Chapter 8. Grape and Wine Production in California

Julian M. Alston, James T. Lapsley, and Olena Sambucci

Abstract

Grapes were California's most valuable crop in 2017. Grapes are grown throughout the state for wine production and, in the San Joaquin Valley, for raisins, fresh table grapes, grape-juice concentrate, and distillate. This chapter outlines the broader grape growing industry as a whole to provide context for a more detailed discussion of wine grapes and wine. We discuss the spatial variation in grape yields and prices within today's California wine grape industry and the evolving varietal mix; the economic structure of the grape-growing and wine producing industry; and shifting patterns of production, consumption, and trade in wine. We interpret these patterns in the context of recent changes in the global wine market and the longer economic and policy history of grape and wine production in California.

Authors' Bios

Julian Alston is a distinguished professor in the Department of Agricultural and Resource Economics, the director of the Robert Mondavi Institute Center for Wine Economics at the University of California, Davis, and a member of the Giannini Foundation of Agricultural Economics. He can be contacted by email at julian@primal.ucdavis.edu. Jim Lapsley is an academic researcher at the UC Agricultural Issues Center, and an adjunct associate professor in the Department of Viticulture and Enology, University of California, Davis, and emeritus chair of the Department of Science, Agriculture, and Natural Resources for UC Davis Extension. He can be reached by email at jtlapsley@gmail.com. Olena Sambucci is a postdoctoral scholar in the Department of Agricultural and Resource Economics at the University of California, Davis. She can be contacted by email at osloan@ucdavis.edu.

The work for this project was partly supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2011-51181-30635 (the *Vitis*Gen project), and award number 2015-51181-24393 (the Efficient Vineyard project). The authors are grateful for this support. Views expressed are the authors' alone.

Table of Contents

Introduction

Grapes have been cultivated in the United States for more than 400 years and in California for more than 200 years. However, California's grape and wine industry did not really take off as such until the end of the 19th century. As discussed and documented in detail by Pinney (1989, 2005) and summarized by Alston et al. (2018), the longer history of grape and wine production in America reflects several significant influences. These include ongoing struggles against the biological barriers to development of an industry, eventually overcome about 150 years ago when the industry was first established in California; the subsequent destruction of the wine industry by government fiat in 1920, with consequences that lasted well beyond Repeal after 14 years of Prohibition; the recovery and reconstruction of the industry and a return to specialized wine grapes through the middle of the 20th century, which was both hindered and hastened by government policies; and seismic shifts in patterns of consumption and production in the modern era, with increased attention to quality and product differentiation.

In the late 18th century, Franciscan missionaries introduced European (*Vitis vinifera*) "Mission" grapes to California for making wine; the first vintage was probably 1782 (Pinney, 1989, p. 238). This was the main form of grape cultivation in California until the 1850s when, on the heels of the 1849 gold rush, the new state of California emerged as a major supplier of wine. California rose to a position of national preeminence in wine and wine grape production by 1880, a status it has held since. Much changed over the subsequent decades, and it was not all plain sailing, but the ultimate outcome was the creation of a thriving, vibrant, fascinating industry. The United States today is recognized globally as a significant wine producer, and the lion's share of the total U.S. value and volume of wine production is sourced in California.

In parallel with the growth in production of grapes for winemaking came the development of industry segments dedicated to growing grapes for other end-uses, including drying for raisins, packing as table grapes for fresh consumption, and crushing for grape juice concentrate and distillation. In the early days, multipurpose grape varieties—such as Thompson Seedless—could be grown for any and all of these end-uses, and flexibly allocated among them from one season to the next. Nowadays, varieties, trellises, and other aspects of the production system are much more specialized for particular end-uses, and the different parts of the grape industry are much less integrated with one another. In many ways, they are now altogether separate industries, each of which is complicated and interesting in its own ways. Taken together, table, raisin, and wine grapes have been ranked as California's most valuable crop in many years and grapes continue to vie for that status with almonds (Sambucci and Alston 2017). In 2017, California had a total of 829 thousand bearing acres of grapes, which produced about 6.5 million tons of grapes, worth some $5.7 billion (2017 $ values) at the farm. Of this total, about $3.6 billion was for wine grapes, $1.6 billion for table grapes, and $0.5 billion for raisin grapes.

This chapter provides an economic overview of the grape and wine industries in California, paying attention to the major developments in the history of those industries and the main influential forces, many of which continue to play a role, including the evolving global and domestic market context. It begins with a broad overview of the grape-producing industry as a whole, and then provides more detail on each of the main grape industries, defined according to the end-use of the grapes. Most of the chapter is devoted to wine grapes and wine, and less to the other end-uses of grapes, partly because it is a more complicated and diverse sector, as will be explained, and partly because we deal with the wine industry as well as the industry producing its primary input: wine grapes.

Current Grape Production Patterns—An Overview

The production of grapes and wine in California dates back at least to the beginnings of European settlement, in the 17th century. Native American pests and diseases (such as phylloxera, Pierce's disease, powdery mildew, and downy mildew, among others), combined with unfavorable climatic conditions, frustrated earlier attempts to establish an industry in the eastern states based on European *Vitis vinifera* grape varieties (Pinney 1989). The consequences of the Gold Rush of the 1850s, combined with technological advantages, California's more favorable climate, and practices for managing the main pest and disease problems, made *Vitis vinifera* cultivation sustainable and enabled the wine industry to take off in the late 1800s, only to be shut down by government fiat a few decades later. While California's wineries were closed by Prohibition (1920–33), grape growing flourished, producing varieties suitable for shipping east for home wine-making, as well as for raisins and fresh consumption.

Repeal in 1933 left an enduring legacy in terms of the varietal mix and industry structure and Byzantine state-specific regulations over wine production and marketing. Following World War II, which imposed different policy strictures and introduced new incentives for reorganizing production, grape and wine production in California entered an era of growth and change, as discussed by Alston et al. (2018). Especially in the past 20–30 years, the industry has evolved considerably in terms of the product mix and quality emphasis, with implications for varieties planted and cultivation practices in vineyards. In this section, we review the current status of the California grape-growing industry in the context of developments over the past half-century, emphasizing the more recent trends.

Area, Volume, and Value of Production

Grapes have multiple end-uses, with some varieties being suitable for more than one end-use, and complete information is not available on the actual utilization of these multipurpose varieties. Even when we know the utilization, it is not always straightforward to compare quantities and values of grapes across end-uses. When they leave the farm, raisins and especially table grapes are close to their final product forms, whereas wine grapes must undergo considerable further processing, with much value-adding, before they become retail wine. Thus, comparing farm-gate values is different from comparing either values at harvest or final values among end-uses of grapes.[1]

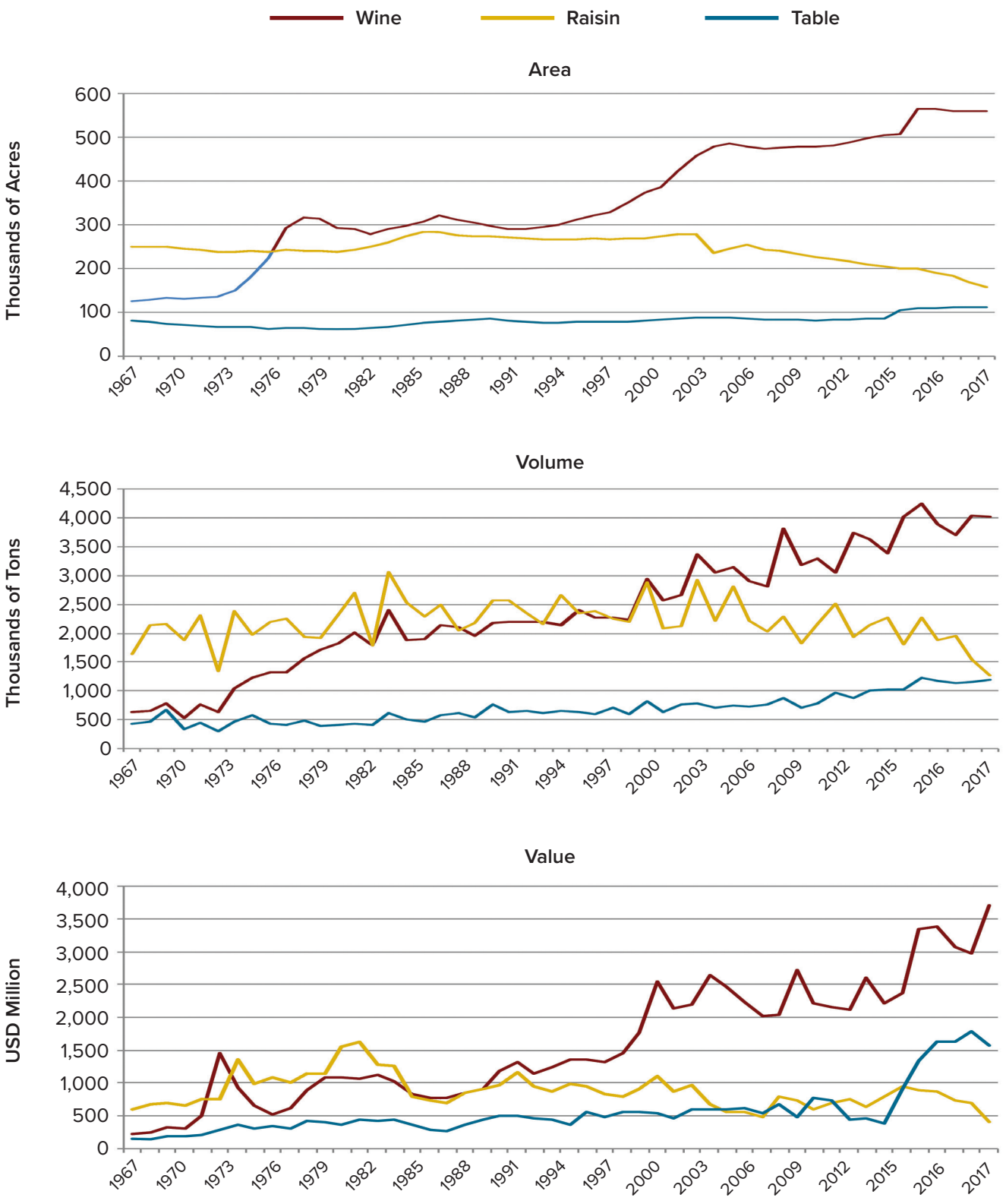
Further complications arise when we discuss production patterns among regions within California, because the available information is based on reports by County Agricultural Commissioners, which are not necessarily comparable among counties. The aggregation of the county-level data yields totals that are not entirely consistent with the totals reported by the United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS) for the state as a whole. We seek to provide consistent and meaningful measures, properly explained.

