operational for avocados from Mexico, Chile, and Peru. The HAB uses the remaining funds for its operations, nutrition and health research, promotion, and information technology programs.
Demand for Fresh Avocados

U.S. per capita avocado consumption grew rapidly during the last two decades after many years of year-to-year variability and slow growth. Figure 1 illustrates changes in consumption and average annual producer prices over time, as per capita consumption increased from 1.1 pounds in 1994 to 8.0 pounds in 2018. The figure represents a classic case of increasing demand. There has been no clear trend in real prices indicating that the supply of fresh avocados is relatively elastic over time, an outcome only possible because demand has expanded to keep pace with the rapid growth in supplies to the U.S. market.

During the 15-year period from January 2, 2003 through December 31, 2017, HAB collected assessments totaling over $495.7 million. Total marketing and promotion expenditures for the 15 years by organization were: CAC, $143.1 million; Chile, $40.5 million; Mexico, $238.3 million; Peru, $11.5 million; and HAB, $63.0 million. These promotion expenditures were a very important factor related to increasing U.S. demand for avocados.

Econometric studies of avocado producer returns from their expenditures on advertising and promotion in the U.S. market have shown positive benefit/cost ratios in the range between 2.5 and 4.0. Each of these studies has concluded that returns from advertising/promotion expenditures are attractive and that increased advertising/promotion expenditures would have yielded additional profits.

Avocado Supply

When California production dominated the U.S. avocado market, variations in year-to-year average California crop yields impacted prices and total revenue. In fact, with inelastic demand, a small California crop would often yield higher total revenue that an unusually large crop. Now, imports tend to respond inversely to the availability of California avocados, year-to-year and seasonal prices are more stable, and a small California crop garners less revenue than a large California crop.

With comparatively high and increasing costs of production, California bearing acreage of avocados decreased from 60,674 acres in 1997 to 50,856 acres in 2017 (16.2%) while average production for the two five-year periods 1993–97 and 2013–2017 dropped from 362.99 million pounds annually during the earlier period to 338.57 million pounds (6.7% reduction).

While average annual per-acre yields vary significantly from year to year, yields have tended to increase over time as less productive acreage has been removed. Thus, total California production of avocados decreased slightly over time and increasing imports, primarily from Mexico, has satisfied the rapid growth in U.S. demand.

Imports reached a total of almost 2.29 billion pounds in 2018, accounting for almost 87.3% of total U.S. fresh avocado consumption. California’s share of total U.S. avocado consumption decreased from 77.8% in 1997 to only 12.9% in 2018. This dramatic growth in U.S. avocado imports and consumption with the accompanying change in market shares and structure has impacted both California acreage and production practices.

Seasonal Marketing Patterns

Before imports became significant, California growers chose avocado varieties and cultural practices to provide year-round availability of marketable fruit. As imports grew, growers switched increasingly to the higher yielding and more profitable Hass and Lamb varieties, and timed the harvest to take advantage of changing seasonal prices. The Hass and Lamb Hass share of California production increased from 83.0% in 1989–90 to 99.4% in 2017–18. As a result, the seasonal marketing pattern for California avocados changed significantly over time.

Figure 2 shows the 2013 through 2017 (five-year) average seasonal marketing pattern for imports, for California production, and for total avocado sales (California plus imports). California’s sales pattern for 1990, before imports were a significant factor in the U.S. market, is also shown. The index is calculated by dividing actual monthly sales by the average monthly sales for the calendar year.

Comparison of the index of California monthly sales during 1990 with the most recent five-year average California index reveals that relative monthly sales at the beginning and end of the calendar year (Jan, Feb, and Sept
through Dec) have decreased significantly and that sales have become much more concentrated during March through August when the monthly index is considerably above 1.0. Note that the 5-year average index for imports tends to run counter to California sales and that the 5-year average index for imports plus California sales is the most uniform of the four shown. Increased imports have shifted California sales to March through August while decreasing the seasonality of all sales (California plus imports).

**Mexican Avocado Production**

Mexican growers have responded to the attractive, growing market for avocados in the U.S. by planting new acreage and increasing production. Mexico was reported to have harvested 200,036 acres of avocados in 1997, the year that limited amounts of fresh Mexican avocados were first allowed entry to the United States. Ten years later in 2007, when Mexican avocados gained access to the total U.S. market, harvested acreage had increased to 272,742 acres. Mexican avocado harvested acreage continued to increase to 466,335 acres in 2017. Production increased from 1.68 billion pounds in 1997 to 4.47 billion pounds in 2017, a 266% increase. A little over 38% of Mexico’s 2017 crop was shipped fresh to the U.S. market. Mexico supplied 87.1% of total U.S. fresh avocado imports in 2018.

**Economic Impacts**

No estimates have been made of the total economic impacts of increased avocado demand. Overall, they would be expected to be large in total and vary by group. In terms of producers, the majority of benefits have flowed to producers in exporting countries, with Mexico reaping most of the benefits. These include the benefits to producers from increased acreage and production, plus increased employment and income for input suppliers and the processing and packing sector.

Increased volumes in the supply chain also increased employment and incomes in the transportation sector, as well as the U.S. wholesale and retail food sector. With increased volumes, avocados were able to secure year-round retail shelf space. U.S. consumers realized a large increase in a healthy diet component at essentially constant real prices over an extended time period.

**Concluding Comments**

The CAC’s efforts to blunt the impact of avocado imports on fresh avocado prices have been much more successful than California producers could foresee when the fight began during the 1990s. Many producers viewed the opening of the U.S. market to Mexican avocado imports as the beginning of the end for profitable California avocado production. With inelastic demand, a potential flood of imports, and California avocado prices forecast to be less than the cost of production, the future looked dire. However, success of the research and promotion programs funded by producers and conducted by the CAC and HAB, together with the phased opening of the U.S. market, increased demand and offset the price-depressing effects of increased supplies.

A viable, but somewhat smaller California avocado industry continues. Mexico has a comparative advantage over California in avocado production and, for that reason, most of the supply response to increased demand has occurred in Mexico.

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**Author’s Bio**

Hoy Carman is an emeritus professor in the ARE department at UC Davis. He can be contacted by email at carman@primal.ucdavis.edu.

**For additional information, the author recommends:**


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Giannini Foundation of Agricultural Economics, University of California

Department of Agricultural and Resource Economics
UC Davis
One Shields Avenue
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Julie McNamara, Communications Director
Giannini Foundation of Agricultural Economics
Department of Agricultural and Resource Economics
University of California
One Shields Avenue, Davis, CA 95616
E-mail: julie@primal.ucdavis.edu
Phone: 530-752-5346

To receive notification when new issues of the ARE UPDATE are available online, submit an e-mail request to join our list to: julie@primal.ucdavis.edu.

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