Agricultural and Resource Economics
ARE UPDATE

Giannini Foundation of Agricultural Economics, University of California Vol. 21, No. 5 May/Jun 2018

ALSO IN THIS ISSUE

California Agriculture: Dimensions and Issues

Philip L. Martin, Rachael E. Goodhue, and Brian Wright

California has led the nation in farm sales since 1948, when Los Angeles County had more farm sales than any other U.S. county. The major reason California's farm sales of $46 billion in 2016 were almost $20 billion higher than Number 2 Iowa at $27 billion is the dominance of high-value fruit, nut, and vegetable crops. This article summarizes the analyses of agricultural economists at UCB, UCD, and UCR of the land, labor, and water inputs needed to produce the state's farm commodities, highlights the status of major crops and livestock, and outlines the challenges facing the state's agriculture, from climate change and trade to research.

California Agriculture: Dimensions and Issues is the third edition of the Giannini Foundation's effort to provide an introduction to California agriculture. We are grateful to the authors who prepared chapters in their areas of expertise.

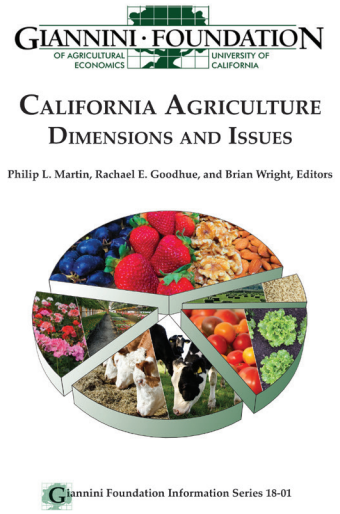
California Agriculture

The value of California crops was $35.4 billion in 2016 and the value of livestock was $10.5 billion. Three-fourths of California's farm sales are fruits and nuts, vegetables and melons, and horticultural specialties such as flowers, nursery plants, and mushrooms—so-called FVH crops. Many of these high-value and high-risk crops require unique growing conditions and irrigation as well as large numbers of seasonal farm workers.

California's leading commodities in 2016 were milk worth $6.1 billion; grapes, $5.6 billion; almonds, $5.2 billion; cattle, $2.5 billion; and lettuce, $2 billion (Figure 2). These five commodities accounted for almost half of California's farm sales, and the top 20 commodities were worth $34 billion or three-fourths of the state's farm sales. The value of milk fell 50% between 2014 and 2016, the value of almonds fell by 45%, and the value of berries fell by 25%.

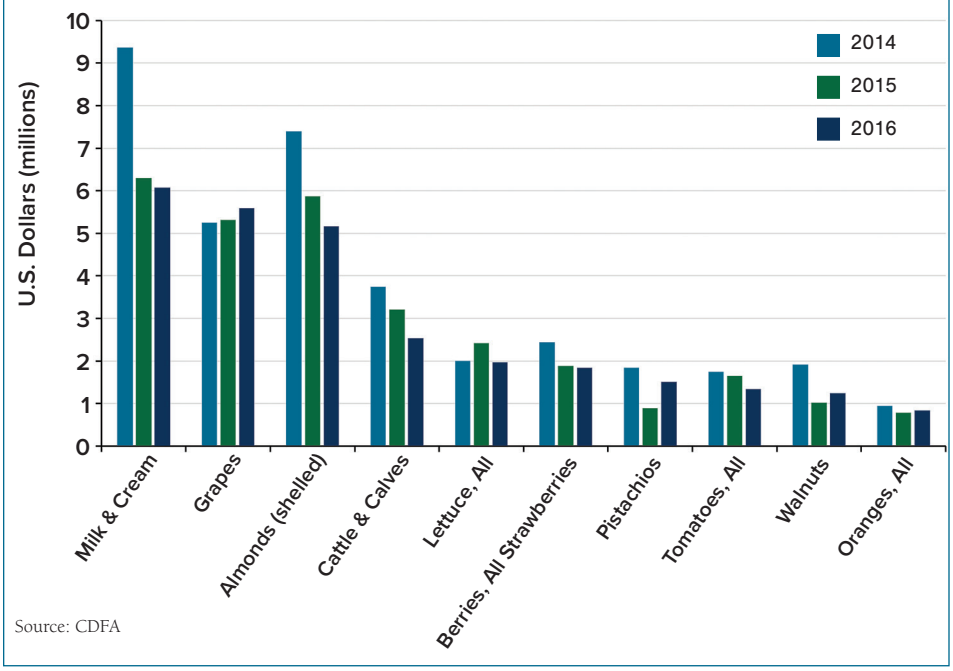
The four leading farm counties accounted for 52% of the state's farm sales: Kern County had farm sales of $7.2 billion; Tulare County, $6.4 billion; Fresno County, $6.2 billion; and Monterey County, $4.3 billion. Kern County accounted for 25% of the state's grape sales, 21% of almond sales, and 42% of pistachio sales.

Figure 1. Cover of California Agriculture: Dimensions and Issues



The new edition of *California Agriculture: Dimensions and Issues* is now available online at giannini.ucop.edu/publications/cal-ag-book/

Figure 2. Top Ten Commodities in California, 2015



Source: CDFA

Tulare County dairies accounted for a quarter of the state's milk and cream and most of the state's orange sales, while Fresno County accounted for a quarter of the state's almonds.

Most California farm commodities are consumed outside the state, including in other countries. Farm exports of $20 billion in 2016 were 43% of the state's farm sales, led by $4.5 billion worth of almonds, $1.5 billion worth of wine, and $1.4 billion worth of dairy products. The major destinations for California's agricultural exports were the EU, taking $3.5 billion worth of California farm commodities; Canada, $3.3 billion; China, $2 billion; Japan, $1.4 billion; and Mexico, $1 billion.

