

The Economic Impacts of the California Almond Industry

A Report Prepared for the Almond Board of California

Daniel A. Sumner, William A. Matthews, Josué Medellín-Azuara and Adrienne Bradley

University of California Agricultural Issues Center

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The Economic Impacts of the California Almond Industry

Executive Summary

The California almond industry is a large and dynamic part of California agriculture and makes major contributions to the California economy. Almond production and value of production have been growing rapidly and the industry has become a larger share of agriculture and its economic contributions have been growing in recent years. California almonds are especially important in international trade. Almonds are projected to account for about 25 percent of California farm exports.

Contributions to the California economy can be understood by distinguishing between direct, indirect, and induced effects of economic activity and by looking at both the value of industry output as well as the value added above the cost of goods and services purchased from other sectors. Direct effects are impacts within the affected industry; indirect effects are the changes to industries that support but are outside the directly affected industry; induced effects are economic ripples from added consumption generated by the direct and indirect effects. Value of industry output is the value of the direct output or service contribution of the industry; whereas, the value added calculations measure the economic contribution of the industry above the cost of goods and services purchased from supporting industries.

This report uses projections of the value of the 2014 almond crop, with comparisons to 2012 and 2013 crop years, to estimate contributions of the almond industry to the statewide economy in California.

We estimate that for the 2014 crop the California almond industry contributes much to the California economy.

- The total impact on the value of California output, including direct, indirect, and induced economic output, is about \$21.5 billion.
- Of the total output value of \$21.5 billion, about \$11 billion is value added. This includes indirect and induced value added. Value added is the economic output measure that contributed to the size of the California economy (Gross State Product).
- Of the \$11 billion of total value added to the California economy, about \$7.6 billion is attributable to almond farming. The remaining \$3.4 billion is contributed by the almond processing and manufacturing sectors.
- The whole almond industry, including processing and marketing, generates about 104,000 jobs statewide, three quarters of which are outside the almond industry.
- Of these 104,000 jobs, total statewide employment generated by almond farming is over 68,000 jobs; direct almond farm employment is about 21,000 jobs, and approximately 47,000 additional jobs are generated through indirect and induced economic activity associated with almond farming. The remaining job generation of approximately 36,000 jobs is associated with the direct, indirect, and induced economic activity of the processing and manufacturing sectors.

Although its economic linkages are statewide (and global), the almond industry is especially important to the economy of the California Central Valley.

Members of the California almond industry also contribute to the state and their local communities in many ways that cannot be captured in financial calculations. Through charitable activities, community engagement, and leadership, members of the almond industry help make California, especially rural California, a more healthy and vibrant place. Finally, almonds contribute to consumer nutrition and wellbeing in California and throughout the world.

Introduction

This report describes and estimates the economic contributions and impacts of the California almond industry. It also provides background and related information to help interpret our quantitative measurement of economic impacts.

Chapter 1 shows the contributions to California economic activity tracing through the direct, indirect and induced impacts of the almond industry. We present a flow chart that shows the stages from almond production on farms, through almond hulling and shelling, almond handling and initial processing, and finally to almond manufacturing. These stages lead to the retail sales of almonds and sales to domestic food processors or exports. We use the software IMPLAN, which is an input-output modeling software and dataset that utilizes publicly available economic data to assess effects of changes in economic activity. We supplement IMPLAN with data provided by almond industry members, which allow us to adapt the model to fit the specifics of the industry. The model and data specify linkages (indirect effects) from each segment of the almond industry to associated input industries including farm inputs such as fertilizers and tractors as well as equipment and materials used in hulling and shelling, handling and manufacturing. We also trace the influence of income earned in the almond industry (induced effects) as it ripples through the economy because of purchases by employees and owners of farms and almond marketing firms.

We find that in addition to billions of dollars of direct value of output and value added and thousands of direct employees, the almond industry contributes additional billions of dollars and thousands of jobs to the economy through these indirect and induced impacts. We project that the 2014 almond crop will contribute about \$11 billion of value added to the California gross

state product (the measure of the size of the California economy) and almost 104,000 jobs statewide, three quarters of which are outside the almond industry.

The almond industry is important especially in the Central Valley of California where almond production and processing are located. Almond economic impacts and employment comprise a substantial part of total economic activity and jobs in the economy of the Central Valley and especially in rural regions. Farms and processors not only employ many Central Valley residents directly, they also buy goods and services from other local firms that also provide jobs and generate incomes. Income generated for employees and proprietors goes to buy local consumer goods and services as well as to pay taxes locally and statewide.

Of course, these economic calculations do not fully capture the contributions of the members of the California almond industry to the state and to their communities. Through charitable activities, engagement, and leadership, members of the almond industry help make California, especially rural California, a more healthy and vibrant place. Members of the almond industry contribute in many tangible ways that are not captured in purely financial transactions. The almond industry also contributes to ecological benefits through leadership in sustainability programs and the development of honey bee best management practices that we have not quantified. In addition, of course, almonds contribute to consumer nutrition, health and enjoyment in California and throughout the world.

Chapter 2 provides background information about almond production, supply and demand, including the importance of almond exports to the industry and to California agricultural exports more broadly. This information is useful to interpret the estimates presented in Chapter 1.

As a major part of California agriculture, generating about 15 percent of the value of California farm output and almost 25 percent of agricultural exports, the California almond industry is a major contributor to a healthy and vibrant agriculture and a sound California economy needed to offer economic opportunity in the state.

1. Contributions of the Almond Industry to the California Economy

The key objective of this project is to measure the economic contribution of the California almond industry. We consider the almond industry as comprised of four segments or sectors: almond growing, almond hulling and shelling, almond handling, and the manufacture of almond products. Other industries are considered as providing materials or services to the almond industry. Nut-tree nurseries, processed food industries that use almond products as ingredients, and retail markets and restaurants that sell almond products are not treated as sectors within the California almond industry. We include their relationships to the core industry in our calculations as indirect impacts (see Figure 1.1).

We use the input-output model and data base from IMPLAN to quantify relationships across the whole economy and how segments of the almond industry relate to each other industry or sector within California. Box 1.1 provides definitions of economic effects and multipliers. To measure the total economic contribution of the California almond industry we collected information from individual firms within the industry that engage in the growing, hulling-shelling, handling and manufacturing of almonds.

We begin with table 1.1 which shows the multipliers that turn direct almond output, value added and employment into the full economic contributions for each sector of the almond industry including the indirect and induced impacts. (The appendix includes tables and descriptions of the contributions of the almond industry within the Central Valley of California, where the almond production and much of the processing is concentrated.)

The direct output multiplier for each of the industry sectors is one by definition: \$1.00 of direct output by each sector equals \$1.00 in direct output for the economy. The indirect output multiplier can be interpreted as the number of dollars of output generated in supporting industries

from a one dollar increase in direct output by the corresponding sector. For example, in table 1.1 under the column for almond growers, the indirect value of output multiplier for almond growers is 0.37 meaning that every dollar of expanded output by almond growers results in \$0.37 of additional output generated by supporting industries that provide materials and services purchased by growers. “Indirect” output multipliers are higher in the handling and manufacturing sectors because growing almonds requires more labor, land and other inputs generated on the farm, whereas processing of almonds requires more purchased inputs from supporting industries such as transport services, materials for packaging, and equipment. The “induced” effects multiplier measures the output in the rest of the economy linked to an increase in direct output through consumption activities of employees and owners within the sector. The total effects multiplier is the sum of direct, indirect and induced effects multipliers. It measures additional statewide economic output from an increase in output by the four sectors of the almond industry. Again, the handling and manufacturing sectors, through their greater dependence on supporting industries for purchased inputs, have the highest multipliers of overall effect on economic output. The almond manufacturing sector produces an additional \$1.71 in economic output for every \$1.00 of direct output increase for a total addition of \$2.71 to the California economy.

Value added can be interpreted also on a per dollar basis. As defined in Box 1.1, value added is the measure of “new” value generated from the inputs held within a segment during the process of combining purchased inputs into a marketable product. This “new” value is represented by salaries and wages, proprietor income, profit and indirect business taxes. The direct value-added multiplier measures the amount of each additional dollar of output value that is allocated to one of the four categories and not to purchases from outside the industry or segment. This portion of output value is what the almond industry contributes to California’s

GDP, which is also measured on a value added basis. Value added avoids any double counting of value of inputs purchased by the almond industry from other industries. For almond growers, \$0.52 of every \$1.00 of additional output from almond production ends up as on-farm salaries and wages, proprietor income, business profit and sales taxes. Among the four sectors of the industry, hullers and shellers have the highest direct value-added multiplier with \$0.60 of every \$1.00 of output adding to the California GDP. The handling and manufacturing sectors have the lowest direct value-added among the sectors but the highest indirect value-added multipliers. Again, the higher dependence on support industries for inputs to the handling and manufacturing sectors is the reason for the higher indirect effects. Induced value-added effects are fairly similar across the four sectors and represent how consumer purchases using income from the almond industry cause additional economic output as they ripple through the economy.

The employment multiplier in each cell can be interpreted as the number of jobs added to the economy by a \$1 million increase in the value of direct output by each sector of the industry. Sectors that are labor intensive and buy services from labor intensive industries have high employment multipliers. For example, every \$1 million in added output of almond handling creates an additional 12 jobs in California, the majority of these jobs, about 8, are created indirectly. As with value-added, the high dependency on purchased inputs in almond handling creates jobs in the supporting industries. Induced employment numbers indicate the number of jobs created in the rest of the economy as a result of increased income within the almond industry and in supporting industries. Added labor and proprietor income creates greater spending within the economy which spurs further job creation.

We apply these multipliers to data on production, value of output and employment in the almond industry in order to estimate the contributions the industry makes to California's

economy during the 2012, 2013, and 2014 crop years. The estimates for the 2014 crop year are based on preliminary projections on volume and value of the most recent crop year provided by industry sources.

The rest of this chapter quantifies the economic relationships between each of the four almond industry sectors and the California economy and shows how the economic impacts flow through the economy. We estimated output values for each of the sectors using a combination of publicly available data and calculations of revenue per unit of production based on information provided by industry participants who responded to questionnaires about their business. The resulting value of output estimates provide the basis for applying the previously discussed multipliers and estimating the statewide economic impacts of each sector and the industry as a whole.

Production of almonds on the farm is the largest contributor to direct industry output, accounting for an average of about 70 percent of total output value over the three crop years represented. Table 1.2 includes projections for the 2014 crop year of the direct farm-value of almond production of \$7.3 billion up from \$5.8 billion in 2013. Of this \$7.3 billion in direct value of output, about \$3.8 billion is value added, which is distributed as salaries and wages for employees and grower-owners as well as indirect business taxes and profit. The direct output of almond growers in 2014 generated more than \$1.5 billion of indirect value added by supporting industries and more than \$2.3 billion of value added for the rest of the economy. Overall, the value added to the California economy from almond growers in the 2014 crop year is projected to be a little over \$7.6 billion.