Figure 1 shows the trends in 50 years of annual observations of the total bearing area, volume, and value of production at the farm level for each of the three main categories of grapes—wine, table, and raisin—based on the classification of varieties of grapes among these three main end-uses, though they might not all have been used as such.[2] Figure 1 shows that the total bearing area of wine grapes has grown considerably both in absolute terms and relative to table grapes and raisin grapes, with notable surges in the 1970s and the 1990s. Raisins have lost ground, especially in the past two decades, while table grapes have crept up fairly steadily. The trends of bearing area are reflected in the trends in volume of production, though the production patterns exhibit more variability, reflecting the boom and bust cycles of production and investment as well as weather effects on yields.

1 In the case of raisin production, we sometimes observe quantities and prices of the dried fruit, and have to use conversion factors to infer the quantity of fresh fruit used to produce them; sometimes the converse.

2 In particular, we know that considerable quantities have been used for the production of grape juice, concentrate, and distillate. Nowadays this production is predominantly based on "wine grapes" (say, 20–30 percent of the total annual "crush") particularly from the Southern San Joaquin Valley, but 50 years ago a much greater share of production for this and all end-uses would have been from Thompson Seedless grapes, a truly multipurpose variety.

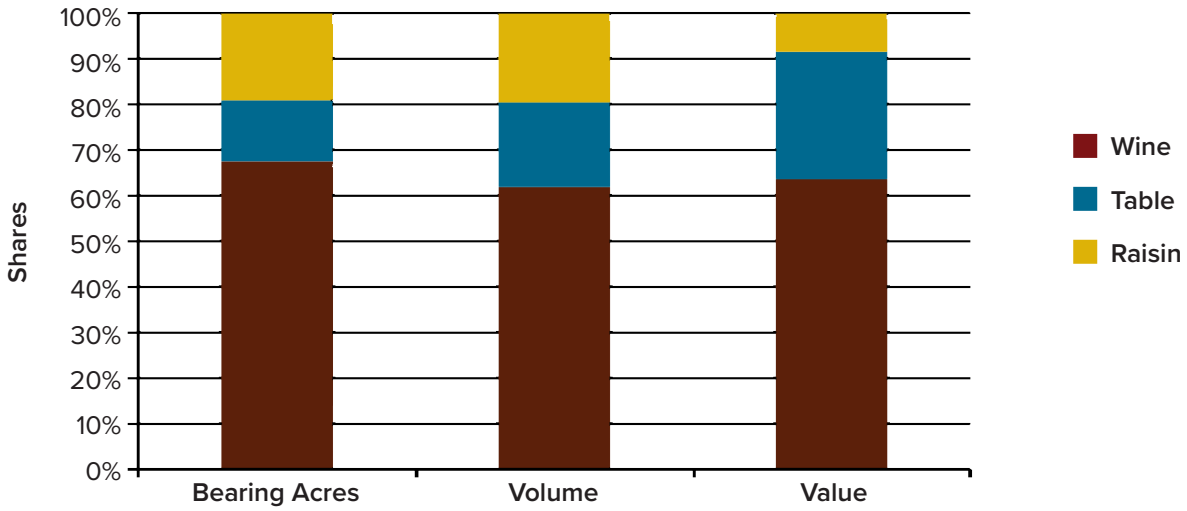
Figure 1. Area, Volume, and Value of Production, by Type of Grapes, 1967–2017



Source: Created by the authors using data from USDA/NASS (1920–2010, 2000–2017a, 2000–2017b)

Notes: Nominal monetary values were deflated by the GDP Implicit Price Deflator USBEA/FRED (2019)

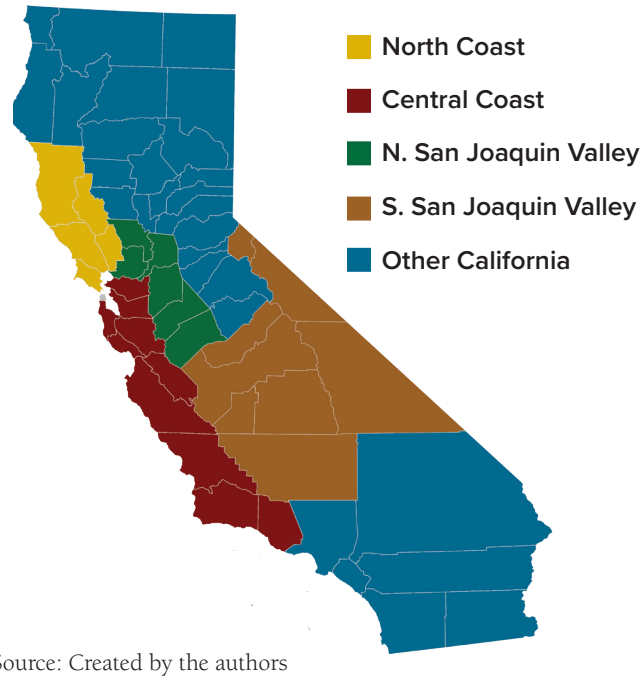
Figure 2. Area, Volume, and Value of California Production, by Type of Grapes, 2017



Source: Created by the authors using data from USDA/NASS (2019)

The third panel of Figure 1 shows an even more pronounced divergence in the trends in real (2017 dollar) value of production among the different end-uses. This pattern reflects a "premiumization" of wine production in terms of both the varietal mix and regional location of production within California, as documented by Alston, Anderson, and Sambucci (2015), and, more recently, a rapid rise in the average unit value of California table grapes.

Figure 3. Grape-Producing Areas of California



Source: Created by the authors

Figure 2 shows the contemporary shares of bearing area, volume, and value of production among the three main types of grapes grown. Wine grapes dominate the picture in every dimension. Table grapes have large shares of volume and especially value compared with their share of bearing area—comparatively high yields per acre and especially high average values per ton; raisins have, conversely, a small share of value compared with their shares of area and volume of production.

Wine grapes are grown in significant quantities in many parts of the state, whereas production of table grapes and raisin grapes is concentrated in the Southern San Joaquin Valley. Table 1 includes details on the bearing area, volume, and value of production of each of the three main categories of grapes in each of five main regions of the state (see Figure 3), based on county-specific data from the County Crop Reports published by the Agricultural Commissioner's office for each respective county (see References for a complete list of reports), and the sum of those elements, representing the state as a whole. For comparison, the table also includes the corresponding state totals obtained from USDA/NASS (2019), which are generally similar but with some notable discrepancies, in particular with respect to the average unit values and consequently the total value of raisins and table grapes.

Most of the total value and volume of grape production comes from the Southern San Joaquin Valley, which

Table 1. Area, Volume, and Value of Production, by Types of Grapes and Region, 2017

Region	Grape Types			
	Wine Grapes	Raisin Grapes	Table Grapes	Total
	Total Area, Thousand Bearing Acres			
North Coast	129			129
Central Coast	119			119
N. San Joaquin Valley	176			176
S. San Joaquin Valley	142	132	133	407
Other California	17	2	7	26
Total California	**582**	**134**	**140**	**856**
NASS Total California	**560**	**158**	**111**	**829**
	Total Production, Thousand Tons			
North Coast	452			452
Central Coast	460			460
N. San Joaquin Valley	1,295			1,295
S. San Joaquin Valley	1,684	1,351	1,529	4,564
Other California	68	22	49	139
Total California	**3,959**	**1,372**	**1,578**	**6,910**
NASS Total California	**4,014**	**1,268**	**1,200**	**6,482**
	Average Unit Value, $ Per Ton			
North Coast	3,311			3,311
Central Coast	1,574			1,574
N. San Joaquin Valley	590			590
S. San Joaquin Valley	332	438	1,813	860
Other California	1,281	455	2,389	1,546
California Average	**917**	**438**	**1,831**	**1,031**
NASS Total California	**927**	**380**	**1,330**	**894**
	Total Value, $ Millions			
North Coast	1,496			1,496
Central Coast	724			724
N. San Joaquin Valley	764			764
S. San Joaquin Valley	559	559	2,772	3,923
Other California	87	10	118	215
Total California	**3,630**	**601**	**2,890**	**7,122**
NASS Total California	**3,721**	**482**	**1,596**	**5,799**

Sources: Created by the authors using data from CDFA (2018). County Crop Reports for Glenn, Stanislaus, and Tehama counties were obtained from the Agricultural Commissioner's Office for each county (see references). NASS state totals are from USDA/NASS (2019).

Notes: Volume of production and price per ton for raisin grapes are reported using fresh equivalent basis

Table 2. Total Grape Area and Number of Grape-Producing Farms, 2017

Region	Total Grape Area		
	Farms	Acres	Acres/Farm
North Coast	4,156	150,481	36.2
Central Coast	1,694	131,697	77.7
N. San Joaquin Valley	1,336	188,244	140.9
S. San Joaquin Valley	2,610	434,808	166.6
Other	2,016	30,042	14.9
Total California	**11,812**	**935,272**	**79.2**

Source: Created by the authors using data from USDA/NASS (2017b)

produces all of California's raisin and table grapes and also a significant share of the state's total volume, but a much smaller share of the total value of production of wine grapes. The wine grapes produced in this region have a comparatively low average unit value, offset to some extent by high yields, and they are used to produce very low-cost wine, grape juice concentrate, and distillate. The other four regions produce only wine grapes in significant quantities, and they vary in their market outlets and structure of production in interesting ways that are discussed in detail in subsequent sections.

Structure of the Grape-Growing Industry

In 2017, the most recent year for which census data are available, California had 11,812 farms that grew grapes. The total area (including non-bearing vines) was 935 thousand acres planted to grapes, an average of 79 acres per farm (USDA/NASS 2017b). These statewide average figures mask some variation among regions, some of which stems from different types of grape production. In the San Joaquin Valley, with an average of more than 140 acres of wine grapes per producer, grape production generally is conducted at a larger scale compared with the coastal regions, especially the North Coast, with an average of 36 acres of wine grapes per producer (Table 2).

Not surprisingly, wine grape growers in California's Central Valley have mechanized, adopting mechanical pruning and harvesting at a higher rate than coastal growers, who generally continue to rely on hand labor for many operations. Over 80 percent of California's wine grapes are harvested by machine. Machine pruning is less widely adopted (Dokoozlian 2013). In contrast, table grape production, in particular, is highly labor intensive, as table grapes are picked by hand and packed in the field, leaving the vineyard ready for direct delivery to the supermarket, but table grape operations tend nevertheless to be relatively large scale, employing large crews of hired labor during the harvest.

Table 3 contains more information on the size distribution of grape producers in terms of area planted to grapes—again, including all end-uses of grapes. As is typical of farm-size distributions, this distribution is heavily skewed to the right. The vast majority of grape producers have relatively small vineyards and, while the average area is 79 acres of vines, the median is closer to 15 acres. Reflecting this skewness, the roughly 55 percent of growers who had less than 15 acres of vines collectively accounted for less than 3 percent of the total vineyard area, while the 92 growers (less than 1 percent of the total) who had 1,500 acres or more were responsible for almost 32 percent of the total area. More than half the total vineyard area is on farms with 500 or more acres of vineyard. Of course, and as noted above, these distributional figures for the statewide industry as a whole will not be equally representative of all segments. In particular, very large vineyards are much more likely to be found in the San Joaquin Valley than in the premium coastal valleys where land values are very much higher.