Land, Labor, and Water

California's agricultural history differs from that of most states, beginning with the distribution of land. The Spanish and Mexican governments granted large parcels or ranchos of 50,000 or more acres to selected individuals. When California became a U.S. state in 1850, farming consisted largely of cattle grazing and dryland or non-irrigated wheat farming on vast ranchos.

Fruit production became profitable in the 1870s, after the transcontinental railroad lowered transportation costs and interest rates, and irrigation facilities were developed to produce oranges, peaches, plums, and pears. California's Mediterranean climate allowed the production of a wide range of crops, from grains and cotton to fruits and vegetables, most of which were produced on large farms with relatively sophisticated operators.

Less than 10% of the state's 100 million acres of land are crop land, and 80% of the state's crop land is irrigated. California has the highest farm land prices in the U.S., reflecting the production of high-value commodities and the profits from alternative uses, such as developing land for housing. Prices for almond orchards, the largest acreage crop, were $30,000 to $40,000 an acre in 2018, depending on soil quality and access to water. The most expensive farm land is Napa vineyards, which can sell for $200,000 an acre or more.

Hired farm workers do most of the work in California agriculture, and their number is rising as the expansion of labor-intensive commodities such as berries offsets mechanization in raisin grapes and shrinkage in commodities such as asparagus. Average annual employment, a measure of full-time equivalent jobs, was 421,000 in 2015, and twice as many people, almost 850,000, worked for wages on the state's farms sometime during the year. Over 90% of California farm workers were born in Mexico, and over half are not authorized to work in the United States.

Farmers normally use about 33 million acre feet of water on 8 million acres of irrigated land, an average of 4 acre feet (an acre foot is 43,560 square feet or about a football field covered with 1 foot of water). In normal water years, about 60% of the water used by farmers is surface water that is stored in dams or reservoirs and conveyed via canals to farmers, and 40% is groundwater pumped from underground aquifers. In dry years, these shares are reversed, explaining why the 2012–15 drought lowered groundwater levels and led to legislation requiring the development of plans to sustain underground aquifers.

Major Commodities

Fruits and nuts account for 40% of the state's farm sales. The eight-county San Joaquin Valley is the U.S. fruit and nut bowl, with most of California's citrus, peaches and nectarines, grapes, and almonds, walnuts and pistachios.

Fruits and nuts are following different trajectories. Fresh fruit consumption has been declining, reflecting reduced consumption of oranges and peaches and nectarines, a turn away from fruit juice, and declining sales of canned and dried fruit. Many fruit farms are relatively small, prompting most fruit growers to join cooperatives such as Sunkist and Sunsweet to market their fruit. Marketing orders regulate the production of many fruits, collecting small fees from first handlers of

commodities to set minimum quality standards, conduct research, and promote consumption.

California has 850,000 acres of vineyards, two-thirds devoted to wine grapes. California crushes over four million tons of wine grapes a year to produce 10% of the world's wine. California has five distinct wine regions: North Coast, Central Coast, Northern San Joaquin, Southern San Joaquin, and other. The North Coast, including Napa and Sonoma countries, accounts for an eighth of the state's wine grape tonnage but over 40% of the revenue from wine grapes, while the Southern San Joaquin accounts for 40% of the state's wine grape tonnage but only an eighth of the value of wine grapes.

Orchards without workers most of the year can have crews of dozens or hundreds during pruning and harvesting seasons. Fruit farmers often use labor contractors to recruit crews of 20 to 50 workers for these labor-intensive phases of production. Their declining ability to bring crews when requested explains why labor accounted for half of the 80 issues identified by the California Fresh Fruit Association as top priorities over the past decade.

Tree nuts—almonds, walnuts, and pistachios—are major success stories, with production and prices rising together over the past quarter century. California has over two million acres of tree nuts, meaning that one-quarter of its irrigated land is producing nuts that are mostly exported. Most tree nuts are grown south of the Sacramento-San Joaquin river delta, explaining the keen interest of nut farmers in the WaterFix proposal to move more water 35 miles from north to south via tunnels to limit damage to delta fish.

Berries: California's berry industry includes two major subsectors: strawberries that are usually planted each year, and cane or bush berries (such as blueberries and raspberries) that can produce berries for a decade or more, although most growers replant cane berries after several years. California produces over 80% of U.S. strawberries and raspberries, and has a rapidly expanding blueberry sector. Berries are high-value and high-risk crops, generating revenues of over $50,000 an acre but exposing growers to disease, labor, and market risks. Land, disease, and labor constraints may slow the berry industry's expansion after two decades of rapid growth.

Vegetables: California produces over half of U.S. fresh vegetables, and the six most valuable are broccoli, carrots, celery, lettuce, bell peppers, and fresh tomatoes, with broccoli and lettuce accounting for almost two-thirds of the value of the state's major fresh vegetables. These fresh vegetables are produced by a relative handful of large grower-shippers, that is, businesses that plant and harvest crops and supply fresh vegetables to buyers year-round by moving production between California and Arizona. Many fresh vegetables are consumed raw, putting the spotlight on food safety after outbreaks of illness linked to E. coli O157:H7, which occurred in spinach in September 2006 and in romaine lettuce in April 2018.

Dairy: California has 20% of U.S. dairy cows and produces more than 20% of U.S. milk, most from mega-dairies with 1,000 or more cows. Feed accounts for over half of the cost of producing milk, and rising feed costs and falling milk prices have shrunk the number of dairies in the state. California dairies rely on hired workers, and some are considering moving to nearby states due to California's minimum wage headed for $15 an hour by 2022, and requirements to provide farm workers overtime pay after eight hours a day or 40 hours a week.

Livestock: Cattle and calves are an unusual sector of California agriculture, relying on low-cost public lands to feed cows and their calves and moving year-old stocker cattle mostly out-of-state to fatten them for slaughter. Many yearling cattle leave the state in trucks and return as beef, posing challenges for the state's cattle industry as regulations on trucking are tightened. California has 10% of U.S. sheep, and the sheep industry is grappling with similar challenges of finding low-cost forage and sending lambs out of state for fattening and slaughter.