Table 1.3 provides information on the contributions from the huller and sheller sector to the California economy. The huller and sheller sector has the greatest share of value added to

total output value within the almond industry. This is consistent with the huller and sheller sector's low demand for purchased inputs and the fact that hullers and shellers do not purchase the almonds they process, but rather provide a service and often take ownership of the hulls and shells. For the crop year 2014, the value of direct output for the huller and sheller sector is \$440 million. Of this, \$263 million, or 60 percent is projected as direct value added to the California economy. Total value added from the hulling and shelling sector, which derives the majority of its revenues from the sale of byproducts, is projected at \$527 million including indirect and induced effects.

Table 1.4 shows contribution of the almond handling sector to the statewide economy. The estimates in table 1.4 are based off of the mark-up value over the almonds purchased from growers, which is total value of the almond handling sector's almond shipments minus the purchase cost of almonds from growers. Direct mark-up value of output for almond handlers for the 2014 crop year is projected to be \$2.23 billion. Almond handlers, in contrast to the hulling and shelling sector, purchase almonds from growers and other inputs. This fact decreases the direct value-added effect and increases the indirect value added effect of changes in total mark-up output value. Indirect value added for almond handlers in 2014 is projected to be \$1.52 billion. Total value added to the economy from the handler sector is projected to be \$2.66 billion. The activity in the handler sector during the 2014 crop year is projected to support 26,789 jobs statewide.

Table 1.5 shows the contribution of the almond manufacturing sector to the statewide economy. The estimates in table 1.5 are based on the mark-up value of output of almond manufacturers, which is total value of manufacturing output minus the cost of almonds transferred from handlers (which may be a division of the same firm). Based on industry

responses, about 40 percent of California's almonds are marketed as manufactured products. The direct mark-up value of these products is projected to be \$483 million in 2014. Combined with the added output value from input suppliers and the rest of the economy, the total value of output is projected to be slightly larger than \$1.3 billion in 2014. Total value added to the economy from the manufacturer sector is projected to be \$355 million with the majority of this occurring through indirect and induced effects. In total, the almond manufacturing sector is projected to support 3,580 jobs in the California economy.

Table 1.6 combines results from the four sectors to estimate industry-wide effects on the California economy. We estimate that almond production and processing for the 2014 crop year will contribute \$10.5 billion of direct value of output to the California economy. This total includes the value of almonds as they are shipped from the industry, either from handlers to out of state processors or to ports for export, or from California manufacturers to retailers, further processors or exporters. Almond industry output in 2014 will generate slightly more than \$6 billion of output value indirectly through purchases of inputs from supporting industries and just over \$5.2 billion in output from the rest of the economy through induced effects. In sum, we project that the total value of output in the California economy from the 2014 almond crop will be about \$21.8 billion.

The contribution of the almond industry to the California gross state product—the measure of the size of the California economy—is measured by the value added impact shown in the second panel of table 1.6. Direct value added of the 2014 almond crop year, measured by the sum of salaries and wages, proprietor income, and business profits minus taxes, is about \$4.5 billion. The indirect value added, which reflect the net economic value created by industries that support the almond industry adds another \$3.4 billion and the induced effects from consumption

activity adds \$3.3 billion. We project that the total contribution of the almond industry to the California economy will be about \$11 billion, based on the 2014 crop. This is the estimate of economic activity that depends on almond production, processing and marketing in California.

The bottom panel of Table 1.6 shows that the 2014 almond crop will provide about 26,000 jobs within the almond industry. Our calculations show that the almond industry will create an additional 44,500 jobs through purchases from supporting industries. The number of jobs created in the economy from induced effects is about 33,700 for the 2014 crop year. In total, output from the California almond industry is expected to create almost 104,000 jobs in the state and about three quarters of those jobs are outside the almond industry in support industries or throughout the economy in sectors stimulated by consumer purchases generated by almond income.

The California almond industry is large and dynamic. Through its linkages with the rest of the California economy it stimulates jobs, income, production and other economic activity across a wide array of industries and sectors. Members of the California almond industry contribute in many ways to their local communities and statewide that we do not quantify fully here. For example, they participate in volunteer activities and make charitable contributions. Almond shipments to the rest of the United States contribute to the economy nationwide. California almond exports generate economic activity globally and have become a prominent symbol of California in the global economy. Finally, California almonds also make additional contributions to diet and nutrition and consumer enjoyment worldwide in ways that we have not quantified in this report.

BOX 1.1

Using Input-Output Models to Measure Economy-wide Impacts and Contributions

Input-output models link the magnitude of changes in an industry or segment of the economy to the associated changes in all the other industries and segments throughout the economy. For example, an expansion of demand for California almonds causes more employment and other economic activity in almond production and handling and these activities cause increased demand for materials and services from outside the industry such as packaging, and trucking. Moreover, income generated by this economic expansion will be spent on other services from groceries to new cars to school teachers. Input-output models and the associated data on economic linkages in the economy provide the tools and information to quantify these impacts as “multiplier effects” without leaving out impacts or double counting. Impacts are generally classified as direct, indirect and induced effects.

Direct Effects: Direct effects are impacts directly within the affected industry. For example, hiring 100 workers to prune almond trees has a direct employment effect of 100 jobs.

Indirect Effects: Indirect effects are the changes in industries outside the directly affected industry through purchases from supporting industries of input goods and services. For example, the employment of 100 pruners may also entail purchase of 100 pruning shears, buying almond transport services, and these input suppliers have purchases of their own that ripple further.

Induced Effects: Induced effects are economic ripples that result from added consumption generated by the added income spent by those with income from the direct and indirect effects. For example, almond growers, processors and their employees spend their incomes at local grocery stores, auto dealerships and barbershops and these local firms have workers of their own.

The sum of direct, indirect and induced impacts tells us the complete impact or contribution of the almond industry on the whole of the California economy. We report the contributions using three economic measures.

Value of Output: The value of direct output or service contribution of an industry or segment. For example, the direct value of almond grower output is simply the market value of almonds produced. For hullers and shellers it’s the total market value for the almond byproducts they sell such as hulls for livestock feed. For handlers, it’s their revenue minus what they pay farmers. The value of manufacturers output is their contribution above the value at the handler stage.

Value Added: Value added is the measure of salaries and wages, proprietor income and profit minus business taxes. It is that proportion of value of output contributed by labor and capital within the sector. An industry’s value added is the economic contribution of a sector above the cost of goods and services purchased from other sectors. Value added for almonds is the industry’s contribution to the size of the California economy.

Employment: Employment is defined as the number of jobs including part-time or seasonal employment. It is not converted to full-time equivalent (FTE) employment.

Figure 1.1: Flow of almonds and other inputs through the production and marketing chain

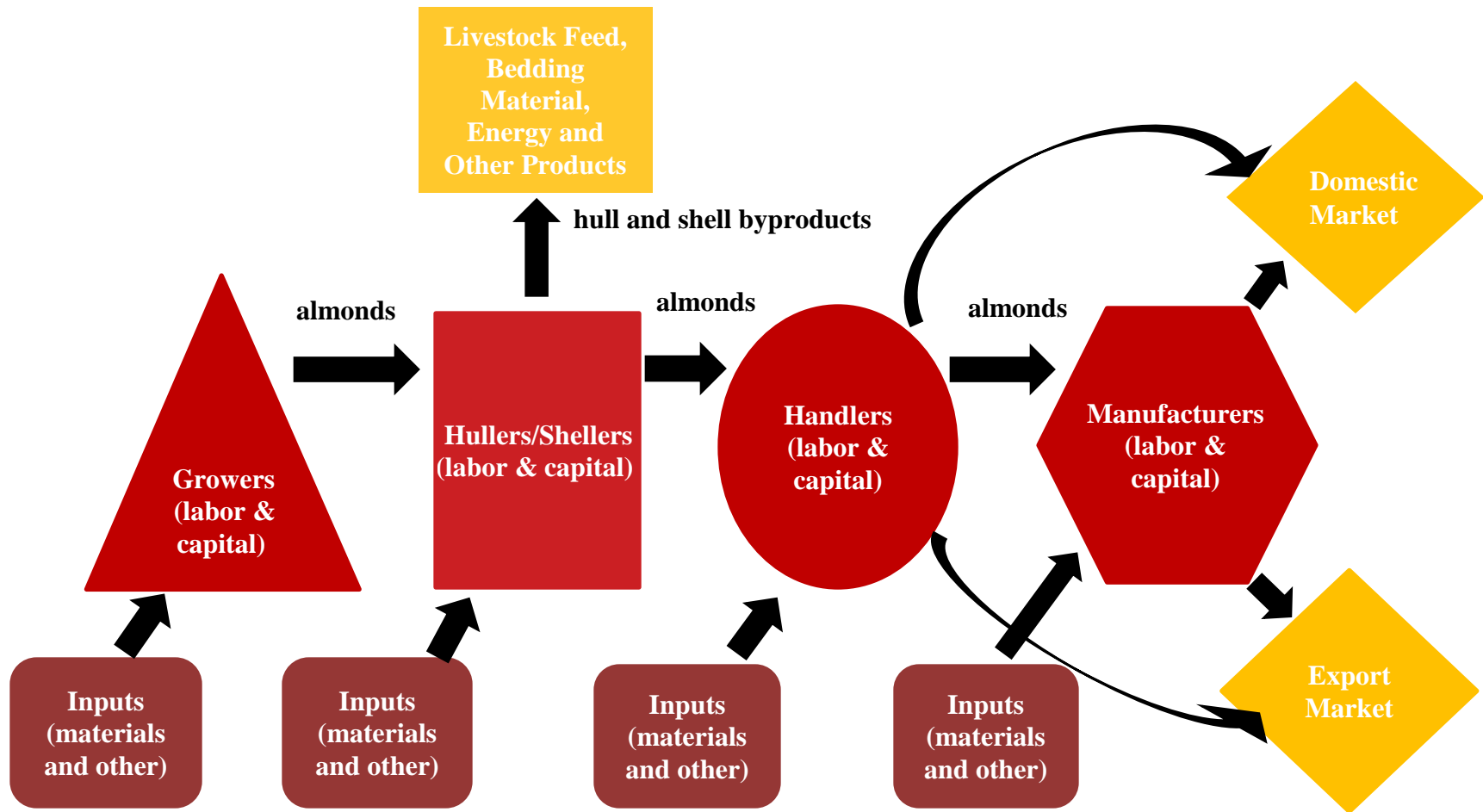


Table 1.1: California Statewide Almond Impact Multipliers

<i>Multiplier</i>	<i>Growing</i>	<i>Hulling</i>	<i>Shelling</i>	<i>Handling</i>	<i>Manufacturing</i>
Value of Output	<i>\$ of output for economy per \$1.00 output by Almond sector</i>				
Direct Effect	1.00	1.00	1.00	1.00	1.00
Indirect Effect	0.37	0.48	1.12	1.38	
Induced Effect	0.50	0.47	0.53	0.33	
Total Effect	1.87	1.95	2.65	2.71	
Value Added	<i>GDP(\$) per \$1.00 of output</i>				
Direct Effect	0.52	0.60	0.17	0.10	
Indirect Effect	0.21	0.31	0.68	0.43	
Induced Effect	0.32	0.30	0.34	0.21	
Total Effect	1.04	1.20	1.19	0.73	
Employment	<i>Jobs per \$1 million of output</i>				
Direct Effect	2.86	5.96	0.67	1.12	
Indirect Effect	3.23	2.94	7.89	4.18	
Induced Effect	3.23	3.02	3.44	2.11	
Total Effect	9.31	11.91	12.00	7.42	

Source: Input-output multipliers were generated in IMPLAN using revenue and costs information provided by industry sources.

