

Contributions of the U.S. Honey Industry to the U.S. Economy

A Report Funded by and Prepared for the National Honey Board



Photo Source: National Honey Board

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Contributions of the U.S. Honey Industry to the U.S. Economy
Report for the National Honey Board
Executive Summary

The people of the United States consumed 596 million pounds of honey in 2017 or about 1.82 pounds of honey per capita (Table ES.1). We estimate that about half of total consumption is through manufactured food products that contain honey as an ingredient, such as bread and cookies, with the other half consumed as retail packaged honey. U.S. beekeepers produced 148 million pounds honey from about 2.7 million bee colonies at a yield of 55.3 pounds per hive. US production equals about a quarter of total US honey supply in 2017 with the remaining 75 percent, or 448 million pounds imported from foreign suppliers.

The United States honey industry is an integral part of agriculture across the country. Unlike production of many agricultural commodities, which may be isolated to one state or one region of the country, commercial honey bee colonies reside in each of the 50 states. Over the last decade demand for honey in the U.S. has quickly outpaced U.S. production resulting in the large imports of honey. To meet U.S. demand for honey the honey industry relies on production of U.S. beekeepers, the services of U.S. based honey importers and honey packers to further process and package honey for U.S. consumers.

In this report we use well-established methods to document linkages from beekeeping/honey production, honey packers and U.S. honey importers to the rest of the U.S. economy and measure how beekeeping, honey importing, and honey packing contribute to income and jobs throughout the U.S. economy. In 2017, U.S. honey production, importing and honey packing contributed about \$4.7 billion in total sales. Of this, \$318 million were from sales of honey from beekeepers to honey packers, \$57 million were services provided by honey

importers, about \$1.6 billion were from sales of honey packers and the rest were sales from associated industries. Being careful to remove any double counting of economic activity, the honey industry contributed \$2.1 billion in value added to the gross domestic product (GDP) in 2017. Of this, about \$169 million were from value added by beekeepers, \$38 million were value added from honey importers, and \$511 million were value added directly from honey packers and the rest were value added in associated industries and activities. About 22,000 jobs in the U.S. were dependent on the U.S. production, importing and packing of honey. Of these, about 13,639 jobs were direct hires by beekeepers, honey importers, and honey packers with the rest coming from associated industries and activities.

The economic contributions of the honey industry begin with labor and inputs to beekeepers. U.S. beekeepers hire workers and buy inputs, including bee feed and health products, hive materials, and services from other industries. These input purchases create indirect economic activity that would not occur in the U.S. without the demand from beekeepers. Likewise, honey importers and honey packers purchase inputs and hire labor in order to accomplish their tasks associated with bringing honey to U.S. consumers and further link the honey industry to the U.S. economy. In addition to these indirect impacts through purchased inputs, income earned by labor hired directly by beekeepers, honey importers, and honey packers and those employed by suppliers of inputs to the honey industry generate consumption of goods and services throughout the economy, which in turn induces more jobs and more income for those outside the honey industry. These induced effects spread the impact of the honey industry throughout the U.S. into all industries and to workers in every occupation.

We have quantified the myriad impacts using honey-specific data for 2017 and a database and model of economic linkages (IMPLAN). The method traces quantitatively the direct

employment, incomes and value added in beekeeping, honey importing and honey packing back through the economy to measure the size of the overall impact.

Table ES.2 shows that in 2017 U.S. honey sales from beekeepers were about \$318 million, sales of honey importing services were about \$57 million, and sales (wholesale) of packaged honey from honey packers were about \$1.58 billion. The sum of the U.S. value of output attributable to honey production, importing and processing was about \$4.74 billion. This figure adds the output value of beekeeper honey production, import services and packaged honey products and other outputs involved in the production and marketing of honey throughout the marketing chain. In that sense, the value of some honey may be counted more than once as it moves through the marketing chain.

Table ES.2 also shows that the U.S. GDP attributable to the U.S. honey industry was \$2.087 billion in 2017. This total is listed in the honey packing column to reflect the full value added of the industry, including the beekeeping sector, honey import sector all the way through the honey packer sector. Value added is the contribution of honey production, honey importing and honey packing to the national economy calculated to remove double counting of the same output in more than one sector and of intermediate inputs such as bee feed to beekeepers or beekeeper-honey to honey packers. The calculation attributes to each sector the amount of economic value that sector adds to the intermediate inputs in purchases. This is the amount that the honey industry added to the U.S. economy. Of the \$2.087 billion in honey industry value added, about \$587 million were generated as income to workers and owners within the honey industry. Another \$1.135 billion in value added were from indirect and induced labor income.

Table ES.2 also shows a total of 22,084 jobs were the outgrowth of the demand for honey in the U.S. in 2017. About 7,642 of these jobs were in beekeeping and another 4,624 were hired

in the honey packing sector. Honey importing provided an additional 236 direct jobs to the U.S. economy. Another 8,445 jobs were created in other industries through indirect and induced impacts.

Much of the increase in honey consumption in the US over the past decade comes from increased use of honey as an ingredient in manufactured food products. We estimate that honey is a major ingredient for about 0.4% of all manufactured products in the US. Also, the manufacture of these products supply jobs and economic output to the US economy. We estimate that honey-based manufactured products had a direct output of \$737 million in 2017. When including indirect and induced effects total output to the US economy was \$2.16 billion (Table ES.3). Direct value added from honey-based manufactured products is estimated at \$277 million with total value added to the US economy equaling \$939 million. In addition, the manufacture of honey-based food products supported 7,968 jobs in the US economy with 2,192 of these jobs being direct food-manufacturing jobs (Table ES.3).

Table ES.1 Core Facts About the US Honey Industry in 2017

US Honey Fact	Value
US Honey Production	
Number of honey-producing hives (million)	2.699
Total pounds of honey produced (million lbs.)	147.64
Pounds of honey produced per hive	55.3
US Honey Trade Volumes (million lbs.)	
Pounds of organic honey imported to US	62.84
Pounds of non-organic honey imported to US	384.67
Total pounds of honey imported to US	447.51
Total pounds of US honey exported	9.9
US Honey Consumption	
Total pounds of honey consumed* (million lbs.)	596
Population of US (millions)	327
Pounds of honey per capita in US	1.82

Source: Honey production data comes from USDA NASS Annual Honey Report. Honey trade data comes from U.S. International Trade Commission. Honey consumption data comes from USDA ERS Sugar and Sweeteners Outlook.

*Total pounds of honey consumed in U.S. in 2017 is calculated as follows. (U.S. production + U.S. imports + 2016 ending stocks) - (U.S. exports + 2017 ending stocks)

Table ES.2: Contributions of Honey Production, Processing and Importing to the U.S. Economy

	<i>Beekeeping</i>	<i>Honey Importing</i>	<i>Honey Packing</i>	<i>Total Honey</i>
U.S. Honey Industry Sales				
Direct (millions)	\$318	\$57	\$1,583	\$1,958
Full effect (Millions)	\$887	\$133	\$4,742	
Contributions of U.S. Honey to Value Added (U.S. GDP)				
Direct (millions)	\$169	\$38	\$511	\$844
Full Effect (millions)	\$448	\$81	\$2,087*	
Contributions of U.S. Honey to Employment				
Direct	7,642	236	4,624	13,639
Full Effect	10,750	688	22,084*	

Source: Data comes from authors' calculations using industry supplied data and the IMPLAN database.

Table ES.3: Contributions of Honey-Based Manufactured Food Products to the U.S. Economy

<i>Economic Impact</i>	
Honey-Based Manufactured Food Product Sales	
Direct (millions)	\$737
Full effect (millions)	\$2,160
Contributions of Honey-Based Manufactured Food Products to Value Added (U.S. GDP)	
Direct (millions)	\$277
Full Effect (millions)	\$939
Contributions of U.S. Honey to Employment	
Direct	2,192
Full Effect	7,968

Source: Data comes from authors' calculations using industry supplied data and the IMPLAN database.

Introduction

After briefly describing recent economic patterns and trends of the U.S. honey industry, this report turns to describing the linkages between the U.S. honey industry and the rest of the national economy. We summarize these linkages by highlighting the number of jobs in the U.S. that are tied to honey production, importing and packing and how much the industry contributes the U.S. GDP.

Section 1 provides the background and context with a series of charts and tables. It then discusses the methodology we use to measure linkages. Section 2 provides detailed data on sales, jobs and value added of the U.S. honey industry.

Section 1. Background, Context and Methods for Determining the Economic Contributions of the U.S. Honey and Beekeeping Industry

1.1 Economic Background and Context of U.S. Beekeeping and Honey Production

1.1.1 Honey Bee Colonies in the United States

Every state in the U.S. contains commercial bee keepers who manage 5 or more colonies (USDA NASS 2018). In total, during the three-year period of 2015, 2016 and 2017, the total number of commercial honey bee colonies in the United States fluctuated annually between about 2.6 million and 3.2 million depending on the time of year (Table 1.1). The highest average number of honey bee colonies in the US from 2015 to 2017 occurs during the third quarter starting July 1 and going through September 30 when about 3.1 million colonies are active in the US. This number declines to just over 2.7 million at the start of the calendar year (Table 1.1). On average, when considering the highest volume of total bee colonies during the year, about 87 percent of the total colonies are producing harvested honey. In 2017 the highest volume of bee colonies was estimated at just under 3 million and about 2.7 million hives produced harvested honey.

When examining the average maximum number of bee colonies per quarter in each of the top ten honey producing states, the movement of bee colonies around the country becomes apparent (Table 1.2). The highest concentration of bee colonies occurs in California during the first quarter of the calendar year, which coincides with the pollination of California's 1.2 million acres of almond trees. On average about half of all bee colonies in the US, or over 1.5 million, are found in California during this time. Bee colony populations in California drop below 1 million during the summer months of July to September. Still, on average, only about 300,000, about 20 percent of California located colonies produced harvested honey from 2015 through

2017. In contrast, over 90 percent of the maximum number of bee colonies found in North Dakota produced harvested honey annually and 128 percent of the maximum number of bee colonies in South Dakota produced harvested honey (Table 1.2). This demonstrates the complex management of bee colonies in the US and the extensive movement of colonies throughout the country.

When considering only bee colonies from which honey was harvested during the year the estimates fall between 2.6 million and 2.8 million colonies for 2015, 2016 and 2017. During the 10-year period between 2007 and 2017 the number of honey-producing colonies in the U.S. trended upwards (Figure 1.1). This increase occurred despite negative pressure on bee populations from issues such as colony collapse disorder, use of pesticides in agricultural production, or increased prevalence of certain bee diseases and predatory pests. Given the overall 10-year upward trend, there were substantial changes in honey producing colony numbers from year to year. The largest spikes in bee colony numbers occurred between 2009 and 2011: in 2009, the number of colonies was about 2.5 million, which increased to about 2.7 million in 2010, before falling to about 2.5 million once again in 2011. Notwithstanding the year-to-year peaks and troughs in colony numbers, the total number of bee colonies from which honey is harvested in the US has increased by about 10 percent since 2007.