Nursery and Cannabis: Nurseries that produce plants for homes, parks, and farms, and greenhouses and open air farms that produce flowers, generate about 10% of California's farm sales. Nurseries are located near their primary customers—new homeowners. Los Angeles, Orange, and San Diego counties have 40% of the state's residents, and San Diego accounts for one-third of the state's nursery sales. Both the nursery and floriculture sectors were hard hit by the 2008–09 recession. The nursery industry is making a comeback, but fresh flowers are increasingly imported.

Cannabis is a unique commodity—perhaps the most valuable in the state. Production of 15 million pounds a year and grower prices of $1,000 a pound make marijuana's farm value $15 billion a year, equivalent to a third of the state's farm sales. California voters approved Proposition 64 in November 2016 to legalize the production, sale, and use of recreational marijuana, encouraging the state to enact laws to regulate and tax the industry. With marijuana that is grown indoors and in greenhouses commanding higher prices, licensed growers with such facilities are poised to expand the legal and regulated market. However, most of the state's marijuana is likely to remain outside this system and will continue to be shipped in violation

of federal law to consumers outside California.

Marketing, Trade, and Innovation

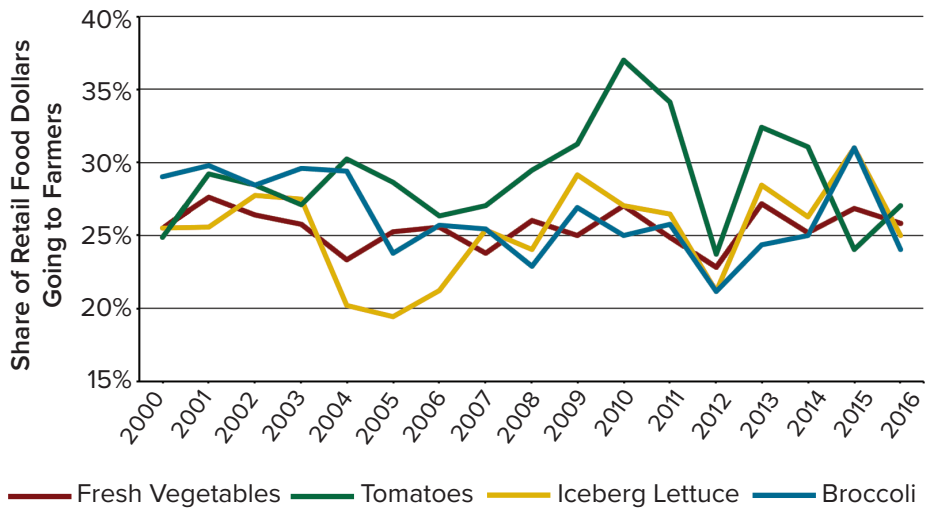
Consumer demand determines what farmers produce, and the rising demand for many fresh fruits and vegetables explains why California farm production and sales have risen. About 13% of typical household (the government term is consumer unit) expenditures are on food. Only $4,000 of these food expenditures are for food eaten at home, and the $3,000 spent on food away from home largely reflects convenience, service, atmosphere and other factors.

Farmers get a relatively small share of the retail food dollar, from 50% for fresh milk to less than 10% for the wheat used to make bread. The farm share of average retail prices for many fruits and vegetables is 20–40%, even though farmers increasingly prepare fresh fruits and vegetables for retail sale (Figure 3). This rate of return is a source of frustration to farmers who often pick and pack commodities in clamshells or bags for consumers.

Farmers have tried many times to increase the demand for particular commodities and to raise their share of the retail price. Many commodities have marketing orders, which are grower-approved agreements enforced by federal and state governments to set quality standards for produce that is marketed. Assessments or fees are collected for each box or carton shipped to market, and marketing boards spend the money collected from growers on research and promotion, such as the Got Milk or Dancing Raisins campaigns.

California exports commodities worth 40% of the state's farm sales, led by almonds, dairy products, walnuts, and wine. Unlike corn and grain, most of the commodities exported from California are not supported by federal government programs, making the state's farmers more keen on free trade than other U.S. farmers. Trade is a two-way street, raising incomes abroad that increase demand for California fruits and nuts but also inspiring farmers in other countries to produce high-value crops to export. China, the world's largest producer of most fruits and vegetables, provides an example of the opportunity and challenge of expanding demand and supply for the commodities that dominate California agriculture.

Figure 3. Farm to Retail Price Spreads, Fresh Vegetables, 2000–2016



Source: USDA, www.ers.usda.gov/data-products/price-spreads-from-farm-to-consumer.aspx

California has high-tech agriculture supported by an educational and industrial complex that educates students, conducts research, and transfers innovations to farmers. Many innovations respond to specific challenges, such as the high cost of water encouraging Southern California farmers to adopt drip irrigation. California is a leader in precision agriculture, using technologies to adjust inputs to reflect the specific needs of particular plants and animals.

Whither California Agriculture

California has a highly-regulated business environment with affluent consumers, a desirable climate, and soils suited to producing many crops. California agriculture has innovative farmers who have benefited from a robust state education and agricultural research system for developing, improving, and adapting innovations.

Suggested Citation:
Martin, Philip L., Rachael E. Goodhue, and Brian Wright. "California Agriculture: Dimensions and Issues." *ARE Update* 21(5) (2018): 1–4. University of California Giannini Foundation of Agricultural Economics.

Authors' Bios

Philip L. Martin is an emeritus professor and Rachael E. Goodhue is professor and chair, both in the Department of Agricultural and Resource Economics at UC Davis. They can be reached by email at plmartin@ucdavis.edu and goodhue@primal.ucdavis.edu, respectively. Brian Wright is professor and chair of the Department of Agricultural and Resource Economics at UC Berkeley and director of the Giannini Foundation of Agricultural Economics. All three authors are members of the Giannini Foundation of Agricultural Economics.