Table 1.2: Statewide Economic Impacts of California Almond Growers, 2012-2014^{1,2}

	2012	2013	2014
	<i>\$1,000,000</i>		
Value of Grower Output			
Direct Effect	\$4,863	\$5,828	\$7,315
Indirect Effect	\$1,809	\$2,167	\$2,720
Induced Effect	\$2,434	\$2,917	\$3,662
Total Effect	\$9,106	\$10,913	\$13,697
Value Added			
Direct Effect	\$2,515	\$3,014	\$3,782
Indirect Effect	\$1,011	\$1,211	\$1,520
Induced Effect	\$1,533	\$1,837	\$2,305
Total Effect	\$5,058	\$6,061	\$7,608
Employment		<u>Number of jobs</u>	
Direct Effect	13,893	16,649	20,897
Indirect Effect	15,692	18,806	23,603
Induced Effect	15,704	18,819	23,620
Total Effect	45,289	54,274	68,120

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

Table 1.3: Statewide Economic Impacts of California Hullers and Shellers, 2012-2014^{1,2}

	2012	2013	2014
		<u><i>\$1,000,000</i></u>	
Value from Huller Sheller Services			
Direct Effect	\$299	\$343	\$440
Indirect Effect	\$144	\$165	\$211
Induced Effect	\$140	\$161	\$207
Total Effect	\$583	\$669	\$858
Value Added			
Direct Effect	\$178	\$205	\$263
Indirect Effect	\$91	\$105	\$135
Induced Effect	\$88	\$101	\$130
Total Effect	\$358	\$411	\$527
Employment		<u>Number of jobs</u>	
Direct Effect	1,783	2,045	2,624
Indirect Effect	880	1,010	1,296
Induced Effect	902	1,035	1,328
Total Effect	3,565	4,089	5,248

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

Table 1.4: Statewide Economic Impacts of California Almond Handlers, 2012-2014^{1,2}

	2012	2013	2014
	<i>\$1,000,000</i>		
Value of Handler Contribution (Mark-up)			
Direct Effect	\$1,505	\$1,759	\$2,233
Indirect Effect	\$1,682	\$1,966	\$2,496
Induced Effect	\$804	\$940	\$1,193
Total Effect	\$3,992	\$4,664	\$5,922
Value Added			
Direct Effect	\$262	\$306	\$389
Indirect Effect	\$1,026	\$1,198	\$1,522
Induced Effect	\$506	\$592	\$751
Total Effect	\$1,794	\$2,097	\$2,662
Employment		<u>Number of jobs</u>	
Direct Effect	1,003	1,172	1,488
Indirect Effect	11,875	13,875	17,615
Induced Effect	5,182	6,054	7,687
Total Effect	18,059	21,101	26,789

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

Table 1.5: Statewide Economic Impacts of California Almond Manufacturers, 2012-2014^{1,2}

	2012	2013	2014
	<i>\$1,000,000</i>		
Value of Manufacturer Contribution (Mark-up)			
Direct Effect	\$321	\$379	\$483
Indirect Effect	\$442	\$522	\$664
Induced Effect	\$106	\$125	\$159
Total Effect	\$868	\$1,026	\$1,306
Value Added			
Direct Effect	\$32	\$38	\$49
Indirect Effect	\$137	\$162	\$206
Induced Effect	\$67	\$79	\$100
Total Effect	\$236	\$278	\$355
Employment			
	<u>Number of jobs</u>		
Direct Effect	360	426	542
Indirect Effect	1,342	1,585	2,018
Induced Effect	678	801	1,020
Total Effect	2,380	2,811	3,580

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

Table 1.6: Statewide Economic Impact of Entire Almond Industry, 2012-2014^{1,2}

	2012	2013	2014
	<u>\$1,000,000</u>		
Value of Industry Output			
Direct Effect	\$6,989	\$8,309	\$10,471
Indirect Effect	\$4,076	\$4,820	\$6,092
Induced Effect	\$3,485	\$4,143	\$5,220
Total Effect	\$14,550	\$17,272	\$21,783
Value Added			
Direct Effect	\$2,988	\$3,563	\$4,483
Indirect Effect	\$2,265	\$2,676	\$3,382
Induced Effect	\$2,194	\$2,608	\$3,287
Total Effect	\$7,446	\$8,847	\$11,152
Employment		<u>Number of jobs</u>	
Direct Effect	17,039	20,291	25,550
Indirect Effect	29,789	35,274	44,532
Induced Effect	22,466	26,710	33,655
Total Effect	69,294	82,276	103,737

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

Appendix A: Value of the Almond Industry to the Economy of the Central Valley

Using the IMPLAN modeling software and database we also quantified relationships across California's Central Valley. In our analysis we define the Central Valley to include the following counties: Butte, Colusa, Fresno, Glenn, Madera, Merced, Sacramento, Kern, Kings, San Joaquin, Solano, Stanislaus, Sutter, Tehama, Tuolumne, Yolo, Yuba and Tulare.

We begin with Table A.1 which shows the multipliers that turn direct almond output, value added and employment into the full economic contributions to the economy of Central California for each sector of the almond industry. See Box 1.1 for definitions of economic effects and multipliers. To measure the total economic contribution of the California almond industry we collected information from individual firms within the industry that engage in the growing, hulling-shelling, handling and manufacturing of almonds.

The direct output multiplier for each of the industry sectors is one by definition: \$1.00 of direct output by each sector is \$1.00 direct output for the economy. The indirect output multiplier can be interpreted as the number of dollars of output generated in supporting industries from a one dollar increase in direct output by the corresponding sector. For example, in Table A.1, under the column for almond growers, the indirect value of output multiplier for almond growers is 0.33 meaning that every dollar of expanded output by almond growers results in \$0.33 of additional output generated by supporting industries that provide materials and services purchased by growers. "Indirect" output multipliers are higher in the handling and manufacturing sectors because growing almonds requires more labor, land and other inputs generated on the farm, whereas processing of almonds requires more purchased inputs from supporting industries such as transport services, materials for packaging and equipment. The "induced" effects multiplier measures the output in the rest of the economy linked to an increase in direct output

through consumption activities of employees and owners within the sector. The total effects multiplier is the sum of direct, indirect and induced effects multipliers. It measures additional statewide economic output from an increase in output by the four sectors of the almond industry. Again, the handling and manufacturing, through their greater dependence on supporting industries for purchased inputs, have the highest multipliers of overall effect on economic output. The almond manufacturing sector produces an additional \$1.43 in economic output for every \$1.00 of direct output increase for a total addition of \$2.43 to the Central Valley economy.

Value added can be interpreted also on a per dollar basis. As defined in Box 1.1, value added is the measure of “new” value generated from the inputs held within a segment during the process of combining purchased inputs into a marketable product. This “new” value is represented by salaries and wages, proprietor income, profit and indirect business taxes. The direct value-added multiplier measures the amount of each additional dollar of output value that is allocated to one of the four categories and not to purchases from outside the industry or segment. This portion of output value is what the almond industry contributes to California’s GDP, which is also measured on a value added basis. Value added avoids any double counting of value of inputs purchased by the almond industry from other industries. For almond growers, for every \$1.00 of additional output from almond production \$0.52 ends up as on-farm salaries and wages, proprietor income, business profit, and sales taxes. Among the four sectors of the industry, hullers and shellers have the highest direct value-added multiplier with \$0.60 of every \$1.00 of output adding to the Central Valley GDP. The handling and manufacturing sectors have the lowest direct value-added among the sectors but the highest indirect value-added multipliers. Again, the higher dependence on support industries for inputs to the handling and manufacturing sectors is the reason for the higher indirect effects. Induced value-added effects are fairly similar

across the four sectors and represent how consumer purchases using income from the almond industry cause additional economic output as they ripple through the economy.

The employment multiplier in each cell can be interpreted as the number of jobs added to the economy by a \$1 million increase in the value of direct output by each sector of the industry. Sectors that are labor intensive and buy services from labor intensive industries have high employment multipliers. For example, for every \$1 million in added output an additional 11 jobs are created in the Central Valley; about half of these jobs are created indirectly. As with value-added, the high dependency on purchased inputs in almond handling creates jobs in the supporting industries. Induced employment numbers indicate the number of jobs created in the rest of the economy as a result of increased income within the almond industry and in supporting industries. Added labor and proprietor income creates greater spending within the economy which spurs further job creation.

We apply these multipliers to data on production, value of output and employment in the almond industry in order to estimate the contributions the industry makes to the Central Valley's economy during the 2012, 2013 and 2014 crop years. The estimates for the 2014 crop year are based on preliminary projections on volume and value of the most recent crop year provided by industry sources.

This section quantifies the economic relationships between each of the four almond industry sectors and Central Valley economy and shows how the economic impacts flow through the economy. We estimated output values for each of the sectors using a combination of publicly available data and calculations of revenue per unit of production based on information provided by industry participants who responded to questionnaires about their business. The resulting value of output estimates provide the basis for applying the previously discussed

multipliers and estimating the Central Valley economic impacts of each sector and the industry as a whole.

Production of almonds on the farm is the largest contributor to direct industry output, accounting for an average of about 70 percent of total output value over the three crop years represented. Table A.2 includes projections for the 2014 crop year of the direct farm-value of almond production at about \$7.3 billion up from \$5.8 billion in 2013. Of this \$7.3 billion in direct output value, about \$3.8 billion is value added, which is distributed as salaries and wages for employees and grower-owners as well as indirect business taxes and profit. The direct output of almond growers in 2014 generated more than \$1.3 billion of indirect value added by supporting industries and more than \$1.6 billion of value added for the rest of the economy. Overall, the value added to the Central Valley economy from almond growers in the 2014 crop year is projected to be a little over \$6.8 billion.