Table 3. California: Size Distribution of Grape Producers, 2017

Size Range	Total Bearing and Non-Bearing Grapes		Cumulative Total	
	Farms	Acres	Acres	Percent
0.1 to 0.9 acres	1,359	528	528	0.06
1.0 to 4.9 acres	3,118	6,997	7,525	0.80
5.0 to 14.9 acres	2,238	19,322	26,847	2.87
15.0 to 24.9 acres	1,181	22,068	48,915	5.23
25.0 to 49.9 acres	1,269	44,443	93,358	9.98
50.0 to 99.9 acres	1,037	72,738	166,096	17.76
100.0 to 249.9 acres	885	133,980	300,076	32.08
250.0 to 499.9 acres	382	132,348	432,424	46.24
500.0 to 749.9 acres	128	78,341	510,765	54.61
750.0 to 999.9 acres	58	49,413	560,178	58.89
1,000.0 to 1,499.9 acres	65	78,730	638,908	68.31
1,500.0 acres or more	92	296,363	935,272	100.00
All Farms	**11,812**	**935,271**		

Sources: Created by the authors using data from USDA/NASS (2017a)

Utilization of California's Grape Production Systems

Several features of grape production make an economic analysis of this industry particularly complicated. First, like other perennial crops, grapes are capital intensive, with a large share of the total costs of production tied up in the biological capital—the vines themselves—and the associated physical capital in trellising and irrigation infrastructure. This biological capital takes years to create on the farm—with a gestation period of several years before vines become fully productive, followed by a productive life of 20 years or more. Eventually, this capital stock depreciates economically, either because of changes in demand for the particular variety, or because of physical deterioration, owing to the burden of chronic diseases (often "trunk diseases") or pest infestations reducing the productivity of the vineyard.[3]

In the short run, grape production is largely pre-determined (supply is highly inelastic with respect to current prices), and prices must adjust to absorb shifts in demand or changes in total production that reflect prior investments or yield shocks from weather or pests (or, as in 2017,

3 In perennial crops, pests and diseases can cause a loss not only of the current year's output but also of the capacity to produce future output. When Pierce's disease kills grapevines, it destroys valuable capital that takes years to replace, entailing a loss in output for several years in addition to the cost of the expenditure to replant the vineyard.

Box 1: Evolving Demand for California Wine and the Media

As discussed and documented by Alston, Lapsley, and Sambucci (2018), the 1970s boom in California wine production and consumption was driven by demand from the "baby boom" cohort reaching adulthood, combined with a trend of improving quality—a trend reflecting increased emphasis on table wine rather than fortified wine, greater use of premium varietals of specialized winegrapes, and improved winemaking methods.

The improved quality of California wines was confirmed on 24 May 1976 when, at the so-called "Judgment of Paris," French judges in blind tastings of top-quality red and white wines from France and California rated California wines best in each category (Stag's Leap Wine Cellars 1973 Napa Valley S.L.V. Cabernet Sauvignon, and Chateau Montelena 1973 Napa Valley/Calistoga Chardonnay). This event made it undeniable that California was producing world-class wines (Taber, 2005).

The 1990s saw a second surge in bearing area of winegrapes in California—from 120,000 hectares in 1992 to 190,000 hectares in 2001—a 60 percent increase. Red wine consumption tripled. A contributing factor to the shift to red wine was a public perception of health advantages, which some ascribe to a report by Morely Safer on "The French Paradox" aired on the news magazine show 60 Minutes on 17 November 1991. This report noted the low incidence of cardiovascular disease among the French and suggested this might be linked to their high per capita consumption of red wine. Americans were open to such a convenient theory: sales of red wine in the United States increased by 39 percent in 1992 (Frank and Taylor, 2016).

That wine demand might be susceptible to sudden swings is also illustrated by the so-called "Sideways Effect." In the Academy Award-winning movie, Sideways, released in October 2004, one of the leading characters—Miles Raymond, a neurotic wine snob played by Paul Giamatti—venerated Pinot noir and denigrated Merlot. This had surprising consequences in the wine market. While the size of the effect is hard to measure precisely, and it may have worn off by now, Cuellar, Karnowsky, and Acostac (2009) estimated a reduction in sales of Merlot by 2 percent over the interval 2005–2008, while sales of Pinot noir increased considerably.

References: Alston, J.M., J.T. Lapsley, O. Sambucci, and D.A. Sumner, 2018. "United States." Chapter 15 in Kym Anderson and Vicente Pinilla, eds, *Wine's Evolving Globalization: Comparative Histories of the Old and New World*. Cambridge: Cambridge University Press.

Cuellar, S.S., D. Karnowsky, and F. Acostac, 2009. "The Sideways Effect: A Test for Changes in the Demand for Merlot and Pinot Noir Wines." *Journal of Wine Economics* 4(2): 1–14.

Frank, M. and R. Taylor, 2016. "Journalist Morley Safer, Who Highlighted Red Wine's Potential Health Benefits, Dies at 84," *Wine Spectator,* May 19. Available at http://www.winespectator.com/webfeature/show/id/Morley-Safer-Dies-at-84 (accessed 22 May 2016).

Taber, G.M, 2005. *Judgment of Paris,* New York NY: Scribner.

wildfires). These features of the production system can give rise to pronounced boom-and-bust cycles and leave grape producers vulnerable to sharp changes in markets (including shifts in demand as different varieties of table grapes or wine grapes become more or less fashionable). The wine grape industry, in particular, has seen some dramatic demand shifts.

Second, unlike most other perennial crops, production of grapes is highly differentiated both in terms of the varieties of grapes grown—classified according to their primary end-use—and, especially within the wine grape sector, in terms of the market "quality" segment and corresponding methods of production. Both within and especially among regions of California, the normal yields and prices of wine grapes vary enormously, more so than for any other farm commodity. This diversity complicates the analysis of the economics of production at the farm level as well as in the retail markets for wine where prices range from a few dollars to hundreds of dollars per 750 ml bottle.

Table Grapes

Over the past 30 years, as shown in Figure 1, annual production of table grapes grew steadily—from 540 thousand tons on 84 thousand bearing acres in 1987 to 1,200 thousand tons on 111 thousand bearing acres in 2017. Over the same period, the real value of that production grew even faster—from $444 million to $1,596 million (2017 real values)—reflecting a considerable increase in average price per ton, especially during the current decade.

At least some of that increase in unit value is due to new varieties of table grapes with enhanced quality traits, for which consumers are happy to pay more—such as large seedless berries, with the desired color, sensory attributes, and seasonal availability. In table grapes, varietal innovation is proceeding apace, including proprietary private varieties developed and owned by individual producers as well as public varieties developed by grape breeders supported by a mixture of government and industry funding.

In 2017, the California Grape Acreage Report (USDA/NASS 2018a) listed details of area planted for more than 70 table grape varieties, of which 15 had at least 1,000 acres planted and together accounted for the lion's share (83 percent) of the total. As one indicator of the rapid rate of varietal change, all of the bearing acreage for several of the current varieties was planted at least 10 years ago, while for several others, all of the current acreage was planted within the past five years. Varieties that had the largest share of bearing acreage in 2017 (Flame Seedless, 18.1 percent; Crimson Seedless, 10.2 percent; Red Globe, 8.6 percent) had much smaller shares of non-bearing acreage (a combined total of 6.7 percent) compared with some up-and-coming varieties (Allison, 10.9 percent; Scarlet Royal, 10.5 percent; Autumn King, 8.13 percent).

Table grapes are typically picked and packed in a single operation, such that they leave the field in retail packs ready for cool storage and shipment to retailers around the world. Quality control is paramount, and growers incur significant labor and other costs both before and during the harvest. University of California Cost and Return Studies indicate that in 2017, table grape growers incurred annual operating costs on the order of $14,000–$18,000 per acre for newer, popular varieties (about 45 percent of these costs was for labor), to generate income of about $30,000 per acre (UCCE 2018a, 2018b). Significant issues for growers in this industry include continued access to sufficient supply of skilled labor, improved varieties, and pesticides and other chemical technologies that are valuable for managing the production process as well as pests and diseases. New concerns about labor supply have promoted enhanced interest in mechanization and the use of information technologies to allow more effective and efficient use of labor, water, and other resources. Promising possibilities are being developed.

Table grapes are available to U.S. consumers year-round. California itself has an extended growing season, because it combines diverse regions and varieties with different harvest times, and the winter months are covered by imports from Mexico and the Southern Hemisphere—especially Chile and, more recently, Peru. California exports table grapes to other countries, especially Canada and China, as well as countries throughout the Southern Hemisphere.

Raisins

Production of raisin grapes peaked in the early 1980s, after which, as shown in Figure 1, the trend in annual area and production was flat for many years, while the real (2017 dollar) value trended down. Since 2000, both area and production have trended down along with value: from 280 thousand bearing acres yielding 2,921 thousand tons fresh equivalent valued at $670 million (compared with 2,112 thousand tons valued at $964 million in the previous year, 1999), down to 170 thousand bearing acres yielding 1,536 thousand tons valued at $482 million in 2017. The patterns of fluctuating (and fading) fortunes for California raisin producers reflect a pronounced pattern of fluctuating production and thus prices—with years of high yields (and low prices) followed next year by low yields (and high prices)—in the context of a static or declining demand. The upshot is a shrinking of the industry and responses by government and industry attempting to mitigate the consequences.

Although raisins are traded internationally, patterns of prices and production indicate that the California industry faces a significantly downward sloping demand. The Raisin Administrative Committee (RAC, a federal marketing order established in 1949) sought to exploit that relationship by using its reserve (supply management) program to divert raisins away from the normal market and thereby to increase the price (and hence, the value) of the crop. In June 2015, the Supreme Court outlawed the RAC's reserve program on the grounds that it represented an unconstitutional taking of property (see, e.g., Crespi, Saitone, and Sexton, 2016). The marketing cooperative, Sun-Maid, almost 100-years old, and the California Raisin Marketing Board (CRMB, a state marketing order created in 1998), continue to provide other industry "collective" goods, but neither of these organizations can manage supply.

Of course, some producers will continue to succeed and even flourish. Varietal innovation has been slow in this industry, compared with table grapes. In 2016, 86 percent of the total area of raisin grapes was still Thompson Seedless, most of which were planted at least 10 years ago, with Fiesta (8 percent), and Selma Pete (4 percent) accounting for most of the rest. However, innovative producers have been adopting new trellises and production systems—such as dried on the vine—that will allow them to operate with less labor and on a larger scale, and thus at lower cost and on an economically more sustainable basis, as indicated by recent University of California Cost and Return Studies (UCCE 2016a, 2016b).