The new edition of *California Agriculture: Dimensions and Issues* is available online at https://giannini.ucop.edu/publications/cal-ag-book/

How Does Meeting the 2015–2020 Dietary Guidelines for Americans Benefit U.S. Fruit and Vegetable Growers?

Karen M. Jetter and Kjersti Nes

This study estimates the economic impact on fruit and vegetable industries in the U.S. from an increase in consumption based on different scenarios, including a shift in demand that meets the recommendation in the *2015–2020 Dietary Guidelines for Americans*. Our results show a substantial potential benefit to the fruit and vegetable industries in the range of $24–$38 billion.

Increased consumption of fruits and vegetables has been linked to a decrease in dietary-related chronic diseases such as obesity, heart disease, diabetes, and some types of cancer. As more people eat more fruit and vegetables, the producers of those commodities stand to benefit from the increase in demand. This study estimates the economic impact on fruit and vegetable industries in the U.S. from an increase in consumption to levels recommended in the 2015–2020 Dietary Guidelines for Americans (DGA) .

Every five years, the dietary guidelines are updated based on current research. The 2015 DGA guidelines for fruit and vegetable consumption have almost doubled from the "5 A Day" (based on servings) recommendation in the 2005 DGA. Now the recommended amounts of fruits and vegetables range between 3.5 cup equivalents (7 servings) and 5 cup equivalents (10 servings) for most people depending on gender, age, and activity level (Figure 1). In addition to recommendations on the total amount of consumption, the 2015 DGA also contains recommendations for the amount of starchy, deep red and dark orange, dark green, and other vegetables to consume.

Current average consumption by people who live in households above 130% of the poverty level exceeds the previous 5 A Day recommendations in the 2005 DGA. Current average consumption for people in these households is around 1.04 cup equivalents (2.08 servings) for fruits and 1.57 cup equivalents (3.14 servings) for vegetables. However, this falls short of the minimum recommendations in the current DGA (Figure 1).

People who live in households with an income at or below 130% of the poverty level consume lower amounts of fruits and vegetables, except for starches, than higher-income consumers. Current average consumption for these households is 0.96 (1.92 servings) cup equivalents for fruits and 1.26 (2.52 servings) cup equivalents for vegetables.

Fruit consumption would need to increase by 66% on average for people in households above 130% of the poverty level, and 76% for people in households below 130% of the poverty level, to achieve the 2015 DGA recommendation at a sedentary activity level. Consumption within the individual vegetables subgroups would have to increase by 77% for people who live in households above the 130% poverty level for red and orange vegetables, 45% for dark green vegetables, and 71% for starchy vegetables (Figure 1).

As people in households at or below 130% of the poverty level eat less fruit and vegetables, the required shifts in demand are greater for them. In a study on the benefits to U.S. growers, if everyone in the U.S. met the 2005–2010 DGA 5 A Day recommendations, the net annual benefits to all growers in the U.S. were estimated to be $460 million—about 69%, or $316 million accrued to California. With the greater recommendations in the DGA 2015–2020 for fruit and vegetable consumption, these benefits may increase, even though people are consuming more now than when that study was completed.

As people who are more active are also able to consume more calories, the shifts needed to reach the

Figure 1. Recommended and Current Consumption of Fruit and Vegetable in Cups Equivalent Servings per Day at Different Activity and Income Levels

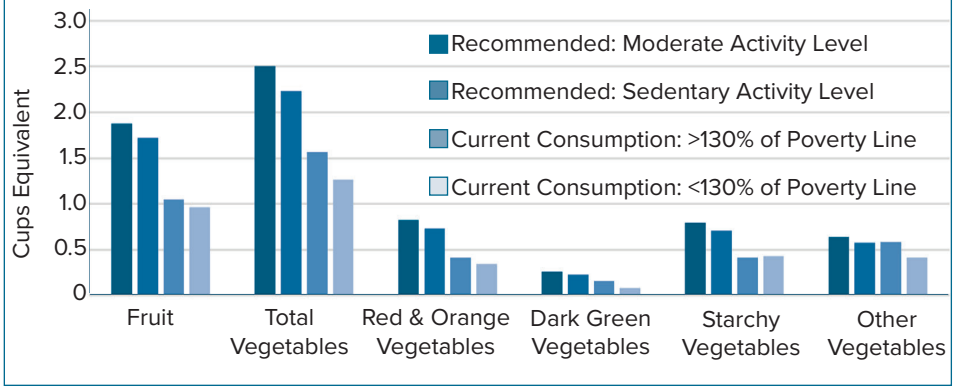
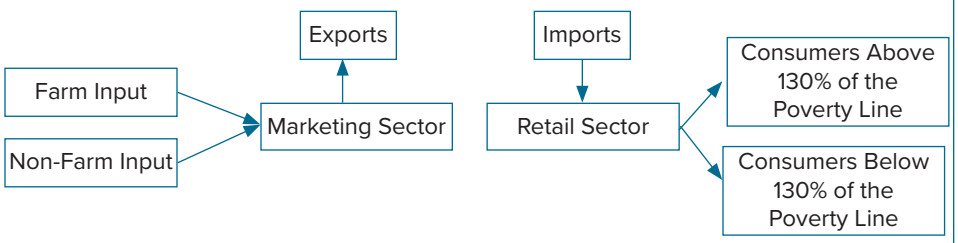


Figure 2. Outline of the Sectors Included in the Market Model



recommendations if everyone engaged in moderate activity levels are higher than if everyone engaged in sedentary activity levels (Figure 1).