Table A.3 provides information on the contributions from the huller and sheller sector to the Central Valley economy. The huller and sheller sector has the greatest share of value added to total output value within the almond industry. This is consistent with the huller and sheller sector's low demand for purchased inputs and the fact that hullers and shellers do not purchase the almonds they process, but rather provide a service and often take ownership of the hulls and shells. For the crop year 2014, the value of direct output for the huller and sheller sector is \$440 million. Of this, \$263 million, or 60 percent is projected as direct value added for the Central Valley economy. Total value added from the hulling and shelling sector, which derives the majority of its revenues from the sale of byproducts, is projected at \$477 million including indirect and induced effects.

Table A.4 shows contribution of the almond handling sector to the Central Valley economy. The estimates in table A.4 are based on the mark-up value over the almonds purchased from growers, which is the total value of almond handling sector's almond shipments minus the purchase cost of almonds from growers. Direct mark-up value of output for almond handlers for the 2014 crop year is projected to be \$2.23 billion. Almond handlers, in contrast to the hulling and shelling sector, purchase many inputs which include purchases of almonds from growers. This fact decreases the direct value-added effect and increases the indirect value added effect of changes in total mark-up output value. Indirect value added to the Central Valley economy for almond handlers in 2014 is projected to be \$1.43 billion. Total value added to the Central Valley economy from the handler sector is projected to be \$2.35 billion. The activity in the handler sector during the 2014 crop year is projected to support 24,823 Central Valley jobs.

Table A.5 shows the contribution of the almond manufacturing sector to the Central Valley economy. The estimates in table A.5 are based on the mark-up value of output of almond manufacturers, which is total value of manufacturing output minus the cost of almonds transferred from handlers (which may be a division of the same firm). Based on industry responses, about 40 percent of the Central Valley's almonds are marketed as manufactured products. The direct mark-up value of these products is projected to be \$483 million in 2014. Combined with the added output from input suppliers and the rest of the economy, the total value of output is projected to be about \$1.2 billion in 2014. Total value added to the Central Valley economy from the manufacturer sector is projected to be \$268 million with the majority of this occurring through indirect and induced effects. In total the almond manufacturing sector is projected to support 3,182 jobs in the Central Valley economy.

Table A.6 combines results from the four sectors to estimate industry-wide effects on the Central Valley economy. We estimate that almond production and processing for the 2014 crop year will contribute \$10.5 billion of direct value to the Central Valley economy. This total includes the value of almonds as they are shipped from the industry, either from handlers to out of state processors or to ports for export, or from California manufacturers to retailers, further processors or exporters. Almond industry output in 2014 will generate about \$5.6 billion of output value indirectly through purchases of inputs from supporting industries and just over \$3.7 billion in output from the rest of the Central Valley economy through induced effects. In sum, we project that the total value of output in the Central Valley economy from the 2014 almond crop will be over \$19.7 billion.

The bottom panel of table A.6 shows that almonds provide almost 26,000 jobs within the industry itself. About 80 percent of these jobs are on-farm, producing and harvesting the crop. The number of jobs created indirectly via supporting industries during the 2014 crop year almost doubles the direct jobs created. Almond industry output in 2014 is expected to create over 44,000 jobs indirectly through purchases from supporting industries. In total, output from the almond industry during the 2014 crop year is expected to create over 97,000 jobs in the Central Valley.

Table A.1: California Central Valley Almond Multipliers

<i>Multipliers</i>	<i>Growing</i>	<i>Hulling</i>	<i>Shelling</i>	<i>Handling</i>	<i>Manufacturing</i>
Output	<i>\$ of output for economy per \$1.00 output by Almond sector</i>				
Direct Effect	1.00	1.00	1.00	1.00	1.00
Indirect Effect	0.33	0.44	1.04	1.04	1.24
Induced Effect	0.36	0.33	0.38	0.38	0.19
Total Effect	1.69	1.77	2.41	2.41	2.43
Value Added	<i>GDP(\$) per \$1.00 of output</i>				
Direct Effect	0.52	0.60	0.17	0.17	0.10
Indirect Effect	0.19	0.28	0.64	0.64	0.33
Induced Effect	0.23	0.21	0.24	0.24	0.12
Total Effect	0.93	1.08	1.05	1.05	0.55
Employment	<i>Jobs per \$1 million of output</i>				
Direct Effect	2.86	5.96	0.67	0.67	1.12
Indirect Effect	3.34	2.96	7.71	7.71	4.07
Induced Effect	2.63	2.36	2.74	2.74	1.40
Total Effect	8.83	11.28	11.12	11.12	6.59

Source: Input-output multipliers were generated in IMPLAN using revenue and costs information provided by industry sources.

Table A.2: Central Valley Economic Impacts of California Almond Growers, 2012-2014^{1,2,3}

	2012	2013	2014
	<i>\$1,000,000</i>		
Value of Grower Output			
Direct Effect	\$4,863	\$5,828	\$7,315
Indirect Effect	\$1,625	\$1,947	\$2,444
Induced Effect	\$1,755	\$2,103	\$2,640
Total Effect	\$8,243	\$9,878	\$12,398
Value Added			
Direct Effect	\$2,515	\$3,014	\$3,782
Indirect Effect	\$910	\$1,091	\$1,369
Induced Effect	\$1,121	\$1,343	\$1,686
Total Effect	\$4,546	\$5,447	\$6,837
Employment		<u>Number of jobs</u>	
Direct Effect	13,893	16,649	20,897
Indirect Effect	16,251	19,475	24,443
Induced Effect	12,779	15,314	19,221
Total Effect	42,923	51,438	64,561

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

³Direct effects reflect state level of output but resulting indirect and induced effects are specific to the Central Valley.

Table A.3: Central Valley Economic Impacts of California Hullers and Shellers, 2012-2014^{1,2,3}

	2012	2013	2014
	<u>\$1,000,000</u>		
Value from Huller Sheller Output			
Direct Effect	\$299	\$343	\$440
Indirect Effect	\$132	\$152	\$194
Induced Effect	\$97	\$112	\$143
Total Effect	\$529	\$606	\$778
Value Added			
Direct Effect	\$178	\$205	\$263
Indirect Effect	\$83	\$95	\$122
Induced Effect	\$62	\$71	\$92
Total Effect	\$324	\$371	\$477
Employment		<u>Number of jobs</u>	
Direct Effect	1,783	2,045	2,624
Indirect Effect	886	1,017	1,304
Induced Effect	706	810	1,039
Total Effect	3,375	3,871	4,968

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

³Direct effects reflect state level of output but resulting indirect and induced effects are specific to the Central Valley.

Table A.4: Central Valley Economic Impacts of California Almond Handlers, 2012-2014^{1,2,3}

	2012	2013	2014
	<i>\$1,000,000</i>		
Value of Mark-up to Handler Output			
Direct Effect	\$1,505	\$1,759	\$2,233
Indirect Effect	\$1,561	\$1,824	\$2,316
Induced Effect	\$567	\$663	\$841
Total Effect	\$3,633	\$4,245	\$5,390
Value Added			
Direct Effect	\$262	\$306	\$389
Indirect Effect	\$961	\$1,123	\$1,426
Induced Effect	\$362	\$423	\$537
Total Effect	\$1,586	\$1,853	\$2,352
Employment		<u>Number of jobs</u>	
Direct Effect	1,003	1,172	1,488
Indirect Effect	11,609	13,564	17,221
Induced Effect	4,122	4,816	6,115
Total Effect	16,734	19,552	24,823

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

³Direct effects reflect state level of output but resulting indirect and induced effects are specific to the Central Valley.

Table A.5: Central Valley Economic Impacts of California Almond Manufacturers, 2012-2014^{1,2,3}

	2012	2013	2014
	<i>\$1,000,000</i>		
Value of Mark-up to Manufacturer Output			
Direct Effect	\$321	\$379	\$483
Indirect Effect	\$397	\$469	\$598
Induced Effect	\$62	\$73	\$93
Total Effect	\$780	\$921	\$1,173
Value Added			
Direct Effect	\$32	\$38	\$49
Indirect Effect	\$106	\$125	\$160
Induced Effect	\$40	\$47	\$59
Total Effect	\$178	\$210	\$268
Employment	<u>Number of jobs</u>		
Direct Effect	360	426	542
Indirect Effect	1,308	1,544	1,967
Induced Effect	448	529	674
Total Effect	2,116	2,499	3,182

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

³Direct effects reflect state level of output but resulting indirect and induced effects are specific to the Central Valley.

Table A.6: Central Valley Economic Impact of Entire Almond Industry, 2012-2014^{1,2,3}

	2012	2013	2014
	<i>\$1,000,000</i>		
Value of Industry Output			
Direct Effect	\$6,989	\$8,309	\$10,471
Indirect Effect	\$3,715	\$4,392	\$5,551
Induced Effect	\$2,481	\$2,950	\$3,717
Total Effect	\$13,185	\$15,651	\$19,740
Value Added			
Direct Effect	\$2,988	\$3,563	\$4,483
Indirect Effect	\$2,061	\$2,434	\$3,077
Induced Effect	\$1,585	\$1,885	\$2,374
Total Effect	\$6,633	\$7,882	\$9,934
Employment		<u>Number of jobs</u>	
Direct Effect	17,039	20,291	25,550
Indirect Effect	30,054	35,600	44,936
Induced Effect	18,055	21,469	27,049
Total Effect	65,148	77,361	97,535

Source: Values were estimated by UC AIC staff by applying input-output multipliers generated in IMPLAN and using revenue and costs information provided by industry sources.

¹Each year reported reflects the almond crop year and not calendar year.

²Values for 2014 crop year are estimated based off of crop volume and value projections provided by industry sources.

³Direct effects reflect state level of output but resulting indirect and induced effects are specific to the Central Valley.

2. Background Description of the California Almond Industry

Almonds have been grown in California since the early 1900's. Since the early 1970's, the value of the almond crop in California has grown steadily with exceptional growth occurring since 2000 (Figure 2.1). In 2012, the farm value of almonds was \$4.35 billion making it the second most valuable crop produced in California behind grapes. Growth in value from 2013 to 2014 has pushed almonds to be the top revenue crop in California. From 1930 to the early 1970's almonds accounted for less than two percent of the total annual value of California's agricultural production (Figure 2.2). Since then, the importance of almonds has grown steadily to where it was ranked third in value among California's agricultural commodities in 2012, accounting for 9.7 percent of the state's agriculture production value.