Although USDA lists bee colonies in all 50 states, the distribution of bee colonies between the United States is complex. As stated previously, beekeepers continually move their colonies all over the country to provide pollination services, track forage to cut down on supplemental feeding costs and provide colonies with pest and disease treatments when necessary (Goodrich B. 2018, Lee et. al 2018, Lee et. al 2017).

It is common for bee colonies to move around the country in various patterns, with common stops for summer feeding in the Dakotas, Montana, and Minnesota. Based on observed transportation routes, it is possible that a colony provides pollination services in Florida, Maine, Michigan, Washington, Oregon, California, and Texas, along with feeding stops in the summer, all within one year (Figure 1.2). While operations may have one location where colonies return to for forage or winter hibernation, it is likely that beekeepers locate colonies in many different states throughout the year, for at least some amount of time.

The more than 20,000 beekeepers in the U.S. differ in how they operate, but a typical migratory pattern might go as follows: The beekeeping year begins in January waiting for almonds to bloom in California. Once almond bloom is over, the beekeeper moves colonies up through the Pacific Northwest pollinating apples and other spring-blooming crops. In May, the beekeeper takes the colonies to North Dakota to produce honey from clover, canola and sunflowers (Goodrich B. 2018, Lee et. al 2018, Lee et. al 2017).

When looking at colonies from which honey was harvested the highest concentrations are in the Dakotas with North Dakota having the greater share. On average about 28 percent of colonies in the US from which honey was harvested were in North and South Dakota annually. Overall, the top seven states for bee colonies remain the same between 2007 and 2017, with the majority of these states seeing an increase in colony numbers or only a slight decrease (Figure 1.3).

1.1.2 Revenue Generation for U.S. Beekeepers and the U.S. Honey Market

Beekeeping operations receive income from three main sources: honey sales, pollination services, and the sale of other apiary products such as beeswax, nucs, and queens. Honey sales are the most public face of beekeeping, given that honey is a product directly marketed to

consumers, but pollination services are as important if not more so in generating revenue. In 2015 and 2016, both honey sales and pollination services generated between \$330 million and \$340 million for U.S. beekeepers, while in 2017 pollination services generated about \$435 million (Figure 1.4). Over the three-year period of 2015, 2016 and 2017 pollination services accounted for 43 percent of total revenues generated for US beekeepers while honey sales generated 38 percent of revenues (Figure 1.5).

Demand for honey in the U.S. obviously has a major impact on beekeeper revenue. Overall honey consumption in the United States has trended upwards over the past twenty years, with most of the growth in consumption occurring in the past decade (Figure 1.6). Between 1997 and 2009, honey consumption levels fluctuated between a low of 325 million pounds and a high of 425 million pounds, with a yearly average of about 370 million pounds.

Over this period, U.S. honey consumption increased about 20 percent, which in large part can be attributed to the growth in US population. In contrast, from 2009 to 2017 honey consumption increased about 65 percent, far outpacing population growth and signaling a growth in per capita consumption of honey (Figure 1.7). Overall, despite a slight fall between 2014 and 2016, about 65 percent more honey was consumed in the U.S. in 2017 than in 1997.

The increase in per capita honey consumption may, in part, be a response from consumers wanting to switch to a healthier sweetener option. When comparing deliveries of honey for food and beverage use in the U.S. with other sweeteners the increase in per capita use of honey coincides with a decrease in consumption of corn sweetener (Figure 1.7 and Table 1.3). From 1997 to 2009 deliveries of honey fluctuated from year to year but the overall trend was flat. Since 2009 honey deliveries have increased steadily resulting in 2017 deliveries being over 65

percent greater per capita. Meanwhile, corn sweetener deliveries, although still high in volume, have declined over 30 percent since the early 2000's.

Despite honey consumption increasing over the past decade, honey production in the US has not followed suit (Figure 1.8 and Table 1.4). Over the same time period production of honey does not appear to have followed any particular trend. Spikes in production occur in 2008, 2010, and 2014, but these are countered with declines in 2009, 2012 and 2017. As a result, volume of honey production in 2017 is at the same level as in 2007. Since the period also saw an increase in the number of colonies in the US, as discussed earlier, honey yield per colony has fallen. Though the spikes in honey production also correspond to spikes in yield per colony, yield has trended downward while production has stayed constant. The decline in honey yield per colony over the past decade can be explained, in part, by a shift amongst beekeepers away from focusing on honey production as a primary source of revenue and more toward pollination services as their main business (Lee et. al 2018, Lee et. al 2017).

The stagnation in US honey production means the increase in consumption has been met through increased U.S. honey imports. The result is that although the US does export some honey (Figure 1.9 and Table 1.5) the country is a large net importer of honey products (Figure 1.10). During the late 1990s and into the early 2000s U.S. honey production kept ahead of honey imports. Starting in 2002, with the exception of 2004, honey imports outpaced domestic production at an increasing rate. In 2017, imports of honey were three times the level of US production, with US production at about 150 million pounds and imports at 450 million pounds (Figure 1.10).

Argentina has traditionally been an important source of US honey imports, providing over 20 percent of the US supply in 2012. Over the past decade, India and Vietnam have

increased shipments of honey to the US, with both countries surpassing Argentina in 2017. India represents about 17 percent of US supply, with Vietnam and Argentina both making up about 13 percent of supply. In general, imports of honey come primarily from Asia and South America, with Canada also being a consistent source of honey shipments (Table 1.6).

A small but growing segment of honey imports is organic honey (Figure 1.11). In 2012 organic honey accounted for 2.3 percent of the total volume of honey imported into the U.S. By 2017 this share had grown to 14 percent of honey import volume. The largest supplier of organic honey to the U.S. is Brazil which accounts for 75 to 95 percent of organic honey imports annually since 2012. Overall, honey imports have gone from 60 percent of U.S. supply in 2007 to 75 percent of supply in 2017. As mentioned previously, this is due to a substantial increase in consumption alongside an unchanging level of domestic production.

The increase in honey consumption coincides with steady increases in retail and wholesale honey prices (Figure 1.12). When adjusted for inflation retail honey prices rose steadily from about \$4.50 per pound in early 2008 to about \$6.70 per pound at the end of 2017. This is a 49 percent increase in per unit retail price. In the US, there is a consistent difference between the retail and wholesale prices of honey, suggesting that processing and distribution costs have remained constant over time. The price of imported honey is far below the wholesale price of US honey and has had a much more gradual increase in price, before falling over the course of 2015 and 2016.

1.2 Modeling and Measuring the Economic Linkages and Contribution

Figure 1.13 is a flow chart that describes the ways in which U.S. beekeepers and honey processors are linked to the broader economy. Also included are the linkages for U.S.

beekeepers in providing pollination services and other byproducts from beekeeping.

Beekeeping operations interact directly with the US economy through the jobs they provide and the inputs they purchase from complementary suppliers. The largest expense for beekeepers in the United States is labor but they also purchase hive materials, feed and bee health supplies and inputs from other industries within the U.S. (Figure 1.14) The honey produced by U.S. beekeepers and imported honey are the largest input expense for U.S. honey packing plants (Figure 1.15). Those plants also use labor and purchase a variety of other inputs and capital goods to make honey products that are then sold in the United States.

Not apparent in Figure 1.13 are U.S. economic impacts induced by income spent or saved by beekeepers and their workers or by the input providers and their workers who support the U.S. beekeeping industry and earn their living through jobs linked to beekeeping and honey production.

Our approach to tracing economic linkage and contributions uses an input-output model. Input-output models link the magnitude of changes in an industry to the associated changes in all the other industries and segments throughout the economy. An expansion in the demand for honey produced and processed in the U.S. causes more employment and other economic activity for beekeepers and honey processing plants. But that additional production and processing causes increased demand for materials and services supplied by firms from outside the honey industry, such as bee feed, bee health and accounting services; supplies used by the apiary; and electricity, packaging, equipment and trucking used by processors. Moreover, income generated by this honey-induced economic expansion will be spent on other services, from groceries and new cars to schoolteachers and bus drivers. Input-output models and the associated data on

economic linkages in the economy allow us to quantify these impacts using recent spending and employment patterns, without double counting or leaving out impacts.

We use the IMPLAN model and database for 2016. These data have a complete set of purchase flows among industries and sectors of the economy. We are able to construct specific sectors within the model that represent beekeeping, honey packing and honey importing using data provided by industry participants. The construction of these sectors uses pre-existing sectors within IMPLAN. For beekeeping we use a sector associated with farm production of animal products other than cattle and poultry, for honey packing the sector identified with food manufacturing is used and for honey importing the sector associated with wholesale supply of farm commodities. For each of the honey industry segments the associated IMPLAN sector was modified using industry participant data. This allowed the IMPLAN model to better fit the realities of the U.S. honey industry and its interaction with the rest of the economy. The specific measures examined using the IMPLAN input-output model are explained in Box 1.1.

Table 1.1: Total Number of Bee Colonies in the U.S. at the Start of Each Quarter, 2015-2017

Year	January 1 Colonies	April 1 Colonies	July 1 Colonies	October 1 Colonies	Number of Honey Producing Colonies ¹
<i>million colonies</i>					
2015	2.825	2.850	3.133	2.875	2.660
2016	2.620	2.801	3.181	3.032	2.775
2017	2.694	2.641	2.995	2.850	2.669
Average 2015-2017	2.713	2.764	3.103	2.919	2.701

Source: Number of bee colonies per quarter comes from USDA NASS Bee Colonies Report. Number of honey-producing bee colonies per year comes from USDA NASS Honey Report.

¹Honey producing colonies are the maximum number of colonies from which honey was harvested during the year.