Fruit and vegetable industries stand to benefit significantly should consumers achieve the recommended levels of fruit and vegetable consumption. Greater fruit and vegetable consumption would be met with increases in production within the U.S., lower exports, and greater imports. California accounts for 38% of total acreage in fruit and vegetable production (NASS, 2012) and would, in particular, be affected. California also specializes in the higher-value fresh market sector for many crops, including fresh asparagus, snap beans, blueberries, carrots, cucumbers and grapefruit. It is the largest producer of fresh asparagus and oranges in the U.S., even though it is not the largest producer of these commodities.

While fruit and vegetable industries stand to benefit significantly if people eat the recommended amounts of fruits and vegetables, smaller shifts may also cause significant benefits. As a result, the following scenarios were analyzed:

- A 10% shift in demand for each commodity
- A 25% shift in demand for each commodity
- A shift in demand corresponding to a consumption level in the 2015 DGA corresponding to a sedentary activity level
- A shift in demand corresponding to a consumption level in the 2015 DGA corresponding to a moderate activity level

Methodology

Market model

The benefits to producers are calculated from estimated changes in prices and production due to a shift in demand for fruits and vegetables using a market model of the U.S. fruit and vegetable market. The market model specifies a system of demand and supply equations in log-linear form. It is used to measure how the increases in demand for fruit and vegetables affect retail prices, farm prices, final consumption, trade, and farm production (Figure 2).

In the market model, fruits and vegetables are produced in the farm sector. Due to California's large share of domestic production, separate equations are included for production from California and for production from the rest of the United States (RUS). The marketing sector takes the farm product and uses inputs to either pack it fresh, or process it to sell as juiced, canned, frozen, or dried products. Commodities are then sent to the retail market or exported. Additional supply to the retail market can be obtained from imports. U.S. market supply is then equal to domestic production in California and the RUS, plus imports, minus exports.

Commodities in the U.S. market are purchased by consumers. Because people who live in households above 130% of the poverty level currently consume more fruits and vegetables than people in households at or below 130% of the poverty, these two groups are specified separately. Finally, 41 individual commodities were included in the study to account for variation in the shifts of different vegetable sub-group recommendations. The fruits and vegetables included in the study, and the subcategories to which they belong are:

- **Fruit:** Apples, apricots, avocados, bananas, berries, blueberries, cantaloupes, cherries, dates, grapes, grapefruits, honeydew melons, lemons, kiwis, oranges, peaches and nectarines, pears, plums and prunes, strawberries, tangerines, watermelons.
- **Dark green vegetables:** Spinach, broccoli, lettuce (leaf and romaine).
- **Red and orange vegetables:** Carrots, sweet potatoes, tomatoes (fresh), tomatoes (processed).
- **Starchy vegetables:** Corn (fresh market sweet), peas, potatoes.
- **Other vegetables:** Lettuces (head, endive, etc.), artichokes, asparagus, beans (snap), celery, cucumbers, onions, bell peppers, cabbage, cauliflower.

A key parameter in the model is how consumers and growers will react to changes in prices. A change in the demand for fruits and vegetables will cause prices for these commodities to rise, causing consumers to buy less, growers to produce more, exports to decrease and imports to increase. How consumers and growers will respond to the change in price is called an elasticity.

Consumers are assumed to be influenced by both the price of the good being analyzed and by changes in the price of goods that can be consumed in place of that good. For example, changes in quantity demanded for apples is influenced by changes in the price of apples, and also changes in the price of oranges, grapes, melons, etc.

Similarly, growers are influenced by the price of a commodity, and the prices of other commodities that can be grown in the same area during the same time period. For example, the choice to grow broccoli would be influenced by the price of broccoli, and the price of cauliflower, but not the price of cucumbers. This is because both broccoli and cauliflower are annual cool season crops and cucumbers are an annual warm season crop.

Data

Data needed to calibrate and parameterize the model are available from various sources for the years 2012–2014. U.S. and California production and farm value data are available from the USDA's *Fruit and Nut Yearbook and Outlook* reports, the *Vegetable and Melon Yearbook and Outlook* reports, and the National Agricultural Statistics Service (NASS). Trade data are available from the United States International Trade Commission's database. Retail prices are calculated from the National Household Acquisition and Purchase Survey (FoodAPS) for the year 2012. Consumption data for fruits and vegetables are obtained from the National Health and Nutrition Examination Study 2011–2012 surveys.

Own-price elasticities of demand and farm supply are obtained from the literature. Cross-price elasticities of demand and farm supply are calculated from the respective homogeneity conditions for linear demand and supply function.

Table 1. Total Change in Producer Benefit in the U.S. in Billions of Dollars

	Increase in Demand		Recommended Consumption Level	
	10%	25%	Sedentary Activity Level	Moderate Activity Level
Total Benefit to Producers	$3.42	$9.00	$23.89	$32.20
California	$1.58	$4.15	$10.69	$14.40
Rest of the U.S.	$1.84	$4.85	$13.20	$17.81

Table 2. Acres Adjustment in California and the U.S

	Increase in Demand		Recommended Consumption Level	
	10%	25%	Sedentary Activity Level	Moderate Activity Level
Total Change in Acres				
California	97,708	244,270	547,453	706,167
Rest of the U.S.	172,601	431,503	827,683	1,067,987
Percentage of Acres Used by Other Crops				
California	1.7%	4.3%	9.6%	12.4%
Rest of the U.S.	0.1%	0.1%	0.3%	0.4%

Armington elasticities are calculated for imports and exports. The elasticity for the marketing input is assumed to be perfectly elastic. The elasticity of substitution between the marketing input and the farm input is 0.05 for fresh commodities, and 0.1 for processed commodities because processed commodities typically use more inputs.

Results

As demand increases in each scenario, the benefits to fruit and vegetable industries increase (Table 1). Even for a small increase in demand of 10%, the net benefits for growers is $3.42 billion. Benefits increase to $9.00 billion for an increase in demand of 25%, $23.89 billion if the recommended consumption level for a sedentary lifestyle is reached, and $32.2 billion if the recommended level of consumption for a moderate lifestyle is reached. According to the 2012 Agricultural Census, the annual farm-gate value of U.S. production of fruit and vegetables was $43 billion.