Historically, almonds and pistachios have been the higher priced nuts. Generally, walnuts yield more volume per acre than almonds and pistachios, but command a lower price per pound. Since 2000, almonds have averaged \$1.84 per pound, pistachios \$1.70 per pound, and walnuts \$0.94 per pound. Since 2010, both walnut and pistachio yield per acre have declined while almond yield per acre has fluctuated slightly. Almond prices peaked in 1995, 2005 and 2013.

2.1 The Evolution of the Almond Industry

New almond orchards are planted in early February and for purposes of cross pollination include at least two or more varieties of almond trees. Once planted, the economic lifespan of an almond orchard is 20 to 25 years, with the first main crop coming three to four years after planting. In a typical season, almond tree buds will bloom between late February and early March in preparation for pollination. Populations of bees are brought to the orchard for pollination, initiating crop development. The almond continues to mature from March to June, with the shell hardening and kernel forming. The almond hulls begin to split in July and early

August, and once completely open, harvest commences. From mid-August through October, the almonds are shaken out of the trees, dried naturally on the orchard floor and then hauled to a huller-sheller for initial processing. Almond handlers further clean, size and sort raw brown-skin almonds, which can then be stored for future sale or sold as wholesale bulk almonds to food processors, food retailers or the foodservice industry. Some almonds move to the manufacturing stage of the industry where they can be blanched, sliced, chopped, roasted or prepared in other forms and packaged for retail sales or sold as bulk manufactured products to the food processor or foodservice industry.

California almond acreage has increased from 36,000 bearing acres in 1920 to 840,000 bearing acres in 2013 (Figure 2.3). Although growing slower until around 1967, almond acreage grew rapidly from the late 60's to the late 80's. Acreage grew slightly through the mid-1990's but has increased significantly since. Acreage growth was one cause of increased almond production, but yield per acre also grew over the century. California almond acreage is now yielding more than eight times the production of the early 20th century. From 1919 to 1929 USDA NASS reported almond yields averaged 217 pounds per acre. During the decade from 1999 to 2009 yields averaged 1,840 pounds per acre. As a result of increased acreage and yield per acre over the past century, production has increased from about seven million shelled pounds in 1920 to over two billion shelled pounds today.

Harvest season for almonds is August 1 through October 31, and trees are currently averaging 6,646 nuts each, a 0.6% decrease from the 2013 crop. Almond production for 2014 is forecast at 2.1 billion meat pounds, an increase of 4.5 percent from last year's crop. This forecast is based on an estimated 860,000 bearing acreage. More almonds are produced each year as bearing acreage in California has increased an average of 21,000 acres each year since 1995. In

addition, California has experienced denser tree plantings, from 84.5 trees per acre in 1986 to 111 trees per acre in 2011. Planting densities for each operation may range from 75 to 180 trees per acre (2012 Almonds Costs and Returns Study: Sacramento Valley). The nonpareil variety accounts for approximately 50 percent of the state's almond acreage. The other two major classifications are California and Mission types, though there are more than two dozen almond varieties produced in California orchards.

The total number of farms in California, including cropland and pastureland, declined from 2007 to 2012 while almond farms increased in number. Overall farms experienced a 3.9 percent decline in number; the number of farms in crop production, specifically, decreased by 5.7 percent; but the number of almond farms grew from 6,474 farms in 2007 to 6,841 farms in 2012, a 5.67 percent increase.

With a nearly constant growth pattern in almond bearing acreage since the 1960's, not only has total production of California almonds grown, but with more efficiency-improving technology, growers have experienced increased almond yield per acre. From the 1920's to the 1960's, almond yield fluctuated year to year from less than 200 to almost 600 pounds per acre (Figure 2.3). However, almond yield per acre reached 1,080 pounds per acre in 1959 and fluctuated from 600 to almost 1,000 pounds per acre until 1976 when production reached another high of 1,100 pounds per acre. Since 1976, almond yield has more than doubled. In recent years, yield per acre has fluctuated annually, increasing by 14 percent in 2010 and 2011 but decreasing by 9 percent in 2012. Yield per acre of almonds produced experienced four percent growth from 2012 to 2013. In terms of kernel weight, the average for all varieties reached a record low of 1.36 grams in 2013. However, the 2014 average kernel weight for all varieties was 1.45, a 6.6 percent increase.

Almond production in California is concentrated mainly in the Central Valley, where the mild climate, rich soil, abundant sunshine and water supply make for ideal growing conditions. More specifically, the Fresno, Kern, Stanislaus, and Merced counties in the San Joaquin Valley accounted for 64 percent of statewide almond bearing acreage in 2011. These counties lead both in terms of volume of almonds produced as well as total yield (CDFA).

Spain was the world's largest producer of almonds until 1987 when increased almond acreage in California caused U.S. production to bypass that of Spain. Spain's almond acreage is the largest in the world, averaging 1.4 million acres between 2006 and 2010, yet yield per acre is lower than average. This is due to fewer technological inputs implemented, for example inadequate irrigation systems in arid areas, which has resulted in lower productivity.

USDA Foreign Agricultural Service forecasts global almond production for the 2014 crop year to be around 2.3 billion pounds. California is projected to produce about 2.0 billion pounds or more than 86 percent of the global almond supply.

2.2 From Production to Marketing: The Almond Supply Chain

Nonpareils are among the first almond varieties to bloom, with other varieties, like Carmel and Mission, blooming later. After the almond fruit develops inside its hull, the hull dries and splits open, revealing a shell that encases the nut. Before they are harvested, the nuts dry naturally for eight to ten days. Almonds are then harvested by mechanical tree shakers between mid-August and October when the almonds, still in their hulls, are knocked to the ground. They are swept into windrows and allowed to dry naturally, ideally to a hull moisture no more than 12 percent, or a kernel moisture content no greater than six percent. This drying process may take anywhere from a few days up to two weeks. The almonds are then collected and delivered for harvest.

After harvest, almonds are delivered to a huller/sheller where the kernels pass through a roller for the hull, shell and any remaining debris to be removed. There are approximately 250 almond hullers and shellers in California. An estimated 90 percent of the huller/sheller volume is represented by the Almond Hullers and Processors Association (AHPA), which consists of 93 huller/sheller members. Approximately two million tons of hulls are collected annually after being separated from the almond meat. For every one million pounds of almond meat, there are 2 million pounds of hulls. In addition, the shell is approximately 25 percent the volume of the hulls (Almond Hullers and Processors Association).

Almond hulls and shells provide material for animal bedding or even serve as a feed ingredient for livestock and dairy operations. The shells can also be used as an alternative fuel source in co-generation plants. The fuzzy hull that surrounds the shell has a fairly high energy value for ruminant animals making it a valuable feed ingredient for dairy producers. In general, California dairy producers mix feed rations that are about 4.5 percent almond hulls. In comparison, alfalfa hay makes up about 17 percent of dairy cow feed rations (CDFA Cost Study Dairy Surveys, 2014). Using almond hulls as feed for livestock reduces the need to produce alfalfa for livestock feed, which is a very water-intensive crop.

An almond handler transfers almonds from the farm gate into channels of trade, either domestically or through exports. Handling may include some further processing such as cleaning, sizing, sorting and bulk packaging. It also includes the activities of selling, consigning, transporting, or shipping almonds or almond forms. There are 105 almond handlers in California, the majority of which handle 24 million pounds of almond shipments or less (Table 2.2).

Once the almond is heated through roasting or further processed into manufactured products their shelf life is shortened. Therefore, manufactured almond products should have

minimal exposure to oxygen either by way of nitrogen flushing or vacuum packaging. Lastly, almond stock is rotated periodically to optimize shelf life.

Almonds are sold in two forms, natural – meaning, the skin is still on – or blanched where the skin is removed. Each of these forms may be sold whole, sliced, slivered, chopped, diced, roasted or raw. Almonds entering the food supply chain are sold through retail, foodservice and food processor ingredient channels. Almonds that are sold as retail raw almonds are packaged as either bulk or snack almonds. For the food processing ingredient channel, almonds are used to produce a number of different processed items: ready-to-eat cereals, energy and granola bars, baked goods, almond butter, almond snack mixes, chocolate and non-chocolate confectionary, frozen novelties, ice cream, and milk substitute. These categories are sold to both food service and retail channels. Almonds are also sold in the food service channel as snack packaged almonds, food service ingredients and in-store supermarket bakery ingredients.

About 47 percent of almonds used in the United States are sold through the retail channel as pure almonds. The food processing channel utilizes 47.5 percent of all almonds used in U.S. foods as ingredient almonds; and 5.5 percent of all almonds used in U.S. foods are sold to the food service channel as pure almonds (Technomic Report, 2013. Almond Board of California).

Within food processing, cereal, energy and granola bars represent almost one third of all almond use. The next highest usage categories are chocolates, and almond snack mixes with shares of 19 percent and 16 percent respectively (Technomic Report, 2013. Almond Board of California). Demand for almond milk has significantly influenced revenue, volume, and unit growth within the milk alternatives category. The share of almond milk in the milk substitute market increased from 21.2 percent in 2010 to 61.3 percent in 2013 (Almond Board of California: Retail Product Movement 2013, Milk Alternatives). In terms of volume, almonds

used in the production of milk substitute account for 6.5 percent of all almonds used in U.S. foods. The almond milk ingredient channel consumes 13.8 percent of all food processor ingredient almonds (Technomic Report, 2013. Almond Board of California).

As almond production has expanded over the century, California almond exports have become increasingly more valuable to the agriculture industry. California is exporting more almonds today than ever before. The volume of California almond exports today is 65 times the volume of exports in 1965 (Figure 2.4). There has been a steady growth rate, 6.6 percent annually on average, in almond exports since 1988. In 1990, a little more than 414 million pounds were exported at a total value of \$564 million. The export total for 2013 was nearly 1.3 billion pounds at a value of \$4.2 billion.

Many agricultural commodities produced in California are exported heavily, including dairy products, wine, table grapes and rice. Total fruit and nut exports accounted for more than half of the value of all California agricultural exports, but tree nuts were California's top agricultural export in 2012, followed by fruit and vegetables. Almonds are California's most valuable individual export commodity, worth approximately \$4.2 billion in export value in 2013, a 23 percent increase from 2012. Almonds are primarily exported as shelled brown-skin nuts, which made up about 1.1 billion pounds, or about 79 percent of 2013 exports. In-shell almonds account for the next largest margin by volume of exports at 18 percent or 242 million pounds exported in 2013. Manufactured almond products make up the remaining 3 percent, 41 million pounds, of total 2013 export volume.