Juice Concentrate and Distillate

Some so-called "raisin grapes" are diverted to other uses, especially when prices for raisins are low. In 2017, 94 thousand tons of raisin grapes were crushed, potentially for use as wine or other uses including grape juice concentrate or distillate; and, in the same year, a further 132 thousand tons of "table grapes" were crushed. These amounts are significant, but small relative to the quantities of raisin grapes and table grapes and the total crush: more than 4 million tons. Nevertheless, juice concentrate and distillate is a significant end-use of California grape production, accounting for a surprisingly large share of the total grape crush.

Our estimates indicate that, since the year 2000, at least 20 percent (and, in one year more than 40 percent) of the total annual grape crush has gone for uses other than wine, including juice concentrate (primarily for use in the food manufacturing industry as a "natural," "healthy" substitute for sugar and other sweeteners), and to make distillate for use to produce brandy or fortified wine (Table 4).

The total quantity going to these non-wine uses varies with the fortunes of the various industry segments. On average, during the period 2000–2017, 14.3 percent of the crush has been used to make grape juice concentrate and 15.5 percent for distillate, leaving 70 percent for wine. On average during this period, out of 3.9 million tons of grapes crushed per year, 2.7 million tons were used to make wine, and 1.2 million tons were used for other purposes (i.e., to make grape juice concentrate and distillate). The grapes used for these other purposes are likely to have been sold for comparatively low prices—perhaps in the range of $200–300 per ton—and would almost all have come out of the Southern San Joaquin Valley. This would leave less than half of the total grape crush from that region (1.6 million tons in 2017) for wine making.

Table 4. Utilization of California's Grape Crush, 2000–2017

Crush Year	Crush Volume				Shares of Total Volume		
	Total	Concentrate	Distilled	Wine	Concentrate	Distilled	Wine
	Thousand Tons				Percent		
2000	3,951	745	749	2,458	18.9	18.9	62.2
2001	3,368	537	651	2,180	15.9	19.3	64.7
2002	3,787	752	808	2,227	19.9	21.3	58.8
2003	3,370	507	654	2,209	15.0	19.4	65.5
2004	3,615	658	623	2,334	18.2	17.2	64.6
2005	4,329	550	565	3,214	12.7	13.0	74.2
2006	3,489	463	541	2,485	13.3	15.5	71.2
2007	3,674	516	509	2,649	14.1	13.9	72.1
2008	3,673	748	507	2,418	20.4	13.8	65.8
2009	4,095	499	532	3,064	12.2	13.0	74.8
2010	3,986	536	578	2,872	13.4	14.5	72.1
2011	3,874	598	581	2,695	15.4	15.0	69.6
2012	4,387	529	569	3,290	12.1	13.0	75.0
2013	4,699	655	729	3,315	13.9	15.5	70.5
2014	4,143	470	699	2,975	11.3	16.9	71.8
2015	3,868	435	661	2,772	11.2	17.1	71.7
2016	4,227	393	504	3,330	9.3	11.9	78.8
2017	4,242	404	448	3,390	9.5	10.6	79.9
Average	**3,932**	**555**	**606**	**2,771**	**14.3**	**15.5**	**70.2**

Source: Created by the authors using data from USDA/NASS (2000–2017a)

Notes: Tons crushed for distillate computed assuming 170 gallons per ton applied to total distillate from U.S. Treasury/TTB (2017a)

Wine Grapes

In 2017, the United States crushed 4.67 million tons of grapes—representing about 12 percent of the world's wine volume (Wine Institute, 2018a, 2018b). Four states accounted for the lion's share (97 percent) of that total: California (CA), Washington (WA), Oregon (OR), and New York (NY). California dominates that group, accounting for about 90 percent of the four-state total. California differs from the other major producing states, and itself contains several distinct wine production regions that differ in terms of terrain, climate, soil types, mixture of varieties grown, and quality of grapes and wines produced. Data on production and prices of wine grapes in California are available in some cases by county (of which there are 58, not all of which grow wine grapes) and in others by crush district (of which there are 17). Some crush districts contain several counties or parts of counties. In Table 5 these data are organized into five contiguous regions, defined such that each crush district fits entirely into one of the five regions (see Figure 3).[4] Treating each of the other significant wine-producing states (i.e., WA, OR, and NY) as a region, we have eight primary U.S. wine-producing regions comprising these three plus the five in California.

Table 5 includes some detail on the salient features of the eight main U.S. wine-producing regions in 2017 (see Appendix Table 5A for more detail). Several distinct patterns are apparent in this table, as illustrated in Figure 4. First, California dominates the nation's total area, volume, and value of wine production. Second, the regional shares differ significantly among measures of area, volume, and value of production. In particular, the Southern San Joaquin Valley has a much larger share of volume compared with area and especially value of production, while the North Coast region has a much smaller share of volume compared with area and value of production. These patterns reflect the relatively high yield per acre (and correspondingly low price per ton) of grapes from the Southern San Joaquin Valley and the conversely low yield and high price per ton in the North Coast. In 2017, in Napa County, the average yield was 3.3 tons/acre and the average crush price was $5,225/ton, almost 10 times the average crush price in the Southern San Joaquin Valley where the average yield was 17.3 tons/acre (Appendix Table 5A). The other regions were distributed between these extremes with higher yields generally associated with lower prices per ton.

4 These regions are North Coast or NC (comprising crush districts 1, 2, 3, and 4); Central Coast or CC (crush districts 6, 7, and 8); Northern San Joaquin Valley or NSJV (crush districts 5, 11, 12, and 17); Southern San Joaquin Valley or SSJV (crush districts 13 and 14); and Other California or OC (crush districts 9, 10, 15, and 16).

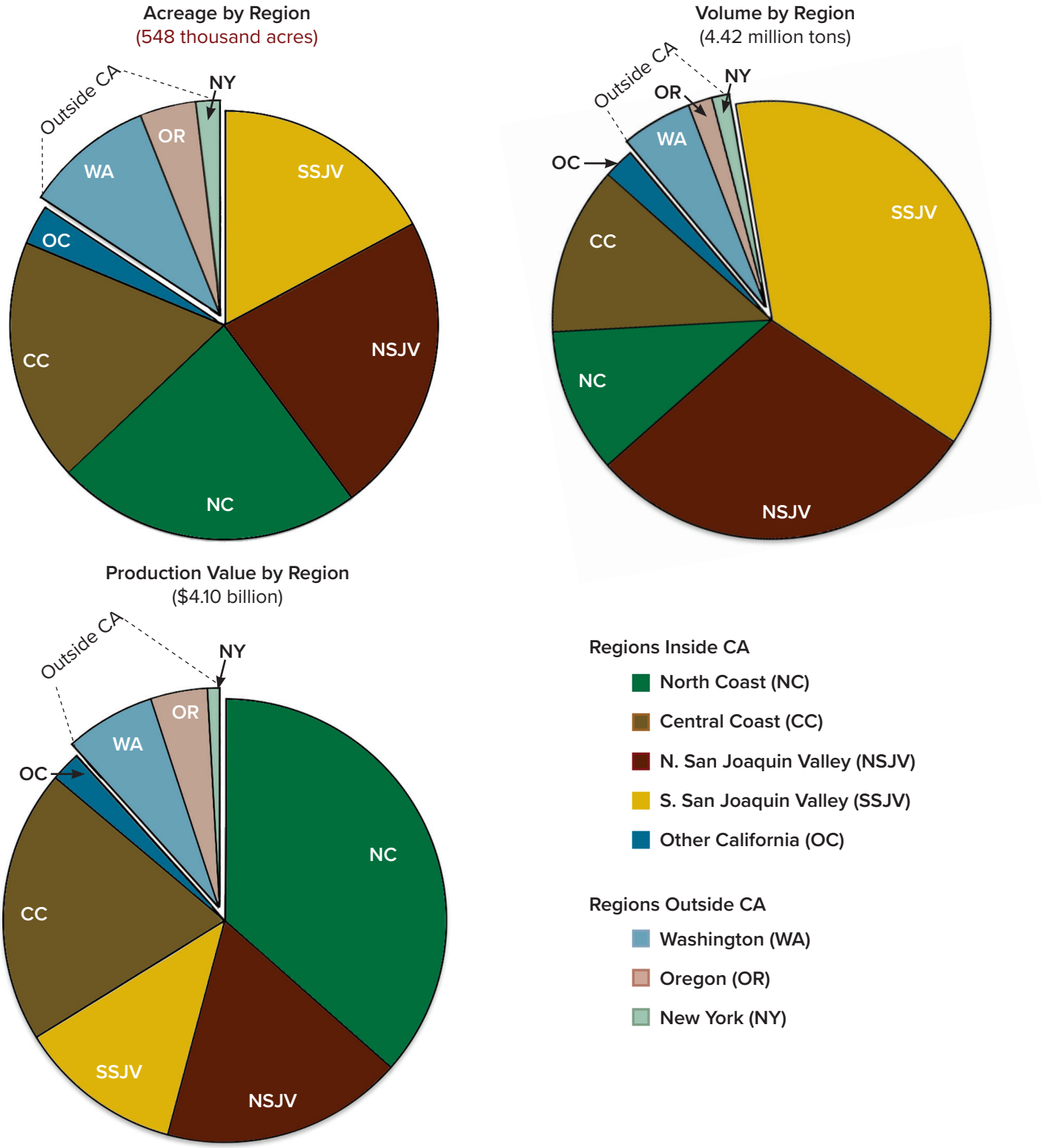
Table 5. Characteristics of U.S. Wine Grape-Growing Regions, 2017

Region	Total Acreage	Volume	Crush price	Value
	Acres	Tons	$/Ton	$ Millions
North Coast (NC)	126,096	467,119	3,268	1,527
Central Coast (CC)	100,308	543,766	1,535	835
N. San Joaquin Valley (NSJV)	123,983	1,273,899	579	737
S. San Joaquin Valley (SSJV)	93,764	1,624,184	309	503
Other California (OC)	16,286	104,715	893	93
Total California (CA)	460,437	4,031,684	921	3,695
Washington (WA)	53,000	229,000	1,210	277
Oregon (OR)	23,000	77,000	2,234	172
New York (NY)	10,058	57,000	649	37
Total United States (U.S.)	**546,495**	**4,376,684**	**955**	**4,181**

Sources: USDA/NASS (2017a,b; 2019). Appendix Table 5A provides more detail

Figure 4. U.S. Wine Regions: Area, Volume, and Value of Production, 2017

Under each heading, you included values in for last year's chapter. Recent Excel files do not include values.