California accounts for around 45–47% of the change in benefits to producers in all the scenarios even though it has only 38% of the total fruit and vegetable acres. However, California tends to specialize in production for the fresh market, and so it has a higher value of production than the rest of the U.S. in the subgroups fruit, dark vegetables, and red and orange vegetables. By value, California's share of production of the commodities included in the study is around 47%.

Long-Run Adjustment

Note that the model calculates the short-term benefits to the fruit and vegetable industries. As consumers demand more fruit and vegetables, more acreage would need to go into production for these commodities. This acreage would either come from less suitable land not currently used for agricultural production, or from other crops being displaced.

In the rest of the U.S., the number of acres planted for other crops not included in the study is 297.6 million average acres for the 2012–2014 period. Currently, these acres are used for cotton, hay, beans, various nuts, etc. We did not include pasture land in this calculation since pasture land is less suitable for fruit and vegetable production. Less than 0.5% of this acreage would need to be converted into fruits and vegetables

The results of this study show that fruit and vegetable industries would also substantially benefit by investing in promotions to increase the awareness of the improved health benefits of eating the recommended amounts of fruit and vegetables.

for production from rest of the U.S. rest of the U.S. to reach the highest recommended levels for a moderate activity level (Table 2).

In the same period, 5.9 million acres were in production in crops other than fruits and vegetables in California. To increase the level of production needed for each scenario, California needs to convert 1.7% of the acres from other crops for the 10% scenario, 4.3% for the 25% scenario, 9.6% to reach the recommendation for a sedentary activity level, and 12.4% to reach the recommended level for a moderate activity level. Most likely the converted acreage would come from the least profitable crops first (Table 2).

This would cause prices for those crops to also rise, but the change in benefits to the non-fruit and vegetable industries would be a net decline in benefits due to a reduction in acreage. However, the net benefits to growers who shift production from a less profitable crop and into a more profitable crop would be positive. Also, if at the higher levels for the shifts in demand there is insufficient acreage to move to fruit and vegetable production in California, this means that growers in California are not as responsive to changes in prices than growers in rest of the United States. This would put upward pressure on farm prices for growers. Growers in rest of the U.S. would then further expand production of fruits and vegetables.

Discussion

Most people are aware that leading a lifestyle that includes more exercise and greater consumption of fruits and vegetables will lead to a healthier life. How to increase fruit and vegetable consumption is the challenge. There is hope, however. After the 2005 DGA guidelines were published, average consumption of fruits and vegetables was far short of the recommended 5 A Day. Today, people in higher-income households consume just over 5 A Day on average, while people who live in lower-income households consume just under. The results of this study show that fruit and vegetable industries would also substantially benefit by investing in promotions to increase the awareness of the improved health benefits of eating the recommended amounts of fruit and vegetables. Even small changes of, say, 10%, result in large changes in benefits to fruit and vegetable industries.

Suggested Citation:
Jetter, Karen M., and Kjersti Nes. "How Does Meeting the 2015–2020 Dietary Guidelines for Americans Benefit U.S. Fruit and Vegetable Growers?" *ARE Update* 21(5) (2018): 5–8. University of California Giannini Foundation of Agricultural Economics.

Authors' Bios

Karen M. Jetter is a researcher economist at the Agricultural Issues Center at UC Davis. She can be reached by email at jetter@primal.ucdavis.edu. Kjersti Nes is a Ph.D. candidate in the agricultural and resource economics department at UC Davis. She can be reached via email at nes@primal.ucdavis.edu.

For additional information, the authors recommend:

Jetter, Karen M., James A. Chalfant, and Daniel A. Sumner. "Does 5 A Day Pay? Potential Gains to Growers from Increasing Consumption of Fruits and Vegetables to Recommended Levels in a Cancer Prevention Diet." *Agricultural Issues Brief* No. 27, 2004. http://aic.ucdavis.edu/pub/briefs/brief27.pdf

Can CalFresh Cut Costs and Better Serve California's Agricultural Counties?

Alexandra E. Hill and Charlotte Ambrozek

Higher rates of employment are associated with more CalFresh caseload terminations, which then increase applications from previous recipients. Reapplications are costly to the state and participants. These effects are largest in California counties with high agricultural employment.

The Supplemental Nutrition Assistance Program (SNAP, previously known as Food Stamps) is the largest domestic hunger safety net program by expenditure and participation. Annually, SNAP provides 42.2 million Americans with food assistance. CalFresh, California's SNAP, accounts for almost 10% of national caseloads and roughly 10.6% of national program spending.

The structure of the SNAP recertification process poses barriers to participation for workers with seasonal employment. SNAP recipients are required to submit proof of income at least semi-annually to continue receiving benefits. This mandatory recertification pushes workers off the program if their recent income is above the SNAP threshold. We find that this results in higher caseload terminations during peak employment months. Additionally, because some terminated households reapply when their incomes fall, we find high rates of "churn" immediately following peaks in terminated cases.

Program churn refers to the exit and subsequent re-entry of a participating household within a short time frame (90 days for this study). Churn is an often-avoidable and costly process for both program administrators and benefit recipients. Mills et al. (2014) found that in six study states, churn accounted for 1–4% of annual state administrative costs. The Alliance to Transform CalFresh estimates annual CalFresh administrative costs of roughly $1.85 billion. Given these high administrative costs, reductions in churning can yield meaningful decreases in total program spending.

California counties with high agricultural employment present an ideal opportunity to identify determinants of churning. California farmworkers follow a seasonal employment schedule and tend to have earnings in the SNAP-eligibility range. In this study, we examine differences in CalFresh entry and exit patterns for counties with high, medium, and low percentages of agricultural employment.