In 2013, California's top destinations for almond exports were China/Hong Kong, Spain, India, Germany, and the United Arab Emirates (Figure 2.5 and Figure 2.6). Collectively, these top five destinations accounted for slightly over half of all California almond exports. The single

largest market for California almonds is the United States, which is almost three times the market size of China/Hong Kong in terms of export volume.

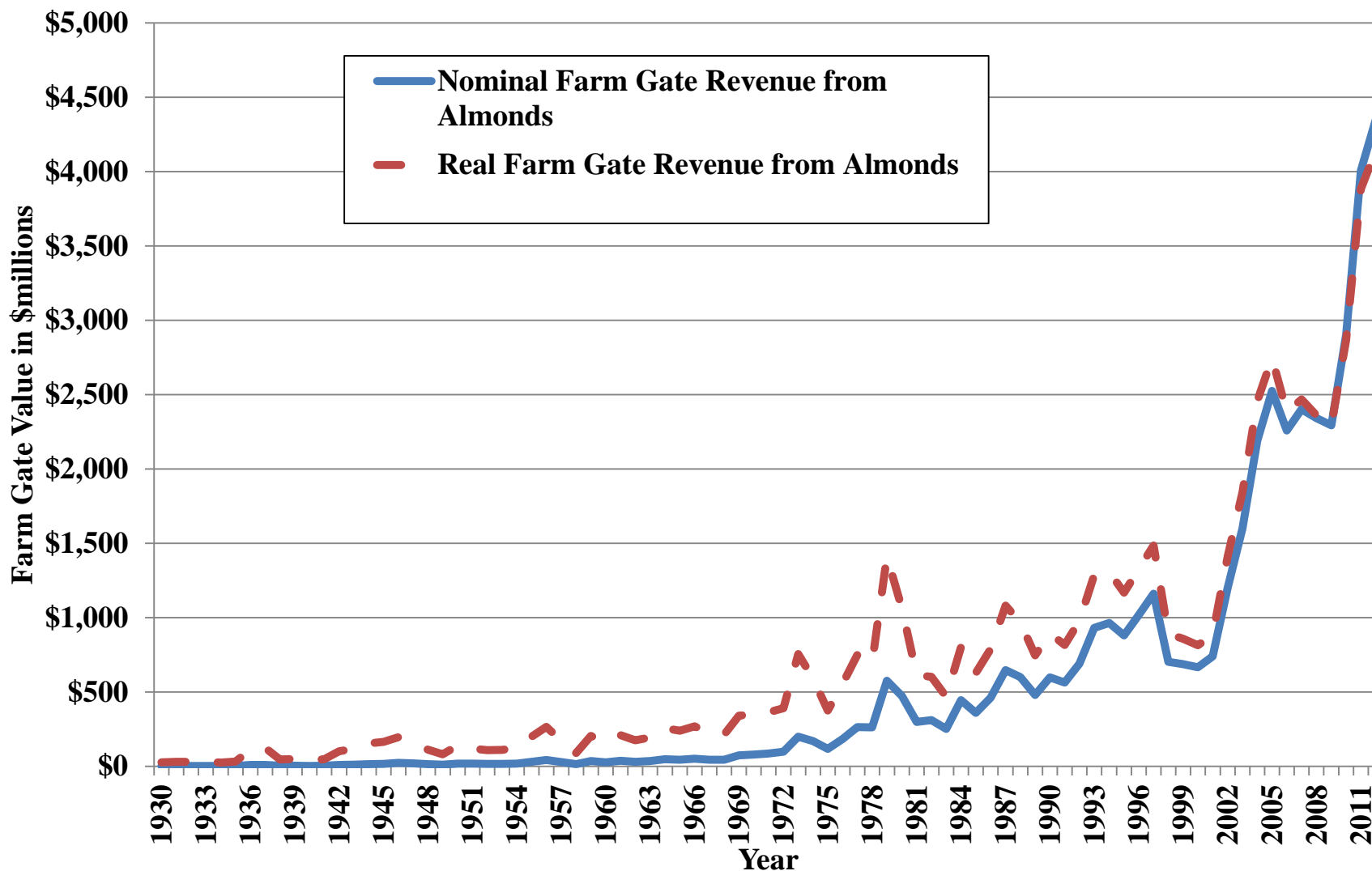
Recently, China/Hong Kong has been the most valuable export destination for California almonds. Since 2009 China/Hong Kong has purchased about 12 percent of all California almonds exported. Of the remaining top five destinations Spain accounts for 11 percent of exports while India (9.6 percent), Germany (8.6 percent) and the United Arab Emirates (7 percent) round out the top five. Historically, almond exports to markets such as the EU, Japan, and Canada have been strong and continue to increase steadily.

California continues to be the leader in supplying almonds to meet global demand. The major export markets for California almonds include Europe, the Middle East, Africa, and Asia Pacific. Demand continues to rise in emerging markets including China/Hong Kong, India, and the United Arab Emirates, causing sustained growth in export volume and value of California almonds. (USDA Foreign Agricultural Service. *Tree Nuts: World Markets and Trade*, 2013).

2.3 Trends in Almond Prices

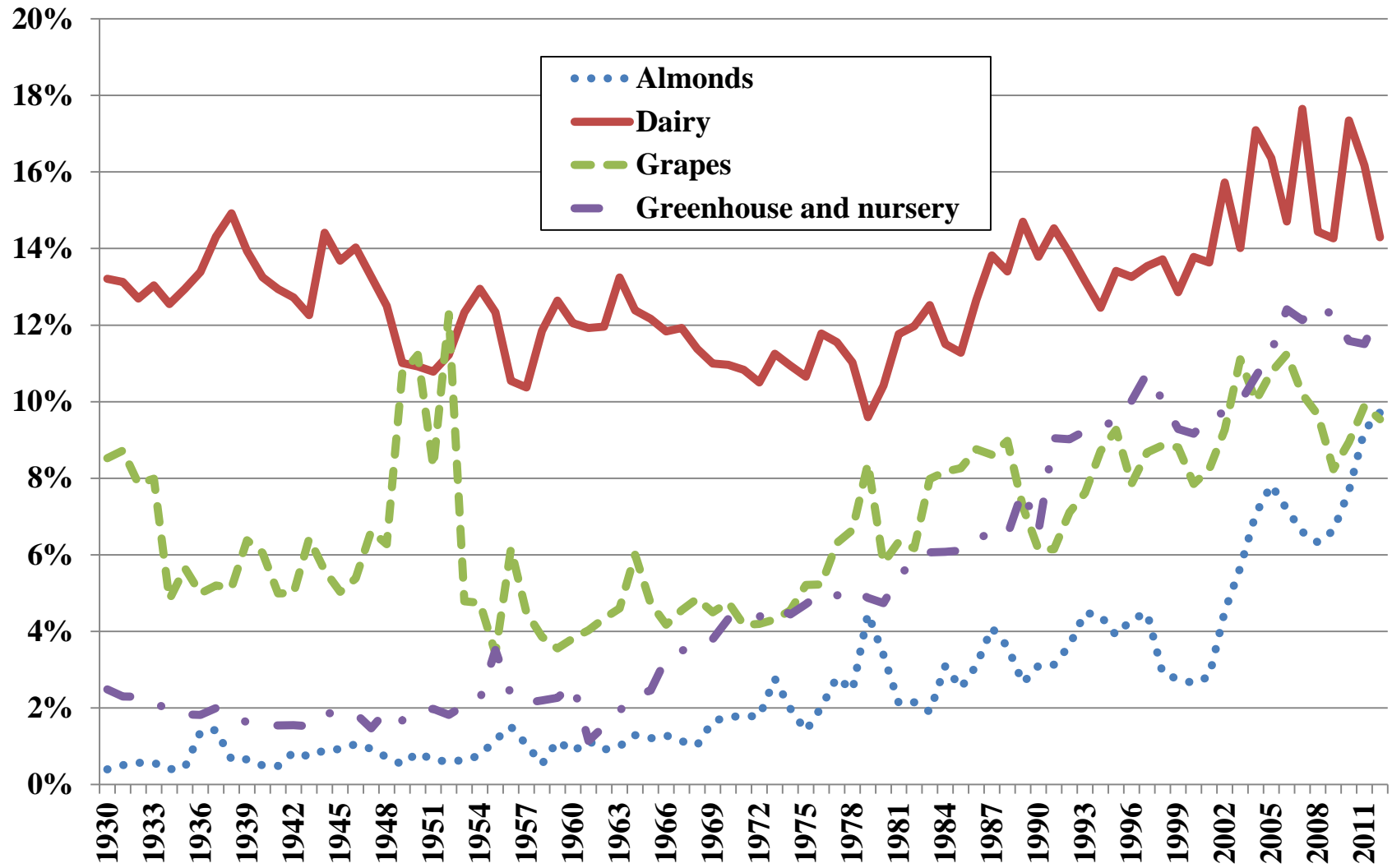
Since 1980, the price of almonds has fluctuated greatly with the market, reaching single peak years followed by extreme drops. The price of almonds per pound in 1980 was \$1.47 but dropped significantly to an industry low of 78 cents per pound in 1981. Between 1980 and 1994, the price of almonds per pound fluctuated between 77 cents and \$1.34 but passed the two dollar mark for the first time in 1995 at a price of \$2.48 per pound. Since, the price of almonds per pound has averaged at \$1.76 and has fluctuated year to year, reaching a low of 86 cents per pound in 1999 and highs of \$2.81 per pound in 2005 and \$2.90 per pound in 2013.