Source: Created by the authors using data from USDA/NASS (2018a,b;2019)

Table 6. Characteristics of California Wine Grapes Crushed, 2017

Region	Total Tons Crushed	Purchased Tons Crushed	Custom Crush	Own Tons Crushed	Own / Total Tons Crushed
		Tons			Share (%)
North Coast (NC)	467,119	295,726	21,026	150,376	32
Central Coast (CC)	543,766	363,852	11,307	168,608	31
N. San Joaquin Valley (NSJV)	1,273,899	1,068,832	3,560	201,507	14
S. San Joaquin Valley (SSJV)	1,624,184	1,553,882	694	69,608	4
Other California (OC)	104,715	53,654	1,456	49,608	47
Total California (CA)	**4,013,684**	**3,335,943**	**38,044**	**639,697**	**16**

Sources: Created by the authors using data from USDA/NASS (2018b). Appendix Table 6A provides more detail

Within the United States, in 2014 five varieties (Chardonnay, Cabernet Sauvignon, Merlot, Pinot Noir, and Zinfandel) accounted for 52.3 percent of the total volume and 63.2 percent of the total value of production from the four states included in Table 5. As discussed in detail by Alston, Anderson, and Sambucci (2015), these five varieties predominate in several of the main production regions—in particular in the premium price regions within California, as well as in Washington and Oregon—but the emphasis varies among the premium price regions and some regions are quite different. In particular, the hot Southern San Joaquin Valley (dominated by French Colombard and Rubired used to produce grape juice concentrate as well as bulk wine) and New York (dominated by non-vinifera American varieties, Concord, and Niagara) are quite unlike the other regions climatically and in terms of their grape varietal mix.

Chardonnay is the most important variety in terms of total bearing area nationally and is highly ranked throughout the premium regions. However, the North Coast region is especially known for its Cabernet Sauvignon, which historically and increasingly is its most important variety. The same can be said for Washington. The cooler coastal regions—in particular, Oregon and the Central Coast region of California—are relatively specialized in Chardonnay and Pinot Noir and other cool-climate varieties. Zinfandel is more significant in the Northern San Joaquin Valley and other mid-price regions, and these patterns reflect this variety's dual roles in serving as both a premium red varietal wine and as lower-priced "blush" (white zinfandel) wine.

Prices vary systematically among regions—in general, the North Coast region has higher prices than other regions for all varieties, and the Southern San Joaquin Valley has lower prices. In addition, prices vary systematically among varieties—generally among the premium varieties grown in significant quantity, Cabernet Sauvignon ranks higher than Chardonnay, and Zinfandel generally ranks lower. But the sizes of the premia, and even the rankings of varieties, vary among regions. For example, Pinot Noir ranks above Cabernet Sauvignon almost everywhere, but not in Oregon where Pinot is by far the dominant variety, nor in the Napa-Sonoma region. Chardonnay ranks above Cabernet Sauvignon in the Central Coast region.

Because grape-growing location has become recognized as an important element of perceived wine quality, the vineyard location is often identified on the wine label. Prior to 1983, wineries could use only geo-political locations, such as counties or towns, on labels. In 1983, the federal government responded to desire from the industry to include more precise vineyard locations on wine labels by creating a new type of location, the so-called "American Viticultural Areas" (AVAs—see U.S. Treasury/TTB, 2013). AVAs are defined geographic areas that may be quite large and cross state or county lines, or may be quite small and lie within a county or, in some cases, another AVA. The Napa Valley AVA is, for instance, a large AVA located within Napa County. The Oakville AVA is a much smaller AVA that is located within the Napa Valley AVA. In contrast, the Carneros AVA is a defined AVA in the southern portion of Napa and Sonoma Counties. Today, wineries may identify the grapes used in a wine as coming from an AVA if 85 percent of the grapes were grown in the AVA.

Wineries

California includes a diverse mixture of wine production models. A vineyard may be vertically integrated with a winery, in a single enterprise, or the two enterprises may be entirely separate. In some cases, a winery may crush and bottle only estate-grown fruit while, next door, a vineyard sells all its production to a winery somewhere else. Because grape growing and wine production are often separate businesses in California, most wineries contract with grape growers for at least some of their volume. Goodhue et al. (2003) reported that 90 percent of California growers sold grapes under contract and that 10 percent of contracts were pre-planting contracts in which the winery contracted to purchase grapes from a not-yet-established vineyard. Production models vary from region to region within California, and Table 6 provides details of the balance between purchased, custom crush, and own tons crushed by wineries (Appendix Table 6A provides more detail). For the state as a whole, only 16 percent of tons crushed were own-grown; the vast majority were purchased. This pattern was even more pronounced in the Southern San Joaquin Valley where about 4 percent of the crush was own-grown. In the premium coastal regions, the share of own-grown fruit in the total crush was closer to 30 percent.

Some wineries may have a cellar door from which they sell at retail whereas others may leave the retailing to others. Reflecting this diversity, California has an active market for wine grapes—whether under contract or for spot sales—as well as markets for bulk wine and bottled wine. Particular sizes of vineyards—depending on the location and market segment to be served—are more or less appropriate for these different business models. Some wine businesses in California are engaged in every aspect: growing grapes, making wine, offering custom crush and winemaking services, importing and exporting bulk or premium wine, and providing cellar door experiences at boutique winery estates.

Among countries, the United States is the world's third-largest producer of wine, and the largest consumer and importer (Wine Institute, 2018b, 2018c; ITC, 2018). The quantity of wine consumed in the United States almost doubled over the past 20 years, from 526 million gallons in 1997 to just over 1 billion gallons in 2017 (Wine Institute, 2018c). This expansion is a result of both population growth and an increasing rate of adult per-capita consumption. Both trends are expected to continue, and by 2030 the volume of U.S. wine consumption is predicted to increase by 50 percent from a 2010 base (Lapsley 2010). U.S. growth trends stand in marked contrast to declines in volume of wine consumed in France, Italy, and Spain (OIV 2017).

Domestic Production and Consumption

Still wine accounts for the vast majority of domestically produced and bulk imported wine that is bottled and consumed in the United States, although smaller volumes of other types of wine are produced, and about 10–11 percent of production is used for distillation. According to 2017 TTB data, over 6015 million gallons of still wine were bottled and "removed" after payment of tax for domestic consumption; this represented 86 percent of the approximately 718 million gallons of domestically bottled wine.[5] Since 2005, the volume of domestically bottled wine (including cider) tax-paid entering the U.S. market has increased by almost one-third: cider consumption increased almost tenfold, from 4.9 million gallons to 45.8 million gallons, while still wine grew by 34.5 percent, and wine cooler volume declined (Table 7).

California produces the vast majority of wine produced in the United States. In 2017, the TTB reports approximately 888.6 million gallons of still wine produced in the United States, with California responsible for 716.3 million gallons, or 84.3 percent. Washington State, with 44.8 million gallons, and New York State, with 28.1 million gallons, were second and third in production (TTB, 2017a). All of California's and Washington State's wine production is from *Vitis vinifera* grape varieties, while New York State's production includes fruit wines and wines produced from native grape species and hybrids. The increase in U.S. demand for wine is reflected in an increase in the number of wineries, which has more than doubled in the past decade. In 2004, there were 4,325 federally licensed wineries or wine blenders in the United States, with 2,059 located in California; by 2017, the number of U.S. wineries had increased to 11,996, with 4,661 located in California. Other major states with

5 Here, "wine" includes cider. The term "removed" here refers to removal of the product from a bonded warehouse, as it enters commerce and, if it is destined for domestic sale, incurs excise tax.

Table 7. Gallons of Bottled Wine Removed, Tax-Paid into the U.S. Market, 2005 and 2017

Wine Type	2005	2017	Percentage Change
	Millions of Gallons		Percent
Still Wine	457.2	615.1	34.5
Cider	4.9	45.8	834.7
Effervescent	19.4	29.7	53.1
Flavored Wines	15.8	23.7	50.0
Wine Coolers	30.3	22.2	–26.7
Total Taxable Removals	**527.6**	**736.5**	**39.6**

Source: Created by the authors based on data from U.S. Treasury/TTB (2005, 2017a)

wineries are Washington State, 1,005; Oregon State, 679; and New York State, 551. However, every state has a few wineries and produces some wine (U. S. Treasury/TTB, 2017).

Although almost 12,000 wineries or wine blenders are operating in the United States, a handful of large wineries dominate production and distribution of wine. Over the past 20 years, the largest U.S. wine producers have become marketers of wine as well as producers, importing bulk wine to be bottled under their own brands, and importing and distributing bottled wines from foreign producers. Industry analysts estimated that in 2016, the three largest U.S. wine producers, E & J Gallo, The Wine Group, and Constellation Brands, together produced or imported approximately 46 percent of all wine sold in the United States. The top 10 producers account for over 61 percent of U.S. sales, and the top 30 are estimated to be responsible for approximately 631 million gallons of the 949 million gallons of wine consumed in 2016, or 66 percent of sales (*Wine Business Monthly*, 2016, Wine Institute 2017). The remaining smaller firms or importers supply the other 318 million gallons.

Since the TTB does not release production data at the firm level, it is not possible to report precise figures of the volume produced by wineries. However, given that there were more than 11,000 wine producers in 2016 and having estimated that the remaining U.S. total wine consumption, after subtracting sales by the top 30 wine firms, was approximately 318 million gallons (including imported bottled wine not sold by the largest firms), it follows that the typical U.S. winery is very small, perhaps producing 20,000 gallons of wine after allowing for imported wines. An examination of wine production by region within California reinforces this conclusion. Using TTB data of California wine producer and blender permit holders at the end of 2017, we sorted wineries by production region. Then, for each region, we computed its share of California's wine grape tonnage and its share of the total number of California wineries. Table 8 shows the results of our calculations (see also Appendix Table 8A).

As noted above, California's Northern and Southern San Joaquin Valley vineyards (crush districts 5, 11, 12, 13, 14, and 17) produce approximately 72 percent of California's wine grapes. However, this productive grape growing region has only 6.8 percent of California's wineries. Central Valley wineries are quite large and efficient, processing almost 3 million tons of grapes in 2017 and producing inexpensive wine. Almost 77 percent of California's wineries are located in coastal areas (crush districts 1–8) yet, collectively, these areas produced less than 26 percent of all California wine grapes. For the most part, these coastal wineries, along with wineries in California's Sierra Nevada foothills, are quite small, each producing small quantities of more expensive wines.

Wines sold in the United States may bear a varietal designation on the label if 75 percent or more of the wine was produced from the named grape variety. Nielsen data for table wine sales for the 52 weeks ending in October 2015, show that approximately 85 percent of wine by value carried a varietal label. Chardonnay, at 19 percent, and

Table 8. Shares of all California Licensed Wineries (2017) and Tons of Wine Grapes Crushed (2017) by Region

Region	Grapes Crushed in 2017	Licenses Issued in 2017	Share of Total Tons Crushed	Share of Total Licenses
	Thousand Tons	Count	Percent	Percent
North Coast	467	2,195	11.6	47.1
Central Coast	544	1,369	13.5	29.4
Northern San Joaquin Valley	1,274	239	31.7	5.1
Southern San Joaquin Valley	1,624	77	40.5	1.7
Other California	105	781	2.6	16.8
Total California	**4,014**	**4,661**	**100.0**	**100.0**

Sources: Created by the authors based on data from USDA/NASS (2018b); U.S. Treasury/TTB (2017b). Appendix Table 8A provides more detail

Cabernet Sauvignon, at 16 percent, were the two most popular varieties, followed by Pinot Grigio, Pinot Noir, Merlot, and Sauvignon blanc, which collectively accounted for 28 percent of the value of table wine sold in the United States. In 2015, red wine represented just over 50 percent of Nielsen-tracked wine sales by value, followed by white wines at 43 percent of value and rose or blush wines at 6 percent (*Wine Business Monthly*, 2016).