Our findings highlight key differences between the three county types in terms of unemployment and SNAP outcomes. We find that, compared with Medium and Low Ag counties, High Ag counties have larger unemployment rates with larger variance, more caseloads per capita, more applications, and higher rates of churn.

We find that increases in the unemployment rate are associated with more applications per capita, fewer cases terminated, and lower rates of program churn. We find that the negative relationship between unemployment and churn is explained by unemployment decreasing cases terminated, which, in turn, decreases churn. We find that terminations result in more subsequent re-applications in High Ag counties relative to other counties. Our results imply that incidence and costs of churn are larger in High Ag counties than in Low and Medium Ag counties. To counteract churn from employment cyclicality, we suggest that counties give program participants the option of reporting quarterly income at the time of recertification.

Unemployment and CalFresh Participation Highest in Agricultural Counties

To categorize California counties based on agricultural employment rates, we utilize county-industry level employment numbers from the California Employment Development Department's (EDD) *Quarterly Census of Employment and Wages*. We categorize counties based on agricultural employment as a percentage of total employment. High Ag counties are those with at least 10% of total employment in agriculture (17 counties). Medium Ag counties are those with 1–10% of total employment in agriculture (21 counties), while Low Ag counties have less than 1% of total employment in agriculture (17 counties). Summary statistics for the grouped counties from 2012 through 2017 are given in Table 1. We do not include three counties because of data restrictions due to their small population sizes.

For county employment and labor force participation by month, we use the EDD's *Local Area Unemployment Statistics*. Because we are interested in examining the role of seasonality in employment on CalFresh program metrics, we first document differences in the unemployment rates between these county types. Shown in Table 1, the High Ag counties have significantly higher average monthly unemployment rates than the Medium and Low Ag counties. Importantly, High Ag counties also have much larger variance (standard deviation) in the unemployment rate than the others.

CalFresh data come from the California Department of Social Services. Table 1 reports the average number of monthly person and household participants per capita for the three county types.

Table 1: Differences in Unemployment and CalFresh Between County Types

Variable	County Ag Type			Difference	
	High Ag	Medium Ag	Low Ag	High-Med	High-Low
# Counties	17	21	17		
% Employment in Ag	10-36%	1-10%	<1%		
Unemployment Rate (%)	11.564	7.997	6.621	3.567***	4.943***
	(4.8184)	(3.0797)	(2.6978)		
CalFresh Persons per capita	0.151	0.095	0.074	.056***	.077***
	(.0598)	(.0425)	(.0411)		
CalFresh Households per capita	0.066	0.044	0.037	.022***	.029***
	(.0247)	(.0222)	(.0192)		
(Household) Applications per capita	0.006	0.005	0.004	.001***	.002***
	(.0015)	(.0017)	(.0015)		
Recertification Termination Rate	32.141	34.487	29.831	-2.346***	2.31***
	(11.3190)	(10.6419)	(14.2702)		
90-day Churn Rate	22.779	20.298	18.990	2.481***	3.789***
	(7.1667)	(5.4253)	(5.2019)		

Alpine, Sierra, and Trinity dropped; Standard errors in parentheses; Difference is a two-sample t-test for difference in means; *p<.05, **p<.01, ***p<.001

Shown in Table 1, High Ag counties have the most monthly applications, CalFresh persons, CalFresh households per capita, and highest percent of applications from individuals receiving CalFresh in the previous 90 days (churn). The higher rates of churn support our hypothesis that seasonality in employment is a driver of programmatic churn. Interestingly, the Medium Ag counties have the highest percentage of unsuccessful recertifications (recertification termination rate). This suggests that county characteristics besides employment seasonality (e.g., average earnings) also affect caseload termination rates.

Unemployment Reduces Terminations, which Reduces Churn

Shown in the top panel of Figure 1, the High Ag counties have the most variation in unemployment and the highest rates of churn. In the High Ag counties, rates of caseload termination and churn are closely related. The peaks in churn follow peaks in terminations, which occur near the low points of the unemployment rate. The relationships between the unemployment rate, terminations, and churn are similar, but less pronounced in the Medium and Low Ag counties.

Table 2: The Unemployment Rate, CalFresh Applications, Terminations and Churn

Predictive Variable	CalFresh Metric (Outcome Variable)		
	(1) Logged Applications per Capita	(2) % of Recertifications Terminated	(3) 90-Day Churn Rate
High Ag Counties			
Unemployment Rate(t)	1.060***	-0.728***	-0.438***
	(0.176)	(0.0659)	(0.0554)
Medium Ag Counties			
Unemployment Rate(t)	1.379***	-0.809***	-0.333***
	(0.213)	(0.0796)	(0.0669)
Low Ag Counties			
Unemployment Rate(t)	3.139***	-1.742***	-0.228**
	(0.272)	(0.102)	(0.0855)
County Fixed Effects	Yes	Yes	Yes
Time Trend	Yes	Yes	Yes
R2	0.844	0.832	0.538
Observations	3905	3905	3905

Standard errors in parentheses; *p<.05, **p<.01, ***p<.001

This implies that the proportion of recertifications terminated increases with employment and is followed by higher rates of churn. This result is confirmed by our regressions and is remarkably robust to different modeling choices.

We use a fixed effects regression to analyze the relationship between the unemployment rate and CalFresh metrics of interest. We separate employment effects for High, Medium, and Low Ag employment counties. We include a time trend and county fixed effects so that the regression coefficients reflect de-trended, within-county variation in the unemployment rate and the CalFresh metric of interest. The regression results are presented in Table 2. The estimated coefficients can be interpreted as the percentage change in the outcome variable associated with a 1% increase in the unemployment rate for a given county type.

Presented in column (1) of Table 2, we find that applications per capita increase with the unemployment rate. The magnitude of this relationship is largest in the Low Ag employment counties, and smallest in the High Ag employment counties; a 1% increase in the unemployment rate is associated with a 3% (Low Ag) and 1% (High Ag) increase in applications per capita. This result is intuitive given that employment in low-wage industries (i.e., agriculture) is less likely to push a household past the CalFresh income eligibility threshold than employment in other industries.