Figure 2.1: Annual Nominal and Real Value of Total Farm Gate Revenues for Almonds, Crop Year 1930-2012



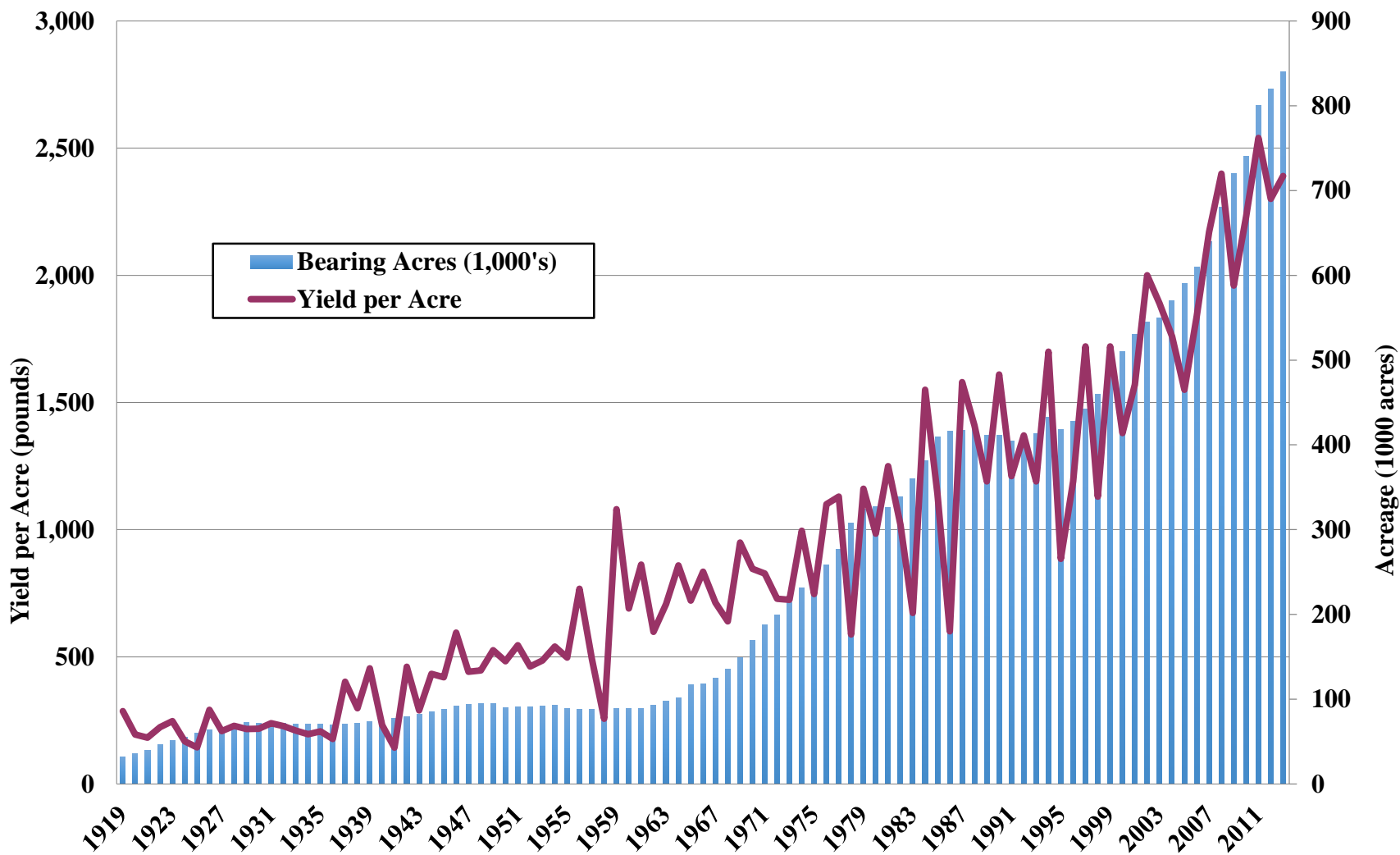
Source: USDA Historical Data – Almonds. NASS QuickStats

Figure 2.2: Top California Agricultural Commodities by Percent of Total Annual Farm Cash Receipts



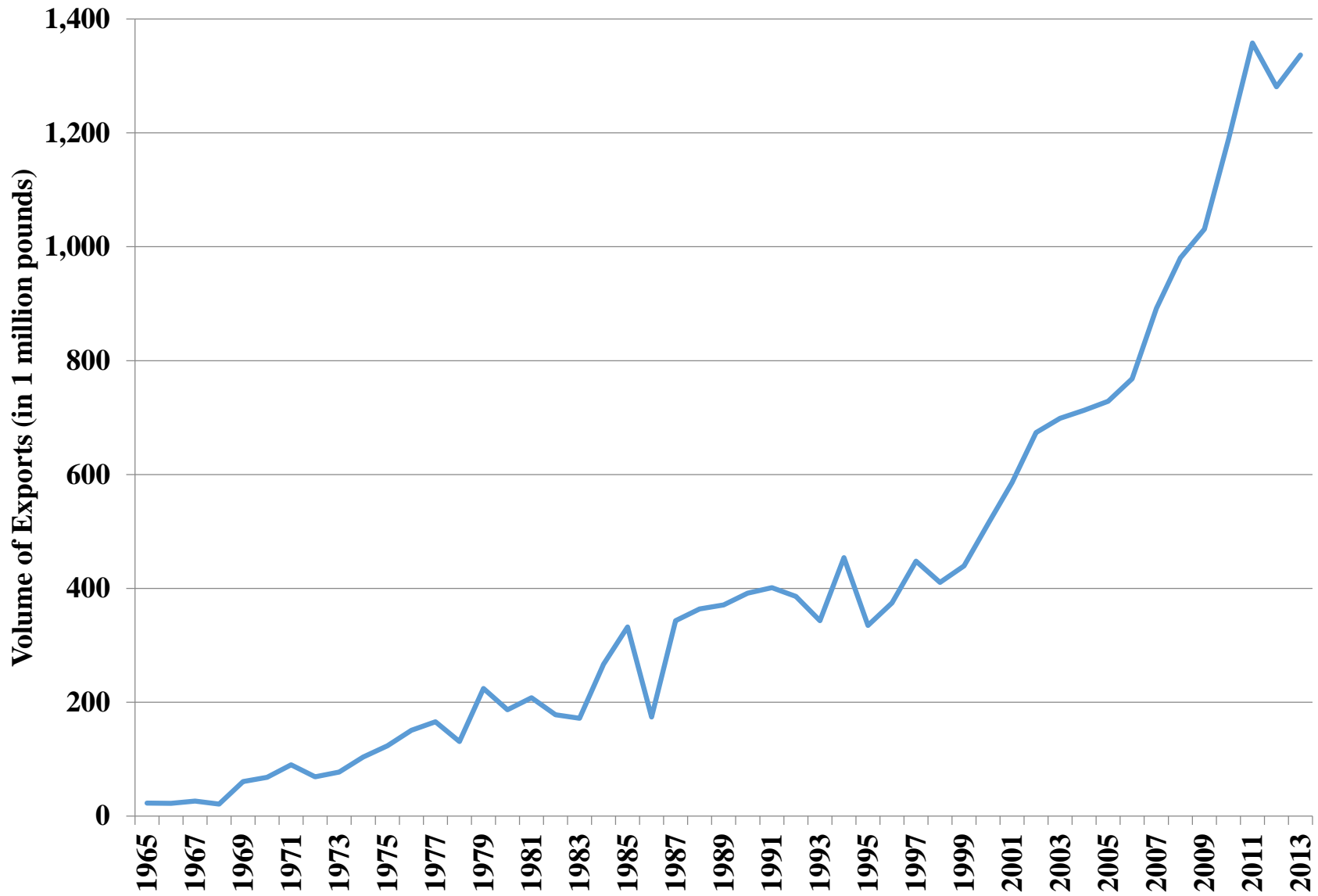
Source: USDA Historical Data – Almonds. NASS QuickStats

Figure 2.3: Annual California Almond Acreage and Yield per Acre, Crop Year 1919-2013



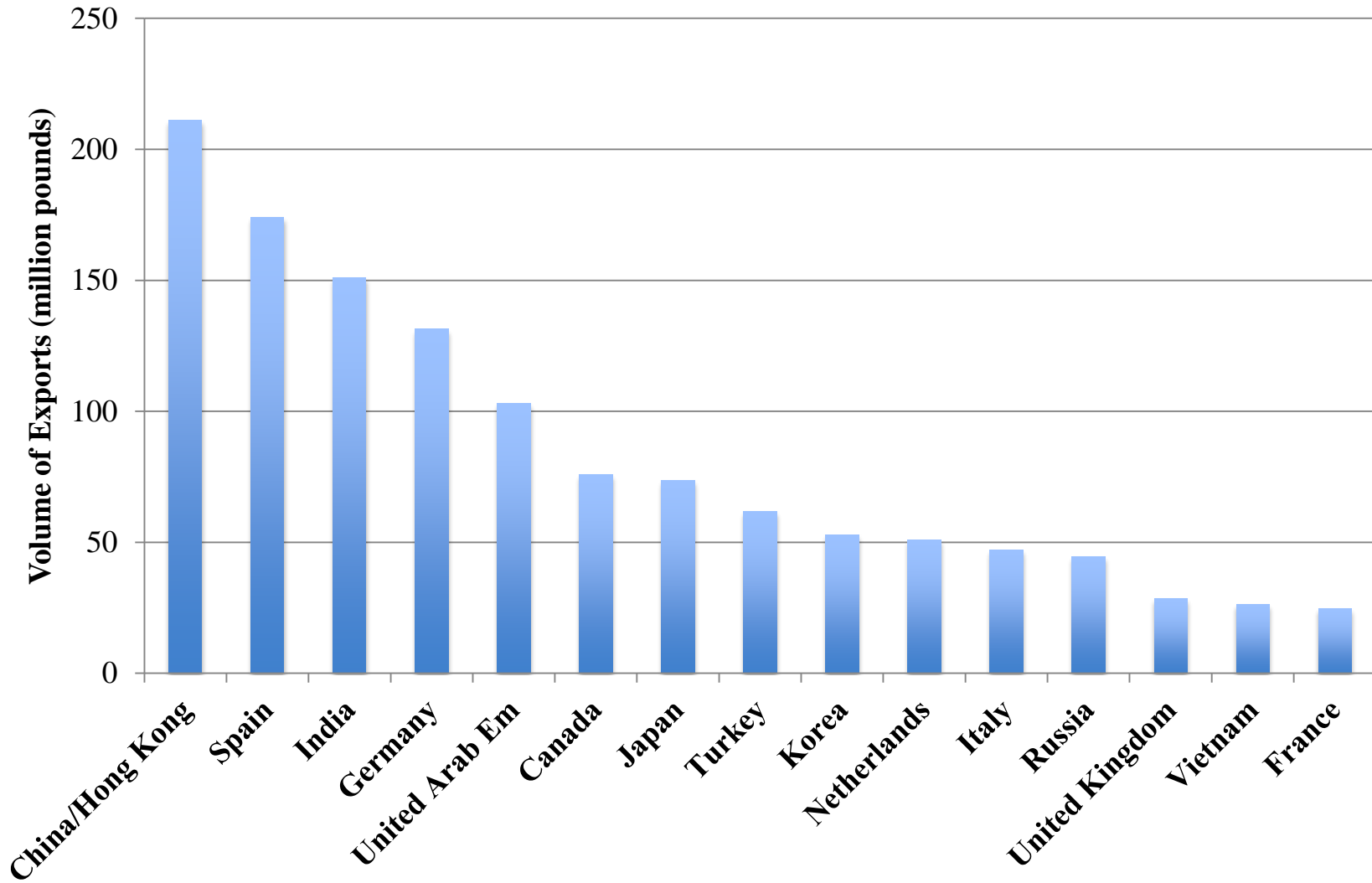
Source: USDA Historical Data – Almonds. NASS QuickStats.