Imports and Exports

The United States consumes more wine than it produces, but even though a net importer, the country exports significant quantities of wine: for the past decade approximately 100 million gallons each year, just over 10 percent of its total production in 2017, if distilling material is included. The United States is also a major importer of wine and, for the past decade, approximately one-third of all wine consumed in the United States has been imported. Figure 5 shows the total volume and value of U.S. exports and imports of wine by year.

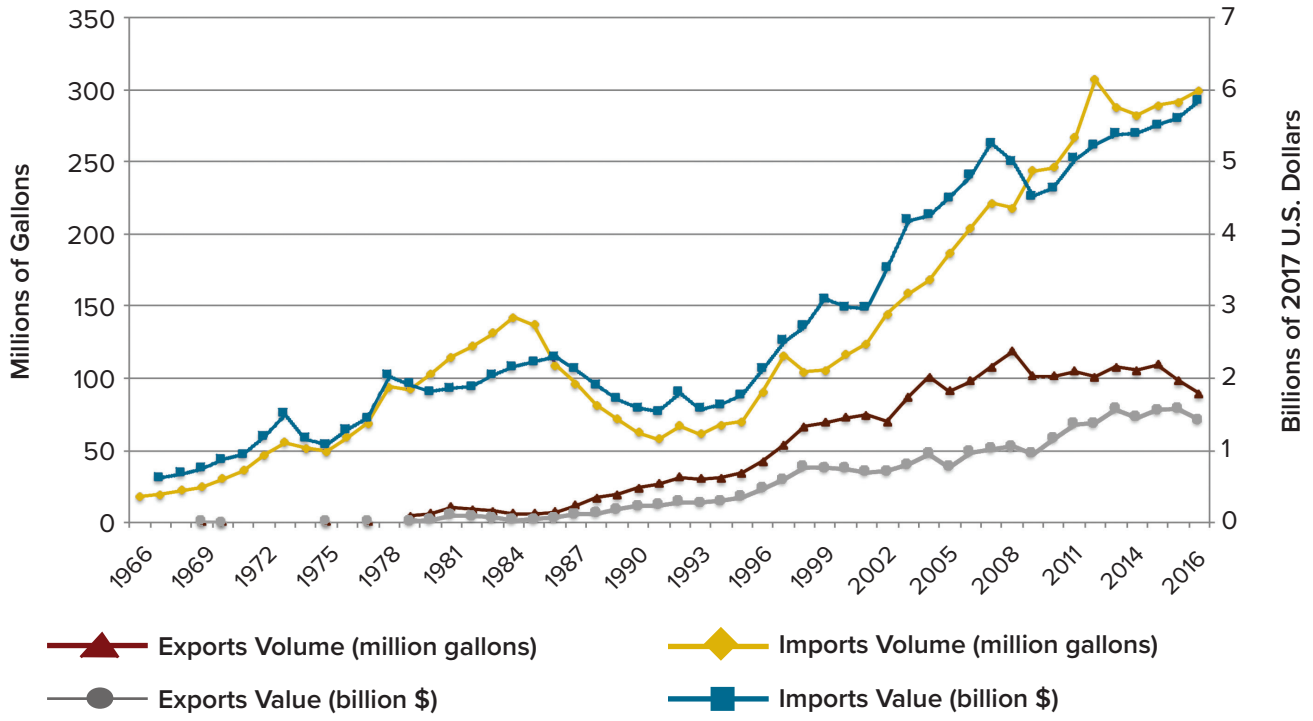
The share of imported wine in total consumption has increased slightly since 2005, but much of the increase in import volume has been in inexpensive bulk wine rather than in bottled wine. In 2005, U.S. wineries imported 10.3 million gallons of wine in containers larger than four liters (here referred to as "bulk wine"), a volume that represented approximately 6 percent of all imported wine. Twelve years later, in 2017, bulk wine imports had grown to 87.7 million gallons, accounting for 28 percent of all imported wine volume. During the same period, bottled wine imports increased by 29 percent from 176.0 million gallons to 227.6 million gallons in 2017 (ITC, 2018).

The growth in volume of imported bulk wine has become an issue for wine grape growers in California's Southern San Joaquin Valley. Their concern centers on a trade policy referred to as "drawback," which allows an importer to recapture up to 99 percent of taxes paid on imported goods when goods defined as "interchangeable" are exported.

In 2003, the U.S. Bureau of Customs and Border Protection allowed drawback on imported wine for the first time and defined interchangeable wine as wine under 14% alcohol by volume (ABV), of the same color, and within 50 percent of value per unit. Such tax refunds could be as high as $1.60 per gallon for wines imported in large containers from countries without free trade agreements. Since prices of bulk wine imported into the United States have ranged around $3.80 per gallon for the past decade, the incentive is strong, and the potential drawback is significant. Some Central Valley grape growers fear that drawback encourages California wineries to import increased quantities of bulk wine, rather than to purchase California grapes. However, Sumner, Lapsley, and Rosen-Molina (2012) concluded that when imports exceed exports, the drawback policy encourages exports, which should increase demand for California grapes. Bulk import volumes have exceeded bulk export volumes since 2011.

The United States exports both bottled and bulk wine. Over the past decade, the volume of exports decreased by

Figure 5. U.S. Imports and Exports of Wine, Value, and Volume, 1966–2017



Sources: Created by the authors using data from ITC (2018)

Notes: Nominal monetary values in these graphs were deflated by the Consumer Price Index (CPI) for all goods taken from USDL/BLS (2018)

17 percent, from 107.8 million gallons in 2007 to 89.5 million gallons in 2017. During the same period, the value of exported wine increased by over 130 percent, from $1 billion in 2007 to $1.4 billion in 2017. The U.K. is the largest importer by volume of U.S. wine and took 32 percent of all U.S. exports by volume. However, most of the exports to the U.K. are shipped in bulk and at an average price of only about $7.20 per gallon. By value, Canada is the most important importer of U.S. wine, buying bottled wine at an average price of over $23 per gallon and receiving 19.4 percent of U.S. wine exports by volume in 2017. Over the past decade, China (Hong Kong and mainland China) has emerged as a major market for U.S. wine, growing from just over 1 million gallons in 2005 to 3.4 million gallons in 2017. Most of this is bottled wine with an average price of about $21 per gallon. Although volume and value of wine exported have increased in the past 11 years, it seems that most U.S. producers are focused more on the expanding domestic market than on export opportunities.

do you want to say since 2007?

Conclusion

The production of grapes and wine in the United States is concentrated in the western United States, dominated by California, which produces four-fifths of the total wine and nine-tenths of the total grapes produced in the United States, including almost all of the table grapes and raisin grapes, as well as wine grapes. While the other segments remain significant, wine grapes have increased in absolute as well as relative importance in the California and U.S. grape industry over the past 20–30 years. At about $6 billion in farm value, grapes continue to be the most valuable crop grown in California, and significant value is added to the crop in producing high-value consumer products—especially in the case of wine. California shipped a record of 281 million cases of wine in 2017, of which 242 million cases went to U.S. consumers for an estimated retail value of $38.7 billion (Wine Institute, 2018d).

Do you need to update this and the numbers in the table?

Wine grapes are best understood as a high-value specialty crop, whose high prices are driven by an increasing demand for wine on the part of American consumers. This increased demand has been met by an expansion of vineyard acreage across the United States, by an increase in importation of bulk and bottled wine, and by a doubling of the number of U.S. wineries over the past decade. Among nations, the United States is now the world's largest consumer of wine, even though it remains a nation of primarily beer drinkers and teetotalers. Although the experiment with Prohibition has left as its legacy a patchwork of laws throughout the nation, making wine distribution cumbersome and costly, increased consumer demand for wines of all types is forcing changes in distribution. These changes, coupled with increased rates of per-capita consumption and population growth, should ensure that the United States remains the world's major wine-consuming country for the first half of the 21st century.

Box 2. U.S. Per Capita Consumption of Wine in Context

Compared with most other countries, the United States is a nation of whiskey drinkers, beer drinkers, and teetotalers, with comparatively low rates of per capita consumption of wine reflecting the fact that a majority of Americans do not drink any! It is only because of its sheer size, in terms of total population, that the nation ranks first in total wine consumption. The table below shows per capita consumption of wine, beer, and spirits in the United States and selected other countries in 2010–14. The United States consumes a similar total quantity of alcohol per capita, compared with other high-income countries, but a much smaller share is in the form of wine and a much larger share is in the form of spirits.

Country	Total Alcohol Consumption, 2010–2014	Volume Shares of Wine, Beer, and Spirits		
		Wine	Beer	Spirits
	LAL/capita/year		Percent	
France	9.2	**59**	19	23
United Kingdom	8.0	**41**	37	22
Australia	7.3	40	**46**	14
Germany	9.6	28	**53**	19
United States	7.0	18	**49**	34
China	3.3	4	44	**52**
World	2.7	15	**43**	42

Source: Based on a more-detailed table in Holmes and Anderson (2017), Table 3.

Notes: Data are volume-based in liters of alcohol (LAL) per year, measured as 5-year averages. The bold number in each row highlights the largest share for that country; measured as shares of total LAL consumed in each form.

Reference: Holmes, A.J. and K. Anderson, 2017. "Convergence in National Alcohol Consumption Patterns: New Global Indicators." *Journal of Wine Economics* 12(2): 117–148.

References

Alston, J.M., K. Anderson, and O. Sambucci. 2015. "Drifting Towards Bordeaux? The Evolving Varietal Emphasis of U.S. Wine Regions." *Journal of Wine Economics* 10(3):349–378.

Alston, J.M., J.T. Lapsley, O. Sambucci, and D.A. Sumner. 2018. "United States." In Kym Anderson and Vicente Pinilla, eds, *Wine's Evolving Globalization: Comparative Histories of the Old and New World*. Cambridge: Cambridge University Press.

County of Alameda Deparment of Agriculture/Weights & Measures Department. 2016. *Alameda County Department of Agriculture/Weights & Measures 2015 Crop Report*. Hayward, CA, July. Retrieved from: https://www.acgov.org/cda/awm/resources/2015cropreport.pdf [Accessed 1 December 2017].

County of Amador Office of Department of Agriculture/Weights and Measures. 2016. *2015 Amador County Agricultural Crop & Livestock Report*. Martell, CA, August. Retrieved from: http://www.co.amador.ca.us/home/showdocument?id=24259 [Accessed 1 December 2017].

County of Colusa Department of Agriculture. 2016. *2015 Colusa County Crop Report*. Colusa, CA. Retrieved from: https://www.countyofcolusa.org/DocumentCenter/View/8248 [Accessed 1 December 2017].

County of Contra Costa Department of Agriculture. 2016. *Contra Costa County 2015 Crop Report*. Concord, CA. Retrieved from: http://www.co.contra-costa.ca.us/DocumentCenter/View/41302. [Accessed 1 December 2017].