Table 1.2: Average Maximum Number of Bee Colonies per Quarter and Number of Honey Producing Colonies for Top Ten Honey Producing States, 2015-2017¹

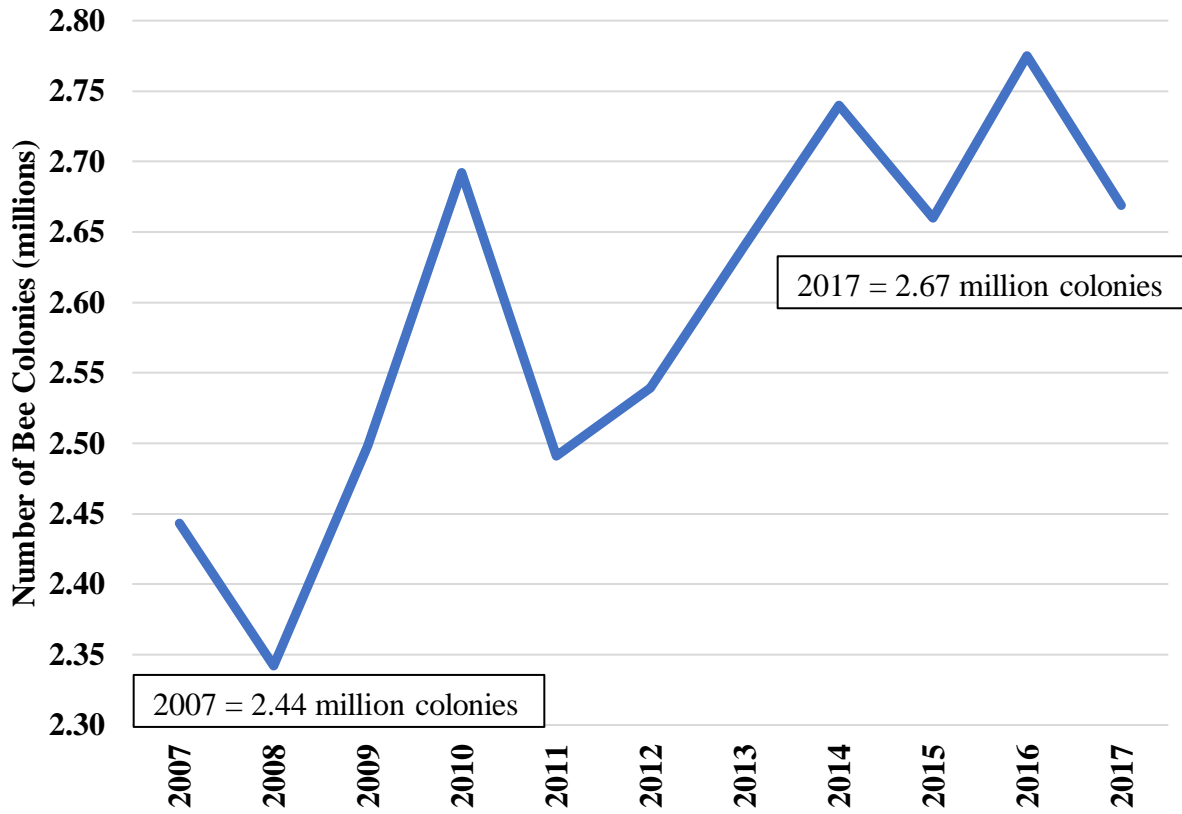
State	Jan-March Colonies	April-June Colonies	July-Sept Colonies	Oct-Dec Colonies	Number of Honey Producing Colonies ²	Share of Honey Producing to Maximum Number of Colonies
<i>1,000 colonies</i>						
California	1,528	1,095	763	1,263	307	0.20
North Dakota	120	465	513	358	477	0.93
Texas	300	331	131	282	126	0.38
Florida	283	248	207	267	213	0.76
South Dakota	63	200	215	154	275	1.28
Montana	52	168	158	123	150	0.89
Idaho	113	81	125	151	94	0.62
Minnesota	54	122	137	106	124	0.91
Georgia	117	127	112	126	88	0.70
Michigan	49	90	102	87	89	0.87

Source: Maximum number of bee colonies per quarter comes from USDA NASS Bee Colonies Report. Number of honey-producing bee colonies per year comes from USDA NASS Honey Report.

¹ Maximum number of colonies is the number of colonies at the start of each quarter plus all the colonies moved into that state during the quarter.

² Honey producing colonies are the maximum number of colonies from which honey was harvested during the year in that state. Colonies that produced honey in more than one state were counted in each state.

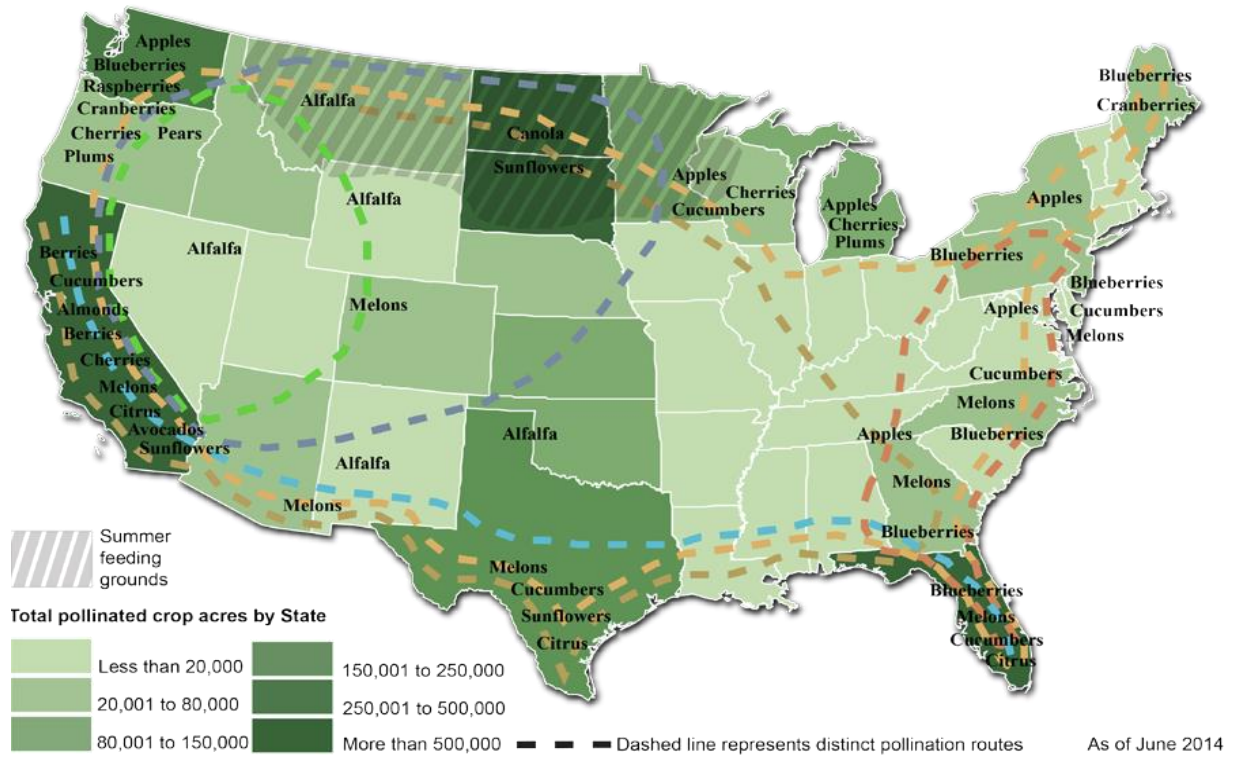
Figure 1.1: Annual Number of Honey Producing Bee Colonies in the United States, 2007-2017



Source: USDA NASS

Note: Only colonies from which honey was harvested are included in this graph.

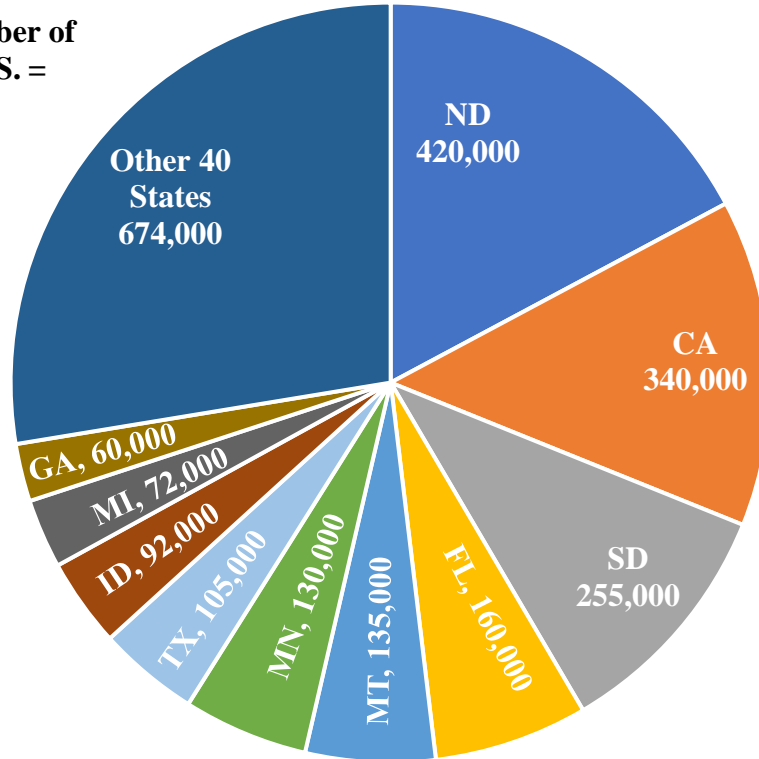
Figure 1.2: Commercial Bee Movements and Crops in the United States



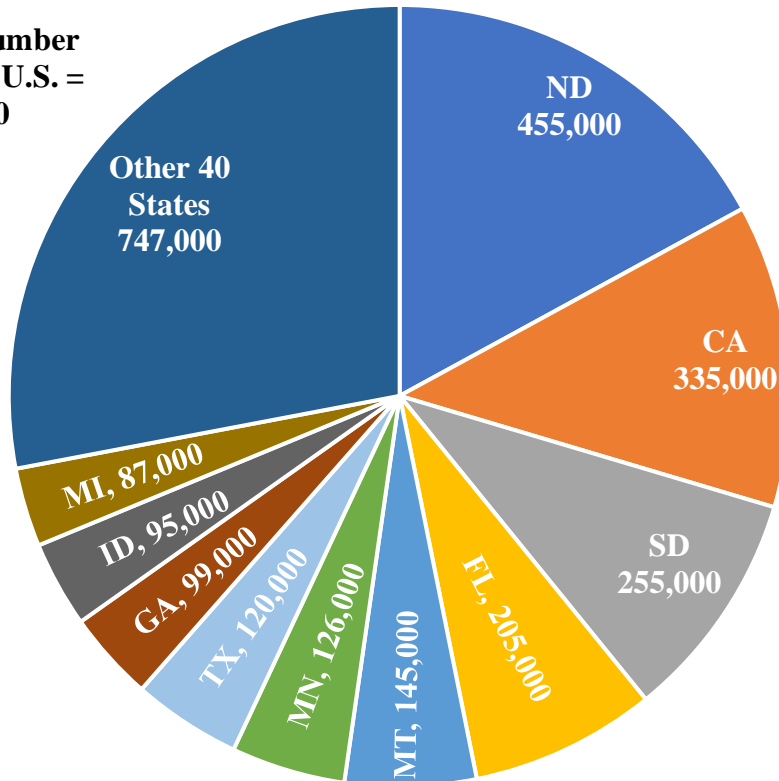
Source: USDA ERS 2014, page 3.