Figure 2.4: Volume U.S. Almonds Exported, Crop Year 1965-2013



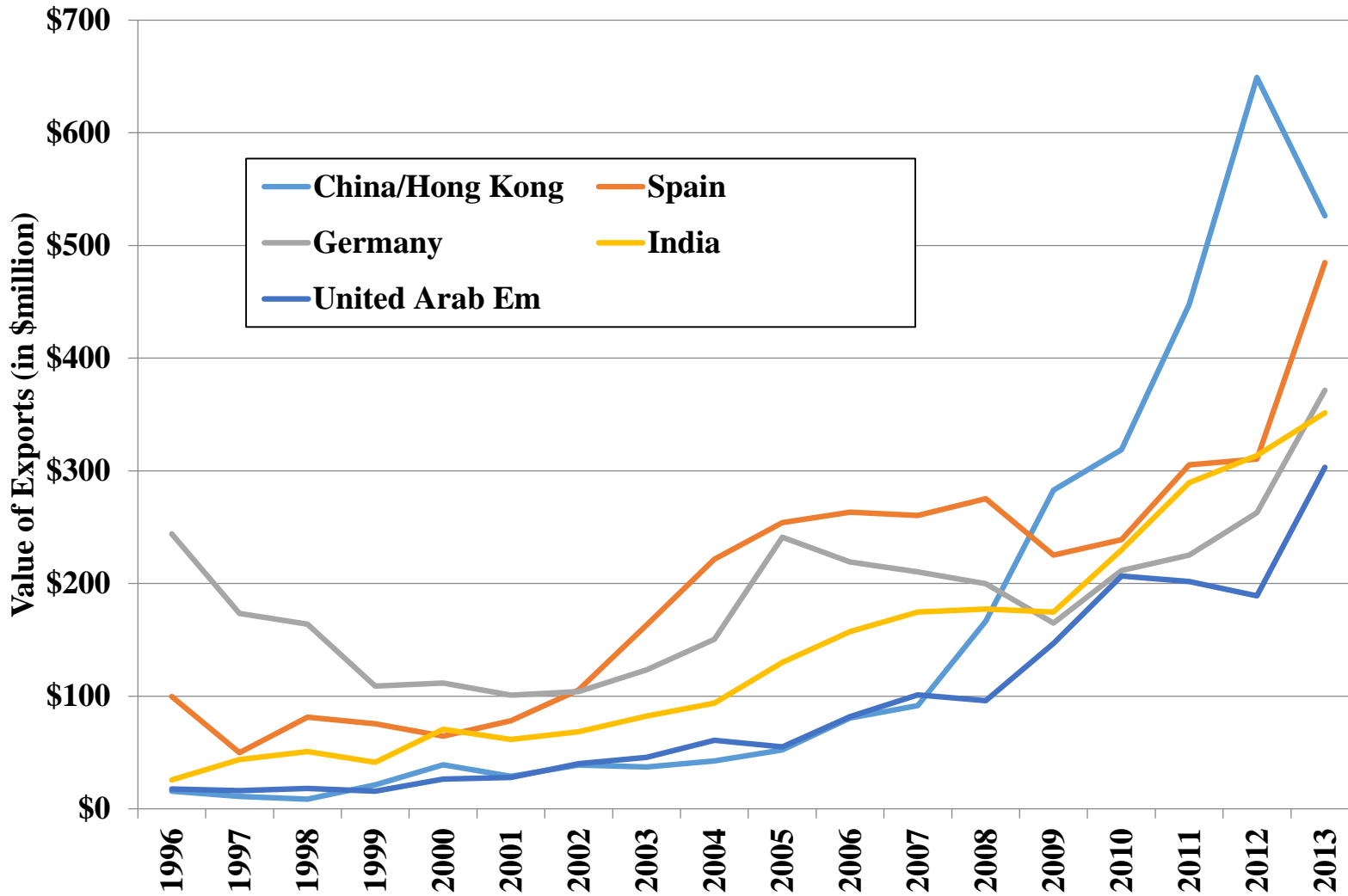
Source: USDA Economic Research Service: Tree Nut Yearbook

Figure 2.5: California Almond Exports to Top 15 Destinations, Calendar Year 2013



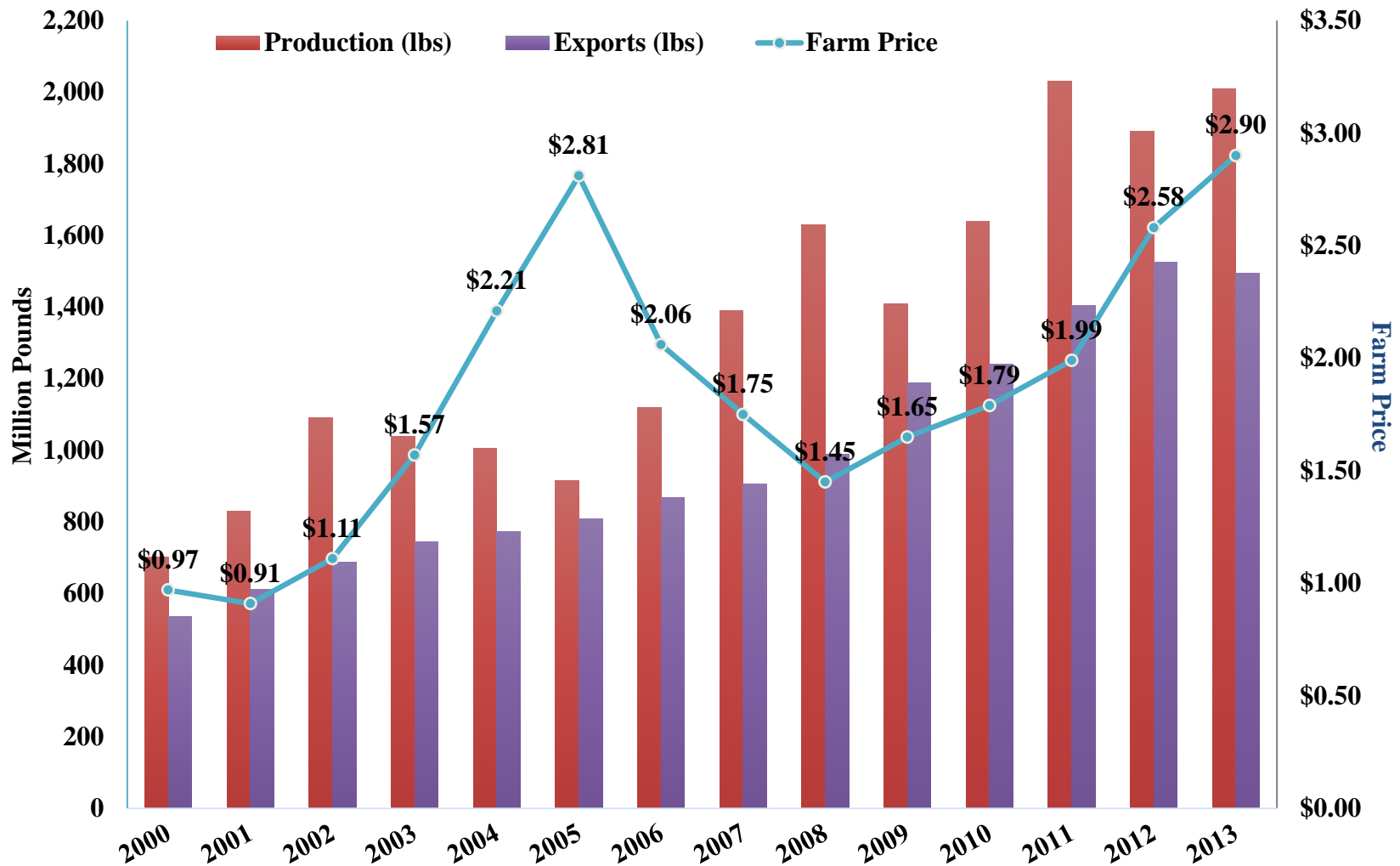
Source: US Census Bureau via USITC Dataweb

Figure 2.6: Export Growth in Top Destinations for California Almonds, Calendar Year 1996-2013



Source: US Census Bureau via USITC Dataweb

Figure 2.7: California Almond Production, Export Volume and Farm Price Calendar Year (2000-2013)



Source: NASS Historical Data, NASS QuickStats, U.S. International Trade Commission

**Table 2.1: California Almond Huller-Shellers,
Calendar Year 2013**

Operation Volume (lbs.)	Number of Operations
> 18 million	27
12-18 million	12
8-12 million	11
2-8 million	23
<2 million	20
Total	93

Source: Almond Hullers and Processors Association

Table 2.2: Distribution of Crop by Handler Size, 2013/14

Volume Handled	Number of Handlers	Percentage of Crop Handled
<1 M	28	<1%
1-24 MIL	53	23%
25-49 MIL	13	23%
50-74 MIL	6	17%
>75 MIL	5	36%

Source: Almond Board of California

3. Concluding Remarks

The California almond industry is large, complex and has experienced rapid growth. We have shown that all segments of the almond industry make major contributions to the California economy. This report describes and measures the economic linkages, contributions and impacts of the almond industry and provides background and related information to help interpret our quantitative measurements of impacts.

The flow chart in Chapter 1 shows the stages from almond production on farms, through almond hulling and shelling, almond handling and initial processing, and finally to almond manufacturing. These stages lead to the retail sales of almonds and sales to domestic food processors or exports. The IMPLAN input-output model and dataset and data from surveys of the industry allow us to specify linkages (indirect effects) from each segment of the almond industry to associated input industries. We also trace the economic impacts of income earned in the almond industry (induced effects) as added consumption ripples through the economy.

We find that in addition to billions of dollars of direct value of output and value added and thousands of direct employees, the almond industry contributes additional billions of dollars and thousands of jobs to the economy through these indirect and induced impacts. For the 2014 almond crop the industry will contribute about \$11 billion of value added to the California gross state product (the measure of the size of the California economy) and about 104,000 jobs statewide, three quarters of which are outside the almond industry.

We also calculate that the almond industry is especially important to jobs in the Central Valley of California where almond production and processing are located. The almond industry

contributed about 97,000 jobs to the Central Valley economy. These jobs are vital in a region that has long had high unemployment.

We have not quantified all the economic contributions of the California almond industry. We have not assessed the value of the almond industry's leadership in sustainability programs, the development of honey bee best management practices, or the benefits to consumers of a healthy source of nutrition. These topics are all amenable to economic analysis but will require research beyond the scope of the current project.