County of El Dorado Department of Agriculture/Weights and Measures. 2016. *El Dorado ~ Alpine Counties 2015 Agricultural Crop & Livestock Report*. Placerville, CA. Retrieved from: https://www.edcgov.us/Government/ag/documents/2015%20Crop%20Report.pdf [Accessed 1 December 2017].

County of Fresno Department of Agriculture. 2016. *2015 Fresno County Annual Crop & Livestock Report*. Fresno, CA. Retrieved from: http://www.co.fresno.ca.us/Home/ShowDocument?id=16902 [Accessed 1 December 2017].

County of Glenn Department of Agriculture. 2016. *Glenn County Agricultural Commissoner's Office 2015 Annual Crop & Livestock Report*. Willows, CA. Retrieved from: https://www.countyofglenn.net/sites/default/files/Ag_Commissioner/Glenn%20County%202015%20Crop%20Report.pdf [Accessed 1 December 2017].

County of Kern Department of Agriculture and Measurement Standards. 2016. *2015 Kern County Agricultural Crop Report*. Bakersfield, CA, September. Retrieved from: http://www.kernag.com/caap/crop-reports/crop10_19/crop2015.pdf [Accessed 1 December 2017].

County of Kings Department of Agriculture/Measurement Standards. 2016. *Kings County 2015*. Hanford, CA, June. Retrieved from: https://www.countyofkings.com/home/showdocument?id=17542 [Accessed 21 March 2018].

County of Lake Department of Agriculture. 2016. *Lake County Department of Agriculture 2015 Crop Report*. Lakeport, CA, June. Retrieved from: http://www.co.lake.ca.us/Assets/Departments/Agriculture/docs/Crop+Reports/2015+Crop+Report.pdf [Accessed 1 December 2017].

County of Madera Department of Agriculture Weights and Measures. 2016. *Madera County Crop and Livestock Report 2015*. Madera, CA. Retrieved from: https://www.maderafb.com/wp-content/uploads/2016/08/2015-MadCo-Crop-Report-002.pdf [Accessed 21 March 2018].

County of Mendocino Department of Agriculture. 2016. *Mendocino County 2015 Crop Report*. Ukiah, CA, August. Retrieved from: https://www.mendocinocounty.org/home/showdocument?id=3274 [Accessed 1 Dec. 2017].

County of Merced Department of Agriculture. 2016. *2015 Report on Agriculture*. Merced, CA. Retrieved from: http://www.co.merced.ca.us/Archive/ViewFile/Item/521 [Accessed 1 December 2017].

County of Monterey Agricultural Commissioner. 2016. *Monterey County 2015 Crop Report Certified Farmers' Markets*. Salinas, CA. Retrieved from: http://www.co.monterey.ca.us/Home/ShowDocument?id=12607 [Accessed 1 December 2017].

County of Napa Department of Agriculture and Weights & Measurements. 2016. *2015 Agricultural Crop Report*. Napa, CA, April. Retrieved from: www.countyofnapa.org/ArchiveCenter/ViewFile/Item/150 [Accessed 21 March 2018].

County of Riverside Agricultural Commissioner's Office. 2016. *Riverside County Agricultural Production Report 2015*. Riverside, CA. Retrieved from: http://www.rivcoawm.org/Portals/0/Publications/2015%20Reports/2015%20Riverside%20County%20Agricultural%20Production%20Report.pdf?ver=2016-09-01-062011-563 [Accessed 1 December 2017].

County of Sacramento Agricultural Commissioner. 2016. *Sacramento County 2015 Crop & Livestock Report*. Sacramento, CA. Retrieved from: http://www.agcomm.saccounty.net/Documents/CropandLivestockReports/2015Report.pdf [Accessed 1 December 2017].

County of San Benito Agricultural Commissioner's Office. 2015. *2015 Annual Crop Report San Benito County, CA*. Hollister, CA, July. Retrieved from: http://cosb.us/wp-content/uploads/2015-Crop-Report-Final.pdf [Accessed 1 December 2017].

County of Santa Barbara Agricultural Comissioner's Office. 2016. *Agricultural Production Report 2015 Santa Barbara County*. Santa Barbara, CA. Retrieved from: http://cosb.countyofsb.org/uploadedFiles/agcomm/crops/2015%20Crop%20Report.pdf [Accessed 1 December 2017].

County of Santa Clara Department of Food and Agriculture. 2016. *Santa Clara County 2015 Crop Report*. San Jose, CA. Retrieved from: https://www.sccgov.org/sites/ag/news/Documents/CropReport2015_FinalWEB.pdf [Accessed 1 December 2017].

County of San Luis Obispo Department of Agriculture/Weights and Measures. 2016. *Weathering the Drought 2015 Annual Report*. San Luis Obispo, CA. Retrieved from: http://www.slocounty.ca.gov/getattachment/a84d5d62-956c-4b57-8852-3535f46069bd/Crop-Report-2015.aspx [Accessed 1 December 2017].

County of Solano Office of Agricultural Commissioner. 2016. *Solano County 2015 Crop and Livestock Report*. Fairfield, CA. Retrieved from: https://www.solanocounty.com/civicax/filebank/blobdload.aspx?BlobID=23010 [Accessed 1 December 2017].

County of Sonoma Department of Agriculture/Weights & Measures. 2016. *Sonoma County Crop Report 2015*. Santa Rosa, CA, July. Retrieved from: http://sonomacounty.ca.gov/WorkArea/DownloadAsset.aspx?id=2147532372 [Accessed 1 December 2017].

County of Stanislaus Agricultural Commissioner's Office. 2016. *Stanislaus County Agricultural Report 2015*. Modesto, CA. Retrieved from: http://www.stanag.org/pdf/cropreport/cropreport2015.pdf [Accessed 1 December 2017].

County of Tulare Agricultural Commissioner. 2016. *2015 Tulare County Annual Crop and Livestock Report*. Tulare, CA, August. Retrieved from: http://agcomm.co.tulare.ca.us/ag/index.cfm/standards-and-quarantine/crop-reports1/crop-reports-2011-2020/2015-tulare-county-annual-crop-and-livestock-report-pdf/ [Accessed 1 December 2017].

County of Yolo Department of Agriculture and Weights & Measures. 2016. *Yolo County Agricultural Crop Report 2015*. Woodland, CA, June. Retrieved from: http://www.yolocounty.org/home/showdocument?id=37378 [Accessed 1 December 2017].

Crespi, J., T. Saitone, and R.J. Sexton. 2016. "The Supreme Court's Decision in the 'Raisin Case': What Does it Mean for Mandatory Marketing Programs?" *ARE Update* 18(6):1-4. University of California Giannini Foundation of Agricultural Economics.

Dokoozlian, N. 2013. "The Evolution of Mechanized Vineyard Production Systems in California." *Acta Horticultura* 978:265–278.

Goodhue, R.E., D.M. Heien, H. Lee, and D.A. Sumner. 2003. "Contracts and Quality in the California Winegrape Industry." *Review of Industrial Organization* 23(3):267–282.

International Organisation of Vine and Wine (OIV). 2017. *2017 World Vitivinicultural Situation: OIV Statistical Report on World Viticviniculture*. Paris, FR. Retrieved from: http://www.oiv.int/public/medias/5479/oiv-en-bilan-2017.pdf [Accessed January 10, 2018.]

Lapsley, J.T. 2010. "Looking Forward: Imagining the Market for California Wine in 2030." *ARE Update* 13(6):12-15. University of California Giannini Foundation of Agricultural Economics.

Pinney, T. 1989. *A History of Wine in America: From Beginning to Prohibition: Volume 1*. Berkeley, CA: University of California Press.

Pinney, T. 2005. *A History of Wine in America: From Prohibition to the Present: Volume 2*. Berkeley, CA: University of California Press.

Sambucci, O., and J.M. Alston. 2017. "Estimating the Value of California Winegrapes." *Journal of Wine Economics* 12(2):149–160.

Sumner, D.A., J.T. Lapsley, and J.T. Rosen-Molina. 2012. "Economics of Wine Import Duty and Excise Tax Drawbacks." *ARE Update* 15(4):1-4. University of California Giannini Foundation of Agricultural Economics.

University of California Cooperative Extension (UCCE). 2016a. "Sample Costs to Establish a Vineyard and Produce Dry-on-Vine Raisins. Open Gable Trellis System. Early Maturing Varieties. San Joaquin Valley-2016." Davis, CA. Retrieved from: https://coststudyfiles.ucdavis.edu/uploads/cs_public/43/85/4385b69b-078a-43d9-8f39-6ac149688fb5/16dovraisinsogtsjvfinaldraft111716.pdf [Accessed January 9, 2017].

University of California Cooperative Extension (UCCE). 2016b. "Sample Costs to Establish a Vineyard and Produce Dry-on-Vine Raisins. Overhead Trellis System. Early Maturing Varieties. San Joaquin Valley 2016." Davis, CA. Retrieved from: https://coststudyfiles.ucdavis.edu/uploads/cs_public/ec/ba/ecba9b89-f1e9-401c-9044-4afa2c060093/2016dovraisinsohtsjvfinaldraft111716.pdf [Accessed January 9, 2017].

University of California Cooperative Extension (UCCE). 2018a. "2018 Sample Costs to Establish and Produce Table Grapes. Joaquin Valley South. Scarlet Royal-Mid-Season Maturing." Retrieved from: https://coststudyfiles.ucdavis.edu/uploads/cs_public/a0/49/a049aa0b-6c15-4f16-b8d1-6f971a003d78/2018tablegrapessjvscarletroyalfinaldraft.pdf [Accessed January 9, 2017].

University of California Cooperative Extension (UCCE). 2018b. "2018 Sample Costs to Establish and Produce Table Grapes. San Joaquin Valley South. Autumn King, Late Maturing." Retrieved from: https://coststudyfiles.ucdavis.edu/uploads/cs_public/be/c7/bec790f2-3cb8-4a07-ac0d-ccfdcb067bb8/2018tablegrapessjvautumnkingfinaldraft.pdf [Accessed Jan 9, 2017].

U.S. Bureau of Economic Analysis, Federal Reserve Bank of St. Louis (USBEA/FRED). 2018. "Gross Domestic Product: Implicit Price Deflator" [A191RI1A225NBEA]. Retrieved from: https://fred.stlouisfed.org/series/A191RI1A225NBEA [Accessed January 9, 2018].

U.S. Department of Agriculture, Foreign Agricultural Service (USDA/FAS). 2016. Export Sales Reporting Database. Retrieved from: http://www.fas.usda.gov/data [Accessed October 15, 2016].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 1920–2010. California Grapes, 1920–2010. Revised, February 2014.