Figure 1.3: Number of Honey Producing Bee Colonies Per State, 2007 and 2017

2007 Total Number of Colonies in U.S. = 2,443,000



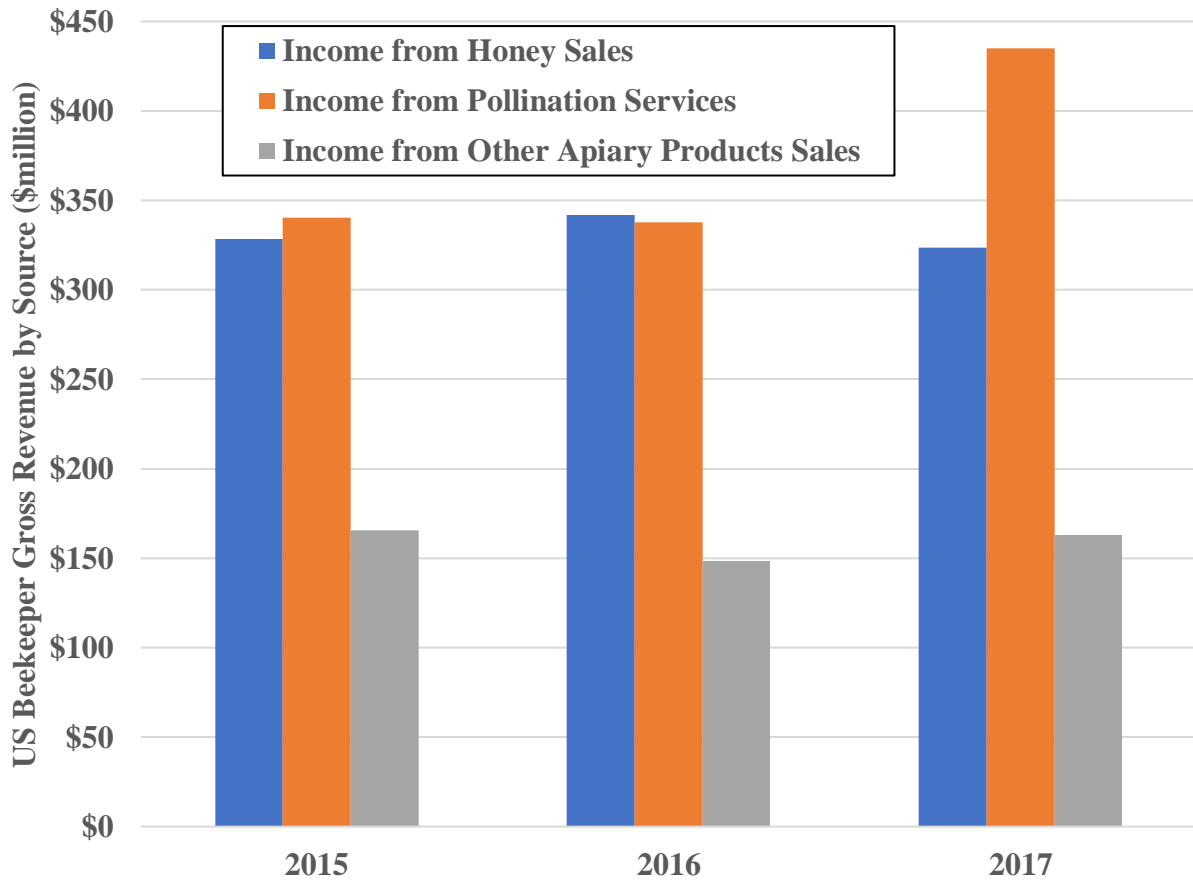
2017 Total Number of Colonies in U.S. = 2,669,000



Source: USDA NASS

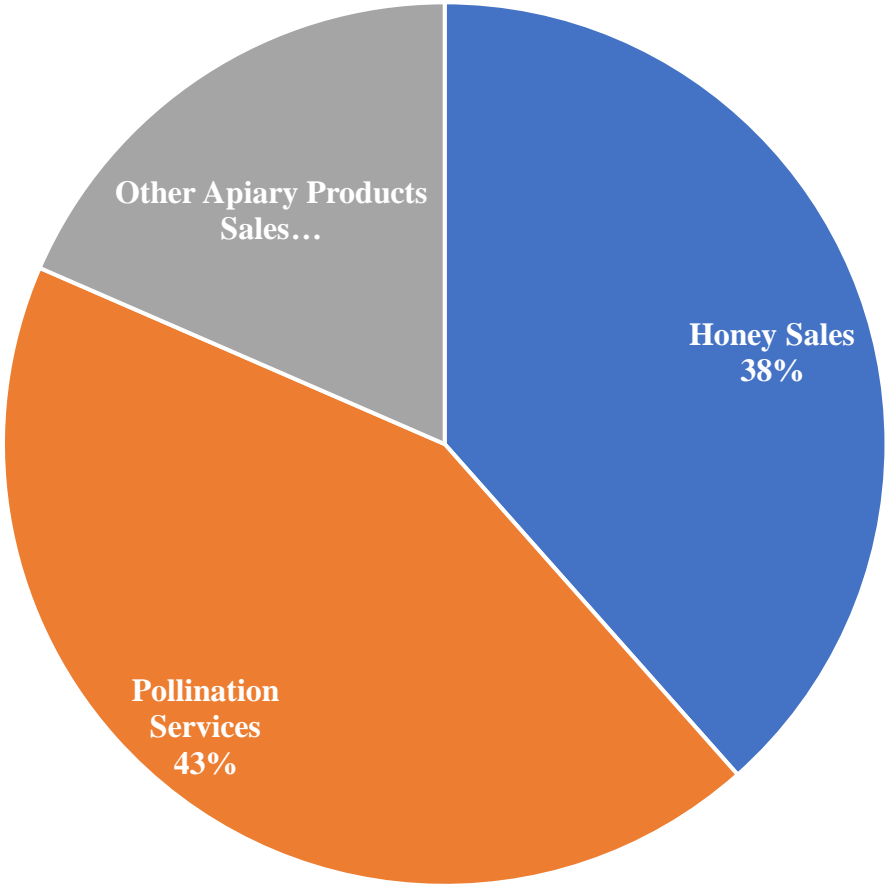
Note: Only colonies from which honey was harvested are included in these graphs.

Figure 1.4: Annual US Beekeeping Revenues Generated by Source, 2015-2017



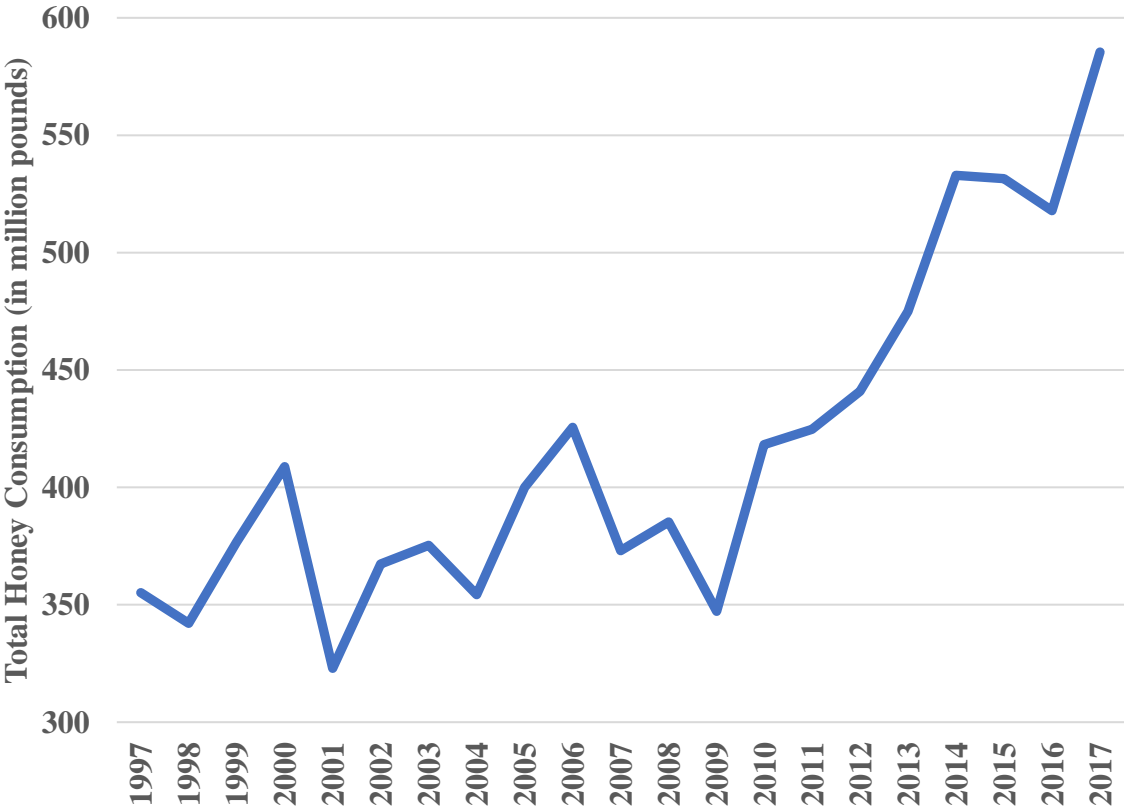
Source: USDA NASS Annual Honey Report

Figure 1.5: Average Share of Annual Revenue Generated for Beekeepers by Source, 2015-2017



Source: USDA NASS Annual Honey Report

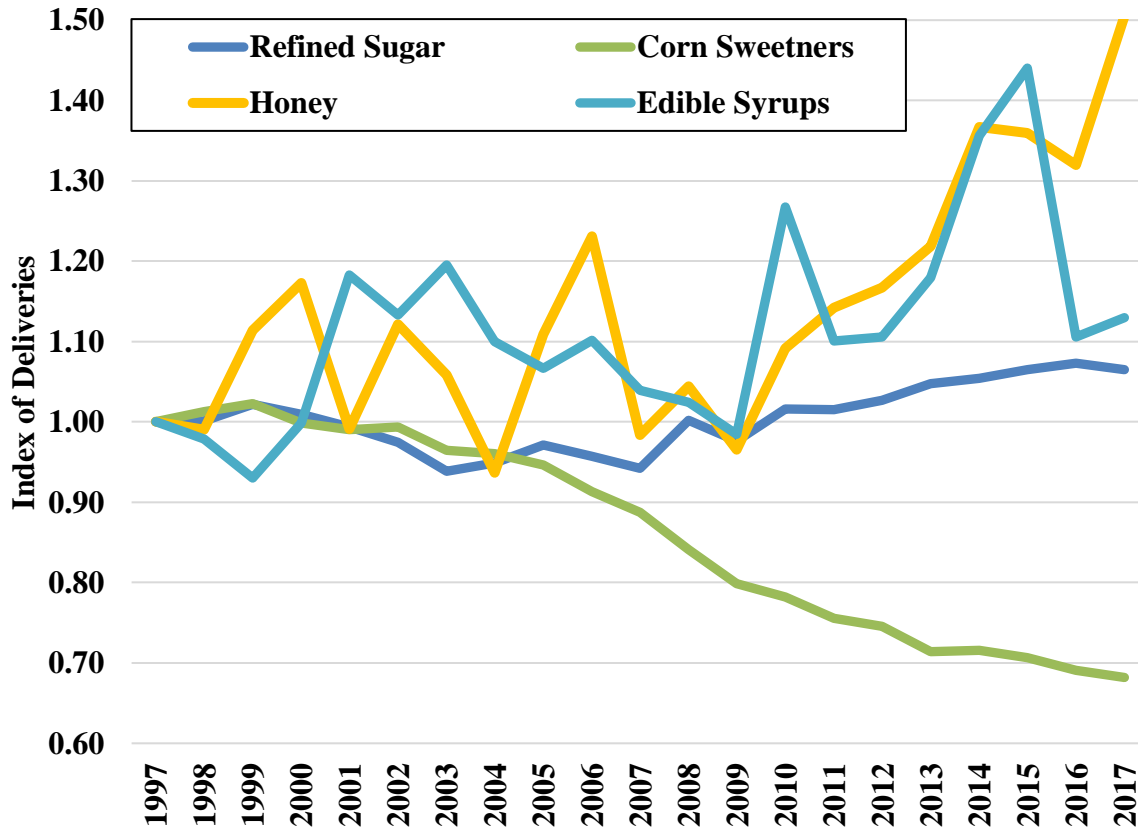
Figure 1.6: Total Annual US Honey Consumption¹, 1997-2017



Source: USDA ERS Sugar and Sweeteners Yearbook

¹Total honey consumption = honey production + honey imports - honey exports.