Given in column (2), the regression of caseload terminations on the unemployment rate reveals a negative and significant correlation for all county types. This implies that as employment (and thus household income) increases, more households fail recertification applications. Again, the magnitude of the relationship is largest in Low Ag counties and smallest

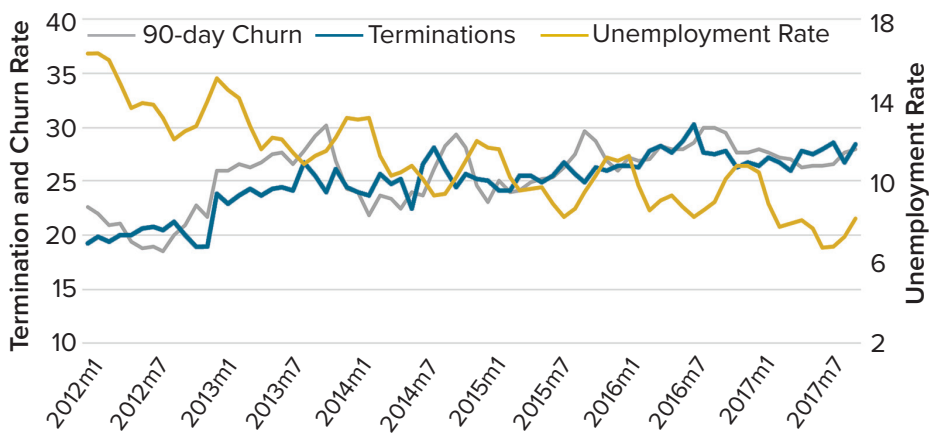
in High Ag counties. We find that a 1% increase in the unemployment rate corresponds with a 1.7% decrease in cases terminated in Low Ag counties and only a 0.7% decrease in High Ag counties. These results are consistent with our expectations because wages are highest in the Low Ag counties, so employment is more likely to result in program ineligibility.

Finally, regression results with churn rate as the outcome variable are given in column (3). Using the unemployment rate as the sole predictor reveals a negative and significant relationship between unemployment and churn that is largest in the High Ag counties and smallest in the Low Ag counties. However, when we include one to three month lagged caseload termination rates as predictors in the model, we find that the significance of the unemployment rate dissipates. This indicates that the unemployment rate only affects churn through caseload terminations.

The positive relationship between terminations and churn is by construction—churning households are defined as terminated cases that reapply within 90 days. The magnitude of the correlation indicates the likelihood that a terminated household reapplies. In High Ag counties, we find that a 1% increase in caseload terminations 3 months, 2 months, and 1-month prior lead to a 0.1, 0.19, and 0.17% increase in churn, respectively. These coefficients are larger than those in Medium and Low Ag counties, indicating that terminated households are most likely to churn in High Ag counties.

The insignificance of the unemployment rate implies that aggregate county employment is not a good predictor of household churn. While the unemployment rate does significantly predict terminations, it does not affect the timing at which households reapply. Particularly in High Ag counties, this suggests that households are finding ways to regain eligibility even during peak employment.

Figure 1: The Unemployment Rate, Caseload Terminations, and Churn



Policy Implications and Conclusions

We find that county churn rates are ordered by proportion of agricultural employment, indicating that High Ag counties contribute disproportionately to churning costs in CalFresh. Further, we find that the unemployment rate significantly predicts terminations, but it does not affect the timing at which households reapply (churn). Particularly in High Ag counties, this suggests that households are finding ways to regain eligibility even during peak employment months. However, the gap in benefit receipts is costly to the household, and the reapplication process is costly to the state.

As a policy strategy, we suggest that counties allow participants to choose between monthly and quarterly reporting. Monthly reporting determines eligibility exclusively based on reported income for one month, while quarterly reporting uses net quarterly average income. Quarterly reporting would lessen the penalty on seasonally employed households for variation in income. Allowing participants to choose between monthly and quarterly reporting would leave households with steady incomes unaffected. Counties with high proportions of low-wage seasonal workers may even consider expanding this to six-month or annual average earnings. This would additionally reduce incentives to manipulate income in a particular month.

Suggested Citation:
Hill, A.E., and C. Ambrozek. "Can CalFresh Cut Costs and Better Serve California's Agricultural Counties?" *ARE Update* 21(5) (2018): 9–11. University of California Giannini Foundation of Agricultural Economics.

Authors' Bios

Alexandra Hill is a Ph.D. Candidate and Charlotte Ambrozek is a Ph.D. student, both in the ARE department at UC Davis. They can be reached by email at alihill@ucdavis.edu and ceambrozek@ucdavis.edu, respectively.

For additional information, the authors recommend:

Mills, G., et al. 2014. "Understanding the Rates, Causes, and Costs of Churning in the Supplemental Nutrition Assistance Program (SNAP)." Washington, D.C.: USDA, FNS. https://www.fns.usda.gov/snap/understanding-rates-causes-and-costs-churning-supplemental-nutrition-assistance-program-snap

"CalFresh Funding: Top Ten Things to Know," July 2013. The Alliance to Transform CalFresh. Available at: http://cafoodbanks.org/sites/default/files/calfresh-funding-factsheet.pdf

Agricultural and Resource Economics
ARE UPDATE
Giannini Foundation of Agricultural Economics, University of California

Department of Agricultural and Resource Economics
UC Davis
One Shields Avenue
Davis CA 95616
GPBS

ARE UPDATE is published six times per year by the Giannini Foundation of Agricultural Economics, University of California.

Domestic subscriptions are available free of charge to interested parties. To subscribe to **ARE UPDATE** by mail contact:

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.

ARE UPDATE is available online at:
https://giannini.ucop.edu/publications/are-update/