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2000–2016a. California Grape Crush Reports, 2000–2016. Retrieved from: https://www.nass.usda.gov/Statistics_by_State/California/Publications/Specialty_and_Other_Releases/Grapes/Crush/Reports/index.php [Accessed October 15, 2016].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2011–2016b. California Grape Acreage Reports, 2000–2016. Retrieved at: https://www.nass.usda.gov/Statistics_by_State/California/Publications/Specialty_and_Other_Releases/Grapes/index.php [Accessed October 15, 2016].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2012a. *United States Department of Agriculture Census of Agriculture, Volume 1, Chapter 1*. Washington DC. Retrieved from: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/California/st06_1_039_039.pdf [Accessed Feb 18, 2016].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2012b. *United States Department of Agriculture Census of Agriculture, Volume 1, Chapter 2*. Washington DC. Retrieved from: http://agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/California/st06_2_031_031.pdf [Accessed February 18, 2016].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2017a. *California Grape Acreage Report, 2016*. Washington DC. Retrieved from: https://www.nass.usda.gov/Statistics_by_State/California/Publications/Specialty_and_Other_Releases/Grapes/Acreage/2017/201704grapeacres.pdf [Accessed February 18, 2016].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2017b. *Grape Crush Report, Final, 2016*. Washington DC. Retrieved from: https://www.nass.usda.gov/Statistics_by_State/California/Publications/Specialty_and_Other_Releases/Grapes/Crush/Final/2016/201603gcbtb00.pdf [Accessed January 8, 2018].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2017c. "Washington Fruit Production." Press Release. Washington DC. Retrieved from: https://www.nass.usda.gov/Statistics_by_State/Washington/Publications/Fruit/2017/FR08_1.pdf [Accessed January 8, 2018].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2017d. "Oregon Fruit Production." Press Release. Washington DC. Retrieved from: https://www.nass.usda.gov/Statistics_by_State/Oregon/Publications/Fruits_Nuts_and_Berries/2017/Fruit.pdf [Accessed January 8, 2017].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2017e. *2016-2017 Agricultural Statistics Annual Bulletin New York*. Washington DC. Retrieved from: https://www.nass.usda.gov/Statistics_by_State/New_York/Publications/Annual_Statistical_Bulletin/2017/2016-2017%20NY%20Annual%20Bulletin.pdf [Accessed January 9, 2017].

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA/NASS). 2017f. *Noncitrus Fruits and Nuts 2016 Summary*. Washington DC. Retrieved from: http://usda.mannlib.cornell.edu/usda/current/NoncFruiNu/NoncFruiNu-06-27-2017.pdf [Accessed January 8, 2018].

U.S. Department of Labor, Bureau of Labor Statistics (USDL/BLS). 2015. *Consumer Price Index Detailed Report, December 2015*. Washington DC. Retrieved from: http://www.bls.gov/cpi/cpid1512.pdf [Accessed October 15, 2016].

U.S. Department of The Treasury, Alcohol and Tobacco Tax and Trade Bureau (U.S. Treasury/TTB). 2005. *Monthly Statistical Report—Wine, January 2005–December 2005*. Washington DC. Retrieved from: http://www.ttb.gov/statistics/05winestats.shtml [Accessed December 17, 2015].

U.S. Department of The Treasury, Alcohol and Tobacco Tax and Trade Bureau (U.S. Treasury/TTB). 2013. "American Viticultural Area (AVA)." Retrieved from: https://www.ttb.gov/wine/ava.shtml [Accessed July 12, 2016].

U.S. Department of The Treasury, Alcohol and Tobacco, Tax and Trade Bureau (U.S. Treasury/TTB). 2016. *Statistical Report–Wine, January–December 2016*. Washington DC. Retrieved from: https://www.ttb.gov/statistics/2016/final16wine.pdf [Accessed January 3, 2018].

U.S. Department of The Treasury, Alcohol and Tobacco Tax and Trade Bureau (U.S. Treasury/TTB). 2017. "List of Permittees." Retrieved from: http://www.ttb.gov/foia/frl.shtml [Accessed January 8, 2018].

U.S. International Trade Commission (ITC). 2018. *International Trade Centre International Trade Statistics 2001–2018*. Washington DC. Retrieved from: http://www.intracen.org/itc/market-info-tools/trade-statistics/ [Accessed June 18, 2016].

U.S. International Trade Commission (ITC). 2016. Trade Database. Retrieved from: https://dataweb.usitc.gov/.

Wine Business Monthly. 2016. "Retail Sales Analysis." January.

Wine Business Monthly. 2017. "WBM 20 List." February.

Wine Institute. 2016. Statistics. Retrieved from: http://www.wineinstitute.org/resources/statistics [Accessed June 2, 2016].

Wine Institute. 2017. "Wine Consumption in the U.S." Retrieved from: https://www.wineinstitute.org/resources/statistics/article86 [Accessed January 9, 2018].

Wine Institute. 2018a. "U.S. and California Grape Crush Historical Totals." Retrieved from: https://www.wineinstitute.org/resources/statistics/article89 [Accessed January 9, 2018].

Wine Institute. 2018b. *World Wine Production by Country, 2013–2015*. Retrieved from: http://www.wineinstitute.org/files/World_Wine_Production_by_Country_2015.pdf [Accessed January 9, 2018].

Wine Institute. 2018c. 2016 *California Wine Industry Statistical Highlights*. Retrieved from: http://www.wineinstitute.org/files/Wine%20Institute%20Economic%20Impact%20Highlights%202016.pdf [Accessed January 9, 2018].

Appendix Table 5A. Characteristics of U.S. Wine Grape-Growing Regions, 2017

Region	Crush District	Total Acreage	Volume	Crush Price	Value
	Number	Acres	Tons	$/Ton	$ Millions
North Coast	1	16,443	70,752	1,698	120
(NC)	2	8,771	47,857	1,756	84
	3	57,603	206,097	2,806	578
	4	43,279	142,413	5,225	744
	Total	**126,096**	**467,119**	**3,268**	**1,527**
Central Coast	6	6,699	28,448	1,177	33
(CC)	7	46,977	282,090	1,405	396
	8	46,632	233,228	1,737	405
	Total	**100,308**	**543,766**	**1,535**	**835**
N. San Joaquin Valley	5	3,469	17,986	1,041	19
(NSJV)	11	70,699	743,360	610	454
	12	29,283	354,231	459	163
	17	20,532	158,372	646	102
	Total	**123,983**	**1,273,899**	**579**	**737**
S. San Joaquin Valley	13	73,137	1,311,813	309	405
(SSJV)	14	20,627	312,371	311	97
	Total	**93,764**	**1,624,184**	**309**	**503**
Other California	9	6,965	74,781	647	48
(OC)	10	6,982	22,118	1,470	33
	15	683	967	696	1
	16	1,656	6,849	1,742	12
	Total	**16,286**	**104,715**	**837**	**93**
California (CA)		**460,437**	**4,013,684**	**921**	**3,695**
Washington (WA)		**53,000**	**229,000**	**1,210**	**277**
Oregon (OR)		**23,000**	**77,000**	**2,234**	**172**
New York (NY)		**10,058**	**57,000**	**649**	**37**
Total United States		**546,495**	**4,376,684**	**955**	**4,181**

This appendix includes tables that provide data at the level of crush districts as well as for the regional aggregates (obtained by summing across crush districts) provided in their counterpart text tables, and they are named accordingly – i.e., Table 5A corresponds to Table 5, and so on

Sources: USDA/NASS (2018a,b; 2019)

Notes: Acreage of wine grapes in NY was calculated by applying the share of volume of wine grapes to the total grape acreage reported in USDA/NASS (2019), as data on wine grape acreage were not available. The U.S. totals encompass only the four states (CA, WA, OR, and NY). The Wine Institute (2018a) reports a national total of 4.67 million tons compared with the 4.38 million tons reported here for the four-state (U.S.) total

Appendix Table 6A. Characteristics of California Wine Grapes Crushed, 2017

Region	Crush District	Total Tons Crushed	Purchased Tons Crushed	Custom Crush	Own Tons Crushed	Own Total Share of Tons Crushed
	Number	Tons	Tons	Tons	Tons	Percent
North Coast	1	70,752	46,490	9,901	14,361	20
	2	47,857	32,393	4,894	10,569	22
	3	206,097	132,710	3,033	70,354	34
	4	142,413	84,133	3,198	55,083	39
	Total	**467,119**	**295,726**	**21,026**	**150,367**	**32**
Central Coast	6	28,448	18,973	608	8,868	31
	7	282,090	179,926	730	101,434	36
	8	233,228	164,952	9,970	53,306	25
	Total	**543,766**	**363,852**	**11,307**	**168,608**	**31**
N. San Joaquin Valley	5	17,936	15,812	134	1,991	11
	11	743,360	675,144	2,398	65,818	9
	12	354,231	241,132	396	112,702	32
	17	158,372	136,744	633	20,996	13
	Total	**1,273,899**	**1,068,832**	**3,560**	**201,507**	**16**
S. San Joaquin Valley	13	1,311,813	1,251,784	563	59,467	5
	14	312,371	302,098	132	10,142	3
	Total	**1,624,184**	**1,553,882**	**694**	**69,608**	**4**
Other California	9	74,781	36,009	688	38,084	51
	10	22,118	13,980	377	7,761	35
	15	967	631	197	139	14
	16	6,849	2,145	194	3,624	53
	Total	**104,715**	**53,652**	**1,456**	**49,608**	**47**
Total California		**4,013,684**	**3,373,988**	**38,044**	**639,697**	**16**

Sources: Created by the authors using data from USDA/NASS (2018b)

Appendix Table 8A. Shares of all California Licensed Wineries (2017) and Tons of Wine Grapes Crushed (2017) by Region

Region	Crush District	Grapes Crushed in 2016	Licenses Issued in 2017	Share of Total Tons Crushed	Share of Total Licenses
		Tons	Count	Percent	Percent
North Coast	1	70,752	121	1.8	2.6
	2	47,857	53	1.2	1.1
	3	206,097	909	5.1	19.5
	4	142,413	1,112	3.5	23.9
	Total	**467,119**	**2,195**	**11.6**	**47.1**
Central Coast	6	28,448	397	0.7	8.5
	7	282,090	124	7.0	2.7
	8	233,228	848	5.8	18.2
	Total	**543,766**	**1,369**	**13.5**	**29.4**
N. San Joaquin Valley	5	17,936	29	0.4	0.6
	11	743,360	174	18.5	3.7
	12	354,231	17	8.8	0.4
	17	158,372	19	3.9	0.4
	Total	**1,273,899**	**239**	**31.7**	**5.1**
S. San Joaquin Valley	13	1,311,813	69	32.7	1.5
	14	312,371	8	7.8	0.2
	Total	**1,624,184**	**77**	**40.5**	**1.7**
Other California	9	74,781	135	1.9	2.9
	10	22,118	307	0.6	6.6
	15	967	60	0.0	1.2
	16	6,849	279	0.2	6.0
	Total	**104,715**	**781**	**2.6**	**16.8**
Total California		**4,013,684**	**4,661**	**100.0**	**100.0**

Sources: Created by the authors based on data from USDA/NASS (2018b), U.S. Treasury/TTB (2017b)