Figure 1.7: Comparison of Changes in Annual Per Capita U.S. Sweetener Deliveries for U.S. Food and Beverage Use by Product, 1997-2017



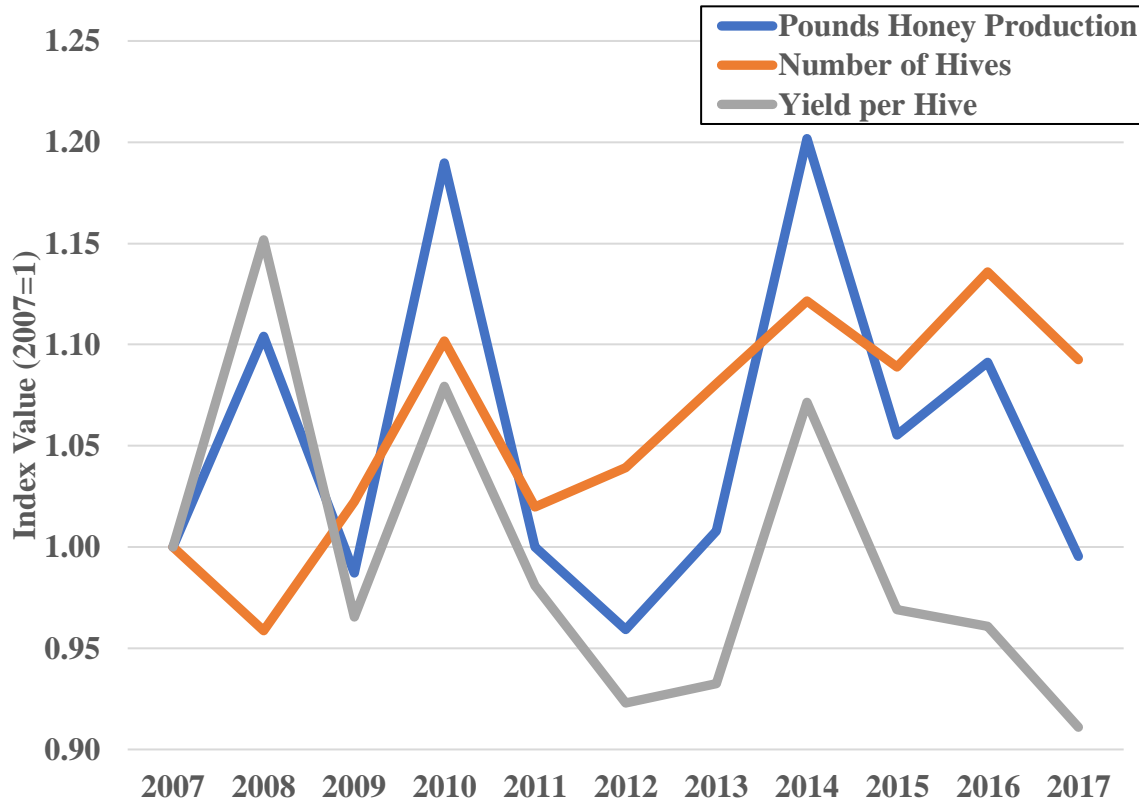
Source: USDA ERS, Sugar and Sweeteners Outlook

Table 1.3 Annual Per Capita Deliveries of Sweeteners for U.S. Food and Beverage Use by Product in 1997, 2007 and 2017

	1997	2007	2017
		<i>Lbs. per year</i>	
Refined Sugar	64.94	61.19	69.17
Corn Sweetener	81.80	72.57	55.78
Honey	0.95	0.93	1.43
Edible Syrups	0.60	0.62	0.68

Source: USDA ERS, Sugar and Sweeteners Outlook

Figure 1.8: Index of Annual U.S. Honey Production, Number of Colonies and Yield per Hive, 2007-2017



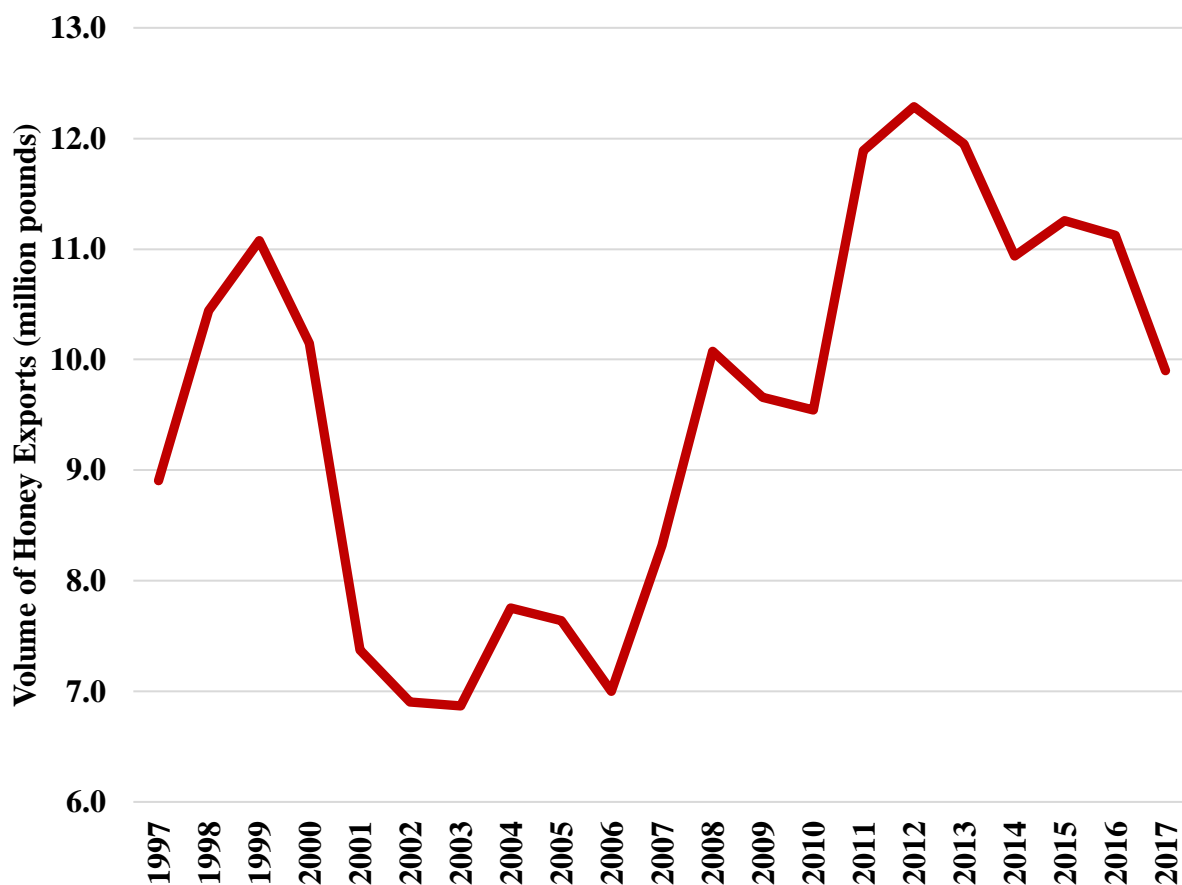
Source: USDA NASS Annual Honey Report

Table 1.4: Annual Honey Production, Number of Colonies and Yield per Colony for 2007, 2012 and 2017

	2007	2012	2017
Honey Production (million lbs.)	148.3	142.3	147.6
Number of Hives (1,000)	2,443	2,539	2,669
Yield (lbs./colony)	60.7	56.0	55.3

Source: USDA NASS Annual Honey Report

Figure 1.9: Total Volume of U.S. Honey Exports, 1997-2017



Source: U.S. International Trade Commission

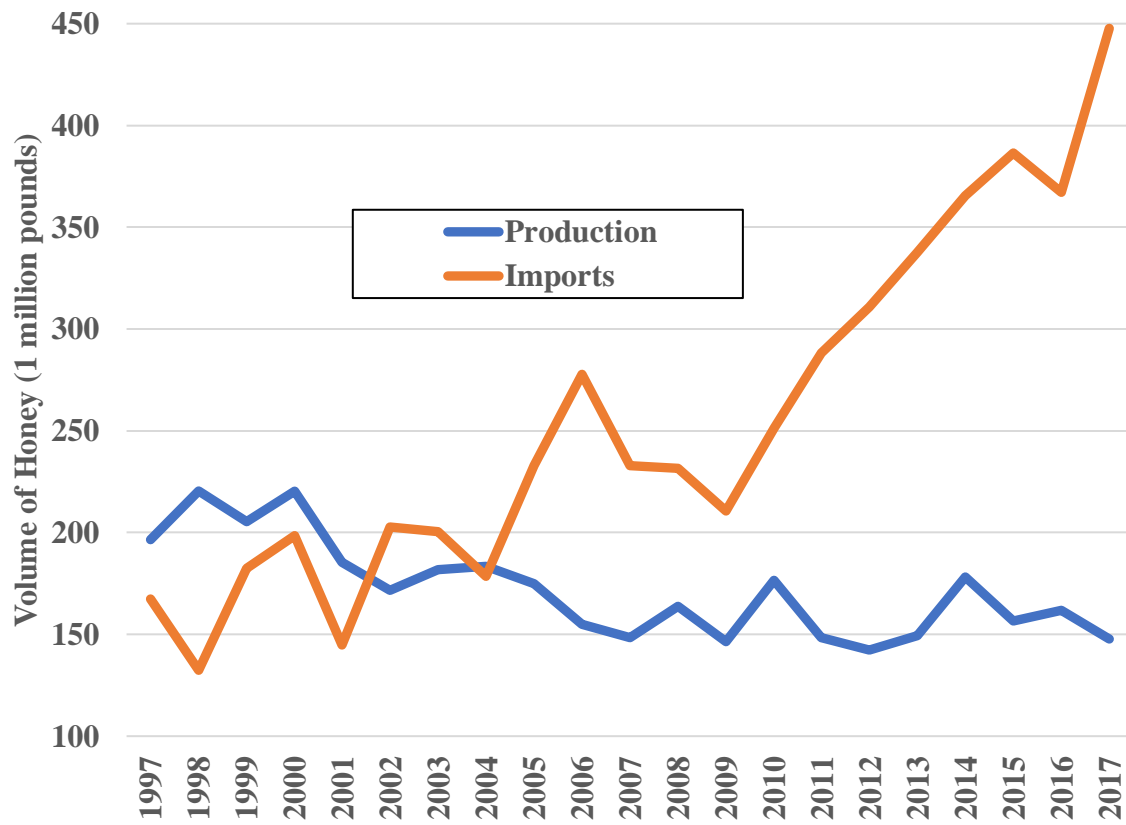
Table 1.5: Volume of U.S. Export of Honey by Destination Country in 1997, 2007 and 2017

1997			2007			2017		
	Volume ¹	% total		Volume ¹	% total		Volume ¹	% total
Saudi Arabia	1,290	14.5	Israel	1,885	22.7	Korea	1,735	17.5
Yemen	1,084	12.2	Canada	977	11.7	Philippines	1,647	16.6
Canada	971	10.9	Korea	887	10.7	Canada	1,426	14.4
Germany	967	10.9	Japan	862	10.4	Kuwait	1,074	10.8
Japan	735	8.3	Malaysia	677	8.1	China/HK	755	7.6
Rest of World	3,859	43.3	Rest of World	3,034	36.5	Rest of World	2,907	29.4
Total Exports	8,906	100.0	Total Exports	8,322	100.0	Total Exports	9,900	100.0

Source: U.S. International Trade Commission

¹Volume in 1,000 pounds

Figure 1.10: Total Annual U.S. Production and Import of Honey, 1997-2017



Source: USDA NASS Annual Honey Report and U.S. International Trade Commission

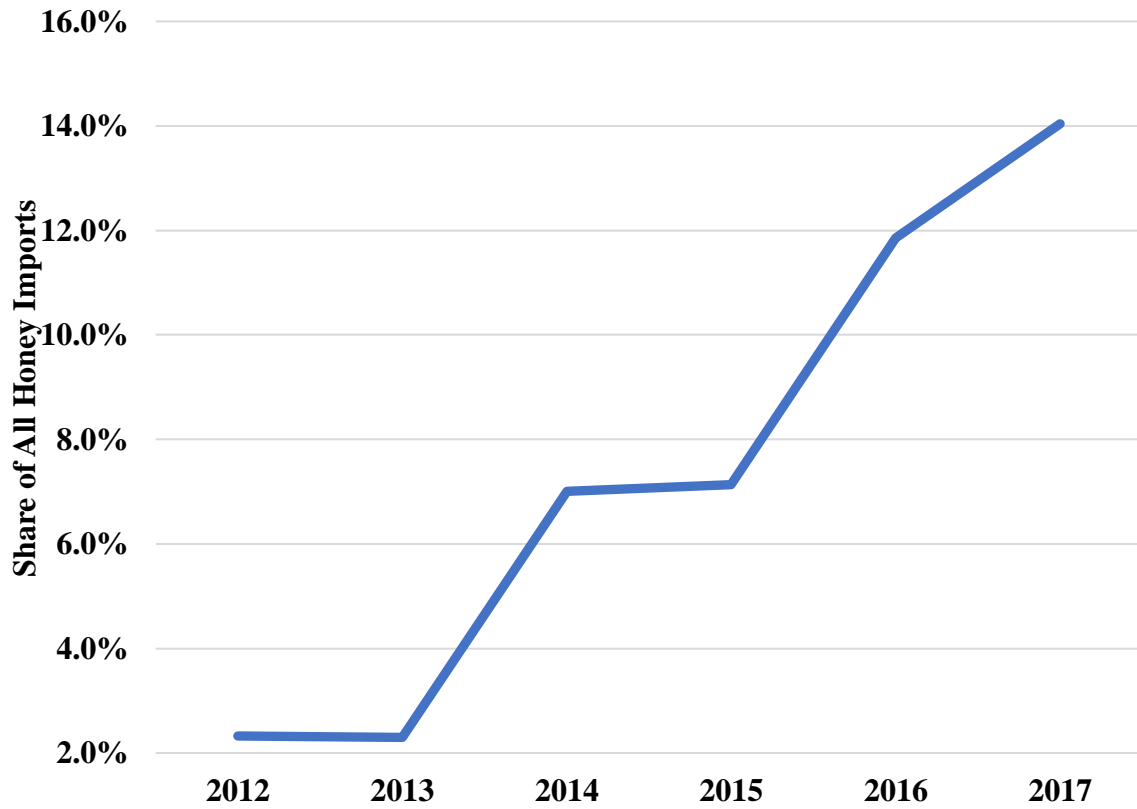
Table 1.6: Source of US Honey Supply by Year for 2007, 2012 and 2017

2007			2012			2017		
Source of Honey	Volume of Honey ¹	Share of US Supply (%)	Source of Honey	Volume of Honey ¹	Share of US Supply (%)	Source of Honey	Volume of Honey ¹	Share of US Supply (%)
Previous Year Stock	40.7	11.3	Previous Year Stock	36.8	8.3	Previous Year Stock	41.3	6.9
US Production	148.3	41.1	US Production	142.3	31.9	US Production	147.6	24.8
Argentina	44.9	12.5	Argentina	93.7	21.0	India	99.6	16.7
China	38.6	10.7	India	47.3	10.6	Vietnam	80.0	13.4
Vietnam	34.6	9.6	Vietnam	45.6	10.2	Argentina	78.0	13.1
Canada	30.8	8.5	Canada	35.2	7.9	Brazil	53.0	8.9
Brazil	26.7	7.4	Brazil	24.9	5.6	Ukraine	42.7	7.2
India	16.9	4.7	Uruguay	24.0	5.4	Canada	34.8	5.8
Russia	9.2	2.6	Mexico	13.6	3.1	Mexico	10.5	1.8
Mexico	7.0	1.9	Malaysia	4.6	1.0	Thailand	9.9	1.7
Uruguay	4.2	1.2	Chile	3.8	0.9	New Zealand	9.3	1.6
Malaysia	4.2	1.2	New Zealand	2.1	0.5	Uruguay	8.9	1.5
Rest of World	15.4	4.3	Rest of World	16.1	3.6	Rest of World	20.9	3.5
Total Imports	232.5	64.5	Total Imports	310.9	69.7	Total Imports	447.5	75.1
Total US Exports	-8.3		Total US Exports	-12.3		Total US Exports	-9.9	
Stock Held	-52.6		Stock Held	-31.8		Stock Held	-30.6	
Total US Supply	361.1	100.0	Total US Supply	445.8	100.0	Total US Supply	596.1	100.0

Source: US honey import data comes from U.S. International Trade Commission; US honey production data comes from USDA NASS Annual Honey Report.

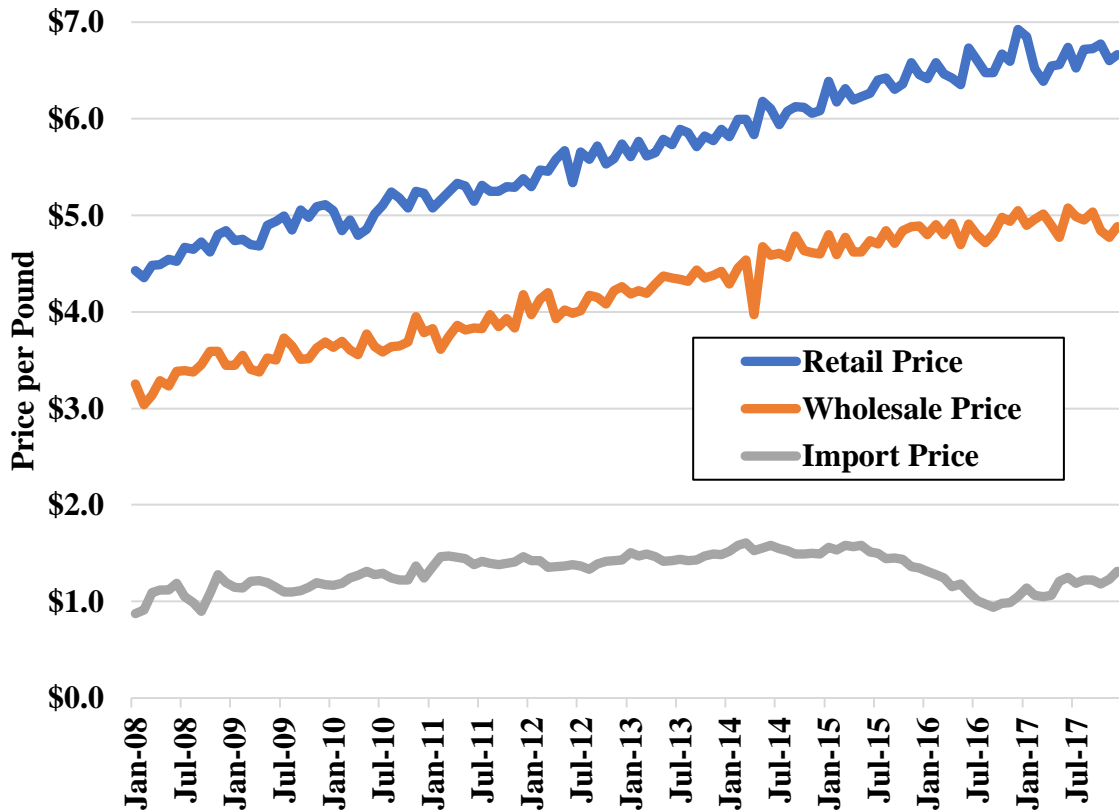
¹ Volumes reported in 1 million pounds.

Figure 1.11: Share of Organic Honey Imports to Total Honey Imports, 2012-2017



Source: U.S. International Trade Commission

Figure 1.12: Inflation Adjusted Monthly Retail, Wholesale and Import Prices for Honey, January 2008 – December 2017.



Source: Import price data estimated from U.S. International Trade Commission trade data. Wholesale and retail honey prices received comes from National Honey Board via *Bee Culture* magazine.

Figure 1.13: Flow Chart of U.S. Honey and Honey Bee Industry

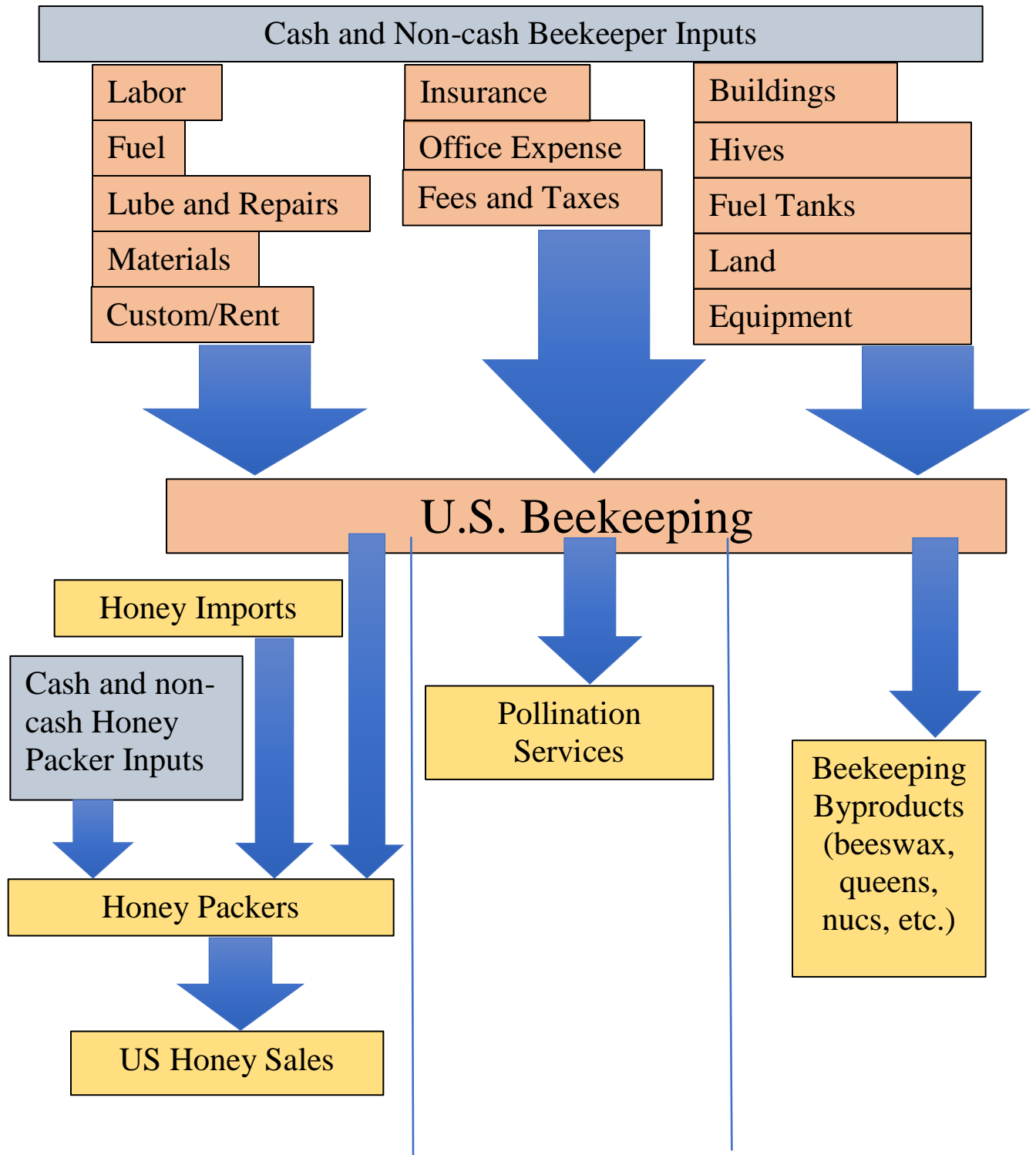
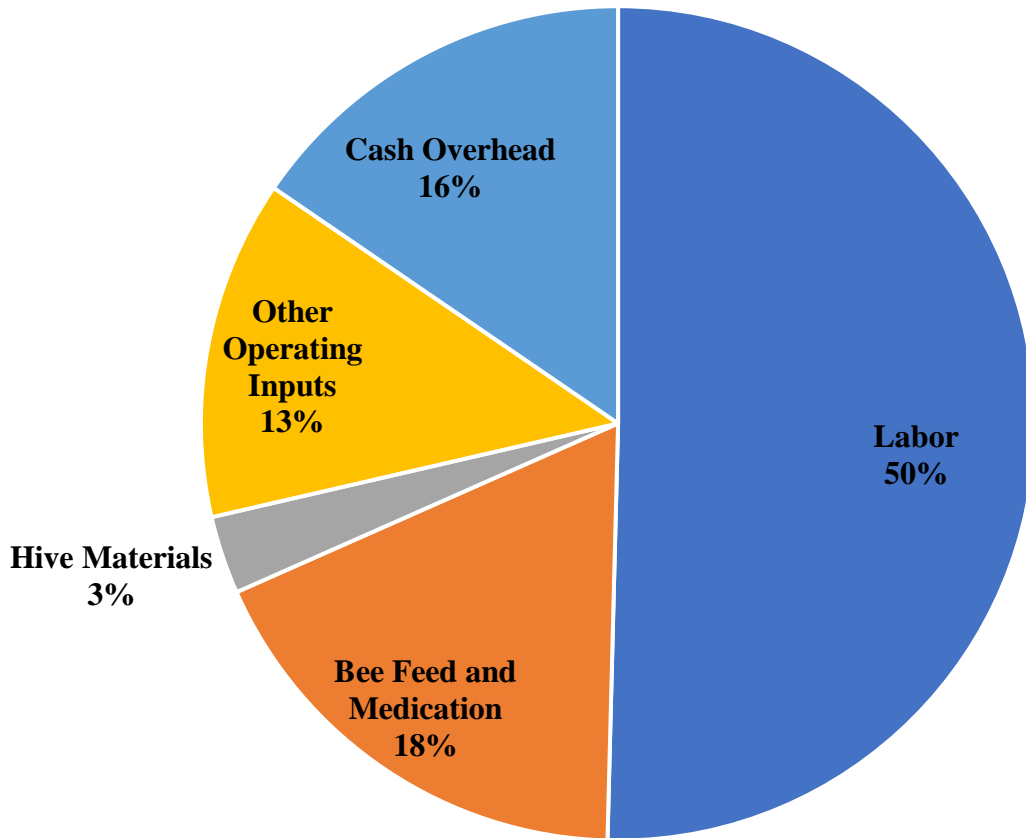
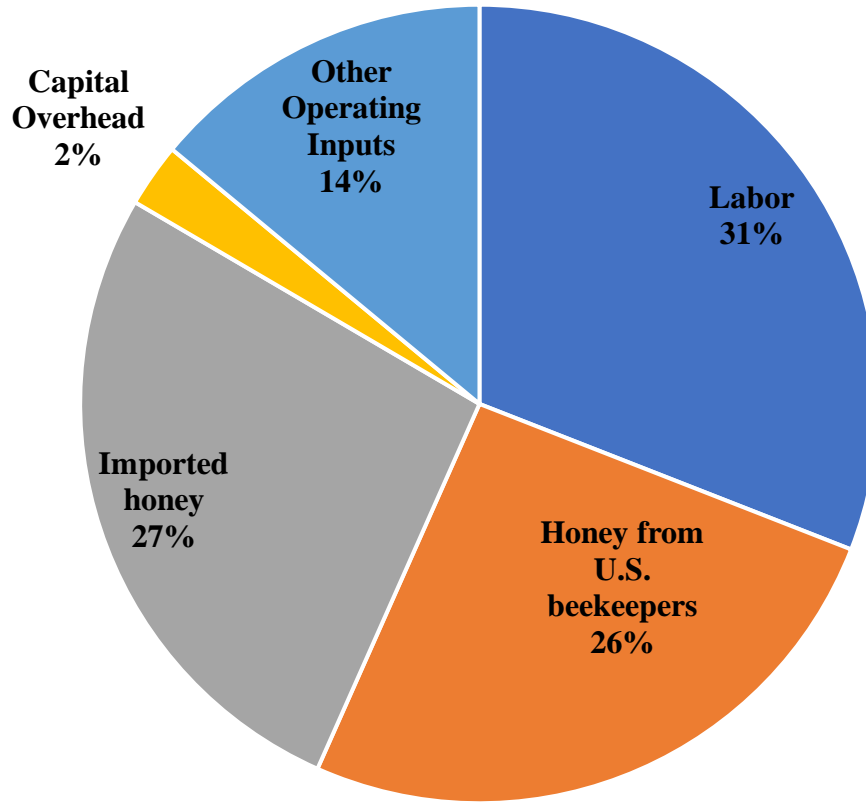


Figure 1.14: Share of Beekeeper Costs of Production by Category



Source: Survey data collected by UC AIC from beekeepers

Figure 1.15: Share of Honey Packer Costs of Production by Category



Source: Survey data collected by UC AIC from honey packers

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 other industries and segments throughout the economy. For example, an expansion of demand for honey causes more employment and other economic activity in beekeeping and honey packing industries 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 goods and services. 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 double counting or leaving out impacts. Impacts are classified as direct, indirect and induced effects.

Direct Effects: Direct effects are impacts directly within the affected industry. For example, hiring 50 workers to move beehives has a direct employment effect of 50 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, an increase in honey demand would entail increased volume of packaging purchased from suppliers, 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, beekeepers, packers 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 beekeeping/honey industry on the U.S. 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 beekeeper output is simply the sum of market values of honey and honey byproducts produced and pollination services offered. For honey packers it's the total market value of processed and packaged honey above the value of honey coming from beekeepers.

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 honey, honey byproducts and pollination services is the industry's contribution to the U.S. 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

Section 2. Economic Contributions of U.S. Honey Production, Honey Packing and Honey Importing to the U.S. Economy

2.1 Economic Contributions of U.S. Beekeeping, Honey Importing and Honey Packing

This section traces how U.S. honey production, packing and handling of honey imports affect the employment, value of output and value added of the U.S. economy through the direct, indirect and induced effects outlined in subsection 1.2 and Box 1.1. Our estimates use data from multiple sources to modify the IMPLAN input-output model to more accurately represent the U.S. honey industry. Costs and revenue data were provided by U.S. beekeepers, honey importers and honey packers via survey and through personal interviews with various stakeholders. Impact estimates are calculated by applying the multipliers generated by IMPLAN to revenues generated by U.S. beekeepers, honey importers and honey packers in 2017.

Table 2.1 indicates approximate direct beekeeper employment for honey production of 7,642, provision of honey importing services employs 236 people and honey packing provides 5,761 direct jobs to the U.S. economy in 2017. U.S. beekeepers produce about \$318 million of honey output and honey importers supply \$57 million of importing services to the market. U.S. honey packers, producing wholesale processed honey for retail consumers generate output of about \$1.6 billion. Each of the industry segments contributes to the U.S. GDP through value added returns on labor and capital. Honey production from beekeepers generates \$169 million of additional value to the U.S. economy. The service of honey importers adds \$38 million and honey packers account for \$511 million to U.S. GDP in 2017.

To generate the figures in Table 2.1 we trace the impacts of the honey industry through the U.S. economy using the impact ratios and multipliers displayed in Table 2.2. Multipliers indicate the magnitude of changes in the U.S. economy from shifts in demand and output in the

U.S. honey industry. We start with the direct value of output “multiplier” of 1.0 and then note that, for beekeeping, indirect output adds another \$821,000 for every additional \$1 million dollars of beekeeping output. Each \$1 million of output from honey packing and honey import services promotes an additional \$1.118 million and \$512,000 in indirect output, respectively. Induced effects add another \$967,000 for beekeeping, \$877,000 for honey packing and \$800,000 for honey import services for each \$1 million increase in sector outputs. Overall, every \$1 million increase in direct output for beekeeping ripples through the economy and creates an additional \$1.79 million in economic output. The ripple effects from honey packers and honey importers add an additional \$2 million and \$1.31 million for every \$1 million increase, respectively.

Contributions to national GDP come from that portion of gross earnings that reflect returns to capital and labor plus the business taxes paid by sector and defined as value added. Direct value added is about \$532,000 per \$1 million dollars of beekeeping revenue, \$323,000 per \$1 million of honey processing output and \$669,000 per \$1 million of honey import service revenues. Beekeeping indirect and induced impacts add another \$875,000 in value added for a total value added of \$1.4 million per \$1 million dollars of beekeeping revenue earned. Honey packers, like most processing industries, purchase inputs for assembly at a greater rate than beekeepers and, therefore, have lower direct effects and higher indirect and induced effects. Every \$1 million of output from honey packing creates an additional \$1.32 million in value added to the U.S. economy. Honey importers add an additional \$746,000 to the U.S. GDP through indirect and induced effects of \$1 million increase in output.

The majority of value added to the U.S. economy from the three honey sectors comes in the form of labor income. Labor income is the portion of sales revenues that goes toward

employee compensation and proprietor income. For beekeeping, every \$1 million in gross sales of honey directly generates \$453,000 in labor income and an additional \$506,000 in labor income from indirect and induced effects. As mentioned previously, honey packers generate lower direct effects on labor income (\$267,000 per \$1 million of output) but a higher effect (\$600,000) on indirect and induced labor income due to greater reliance on input suppliers, relative to beekeepers. Honey importers, who provide a service of wholesaling imported honey to honey packers and food manufacturers, have the lowest total effect on labor income generating \$783,000 per \$1 million of gross revenues earned.

Employment effects in Table 2.2 are interpreted as the number of jobs created per \$1 million of output earned. For beekeeping, every additional \$1 million of output generates 24 direct beekeeping jobs. Approximately 10 additional jobs are created in the economy from indirect and induced effects for a total of 34 jobs created from every \$1 million in beekeeper revenue generated. Honey packers and honey importers each generate 14 and 12 jobs respectively for every \$1 million in sales earned.

Using the multipliers generated with IMPLAN and applying gross revenues for beekeeping, honey packing and honey importing we are able to calculate the economic impact the U.S. honey industry had on the U.S. economy in 2017. Table 2.3 shows the total economic impacts from beekeeping in the United States. Total beekeeping impacts are broken down into the three main sources of revenue generation: sales of honey, sales of pollination services and sales of byproducts such as beeswax, queens and nucs. In 2017, pollination services provided the largest source of revenue U.S. beekeepers generating \$435 million in direct output (USDA NASS 2018). Honey sales earned beekeepers \$318 million and byproduct sales generated an additional \$163 million for U.S. beekeepers (USDA NASS 2018). In total, beekeeping in the

U.S. generated \$916 million in direct output and \$2.55 billion in total output for the U.S. economy in 2017. Furthermore, beekeeping activity added \$1.29 billion in value added to the national GDP and provided a total of 30,948 jobs to the U.S. economy with 22,000 of those jobs as direct beekeeping jobs (Table 2.3).

Honey importers provide a service of wholesaling imported honey to honey packers and food manufacturers in the U.S. The contribution of honey importers on the U.S. economy occurs from the revenues generated and jobs provided from wholesaling already imported honey. Therefore, gross revenues for honey importers do not include the import value of foreign honey as this value would contribute to the economies of foreign suppliers and not the U.S. economy (Table 2.4). The direct output of honey importers is calculated at \$57 million, which reflects a 10 percent margin earned by importers on the total value of honey imported in the U.S. in 2017. Of the \$57 million earned by honey importers in 2017 more than a third (\$20 million) went to employee compensation and proprietor income (Table 2.5). Overall, honey import services contributed \$38 million to the U.S. GDP directly and an additional \$43 million through indirect and induced effects. Honey importers supported 236 jobs directly and 688 jobs in total throughout the economy (Table 2.5).

The U.S. honey packing industry had an estimated \$1.58 billion in direct output in 2017 (Table 2.4). This estimate is calculated assuming that half of the total supply of honey in the U.S. is processed by honey packers for retail consumers with the other half designated for food manufacturers as processed food ingredients. The volume of honey handled by U.S. honey packers is estimated at 298.1 million pounds in 2017. We further assume the volume of honey processed by honey packers consists of 100 percent of U.S. production with the remaining volume coming from imports. The value of output for honey packers in 2017 is equal to total

volume of honey multiplied by the average wholesale price per pound (Table 2.4). The \$1.58 billion in direct output from honey packers generated \$511 million in direct value added to the U.S. economy. Over 80 percent of the direct value-added contribution came in the form of employee compensation and proprietor income. The ripple effects from honey packers, which reverberates to U.S. beekeepers and honey importers, generated an additional \$3.2 billion in economic output and \$1.5 billion in value added to the U.S. economy through indirect and induced effects. Honey packers also supported 4,624 direct jobs and a total of 22,084 jobs throughout the U.S. economy.

Overall the U.S. honey industry, including production from U.S. beekeepers, handling of honey imports in the U.S. and packing of U.S. honey supply contributes a total of 13,639 direct jobs in the U.S. economy and adds \$844 million to the U.S. GDP (Table 2.6).

2.2 Economic Contributions of Honey in U.S. Food Processing and Manufacturing

We estimate that over half of the honey consumed in the U.S. is as an ingredient in processed food products such as breakfast cereals and bakery goods. We further assume that all of the honey used in food processing is imported honey. In the previous sub-section, we discussed the impacts of the U.S. honey industry by examining the “upstream” effects of beekeeping, honey importing and honey packing. This analysis allows examination of how shifts in honey production, imports or packing would impact the U.S. economy through changes in value of purchased inputs and hired labor necessary to deliver honey products to the U.S. market. We also believe it is worthy to discuss the potential impacts that honey has on downstream food processing. In other words, examine the impact that a restriction in honey imports or honey availability would have on the food processing sector.

To conduct this analysis, we choose six food processing industry sectors within IMPLAN that would use honey as an input ingredient. The six sectors selected are 1) breakfast cereal manufacturing, 2) bread and bakery products manufacturing, 3) cookie and cracker manufacturing, 4) flavoring syrup and concentrate manufacturing, 5) dressing and sauce manufacturing and 6) other snack food manufacturing. To determine the impact of honey as an input, we estimate honey's share of aggregate expenditures on intermediate inputs for all six manufacturing sectors. Using values within the IMPLAN database, total intermediate expenditures across the six sectors was \$88.5 billion. The value of imported honey designated for food processing was \$420 million, or about 0.47% of total expenditures. We apply this share of total expenditures to the aggregate economic impacts from the six food processing sectors to estimate the value of food processing dependent on honey as an input ingredient (Table 2.7).

Direct output for the U.S. food processing sectors related to honey-inclusive products is about \$737 million with total output of about \$2.2 billion. The value-added to the U.S. economy from the manufacture of these products totaled \$939 million when including indirect and induced effects. Of this, more than half (\$515 million) was in the form of labor income. The number of direct jobs attributed to the manufacture of honey-inclusive products is 2,192 and just under 8,000 jobs in the U.S. economy are impacted by the production of honey-inclusive processed food products.

Concluding Remarks

The U.S. honey industry, including honey production by U.S. beekeepers, honey importers and honey packers, directly supports 12,502 jobs in the U.S. economy and contributes \$718 million to the U.S. GDP in 2017. When including indirect and induced effects about 22,084 jobs in the US are supported by honey production and sales and \$2.1 billion in new value is added to the US economy. Consumption of honey in the United States is increasing and consumers' choice of honey as a sweetener over other options is gaining in popularity. Much of the increase in honey consumption comes in the form of processed food products. The availability of honey as an input ingredient impacts the U.S. economy through the jobs supported and labor income generated from the manufacture of honey-inclusive food products.

In addition to the contributions the honey industry makes to the U.S. economy, honey production contributes to the national health and well-being of its citizens by offering a healthful, nutritious and enjoyable sweetener option to U.S. food consumers.

Table 2.1: Economic Aggregates for the U.S. Honey Industry, 2017

	<i>Beekeeping</i>	<i>Honey Importing</i>	<i>Honey Packing</i>
Direct Employment	7,642	236	4,624
Direct Value of Output (\$millions of sales)	\$318	\$57	\$1,583
Direct Value Added (\$millions of returns to labor and capital plus business taxes within the sector)	\$169	\$38	\$511

Source: IMPLAN data set and authors' calculations for adjustments to 2017 honey production and prices from USDA, US Dept of Commerce and The National Honey Board.

Table 2.2: Impact Multipliers for the US Honey Industry Sectors of Beekeeping, Honey Processing and Honey Importing

<i>Multiplier</i>	<i>Beekeeping</i>	<i>Honey Importing</i>	<i>Honey Packing</i>
Value of Output	<i>\$ of output for economy per \$1.00 output by honey sector</i>		
Direct Effect	1.000	1.000	1.000
Indirect Effect	0.821	0.512	1.118
Induced Effect	0.967	0.800	0.877
Total Effect	2.787	2.312	2.995
Value Added	<i>GDP (\$) per \$1.00 of output</i>		
Direct Effect	0.532	0.669	0.323
Indirect Effect	0.335	0.300	0.505
Induced Effect	0.540	0.446	0.490
Total Effect	1.408	1.415	1.318
Labor Income	<i>Labor income per \$1.00 output by honey sector</i>		
Direct Effect	0.453	0.345	0.267
Indirect Effect	0.202	0.186	0.324
Induced Effect	0.304	0.251	0.276
Total Effect	0.959	0.783	0.867
Employment	<i>Jobs per \$1 million of output</i>		
Direct Effect	24.007	4.109	2.920
Indirect Effect	3.795	2.936	5.608
Induced Effect	5.969	4.930	5.420
Total Effect	33.771	11.975	13.948

Source: Multipliers were generated in IMPLAN using revenue and costs data from multiple sources including survey responses by industry stakeholders, USDA and the National Honey Board.

Table 2.3: Economic Impacts of the U.S. Beekeeping Industry in 2017 by Output.

<i>Impact Measure</i>	<i>Honey</i>	<i>Pollination Services</i>	<i>Bee Byproducts¹</i>	<i>Total Beekeeping</i>
Value of Sector Output	<i>\$1,000,000</i>			
Direct Output	\$318	\$435	\$163	\$916
Indirect Output	\$261	\$357	\$134	\$752
Induced Output	\$308	\$421	\$158	\$886
Total Output	\$887	\$1,212	\$455	\$2,554
Value Added				
Direct Value Added	\$169	\$232	\$87	\$488
Indirect Value Added	\$107	\$146	\$55	\$307
Induced Value Added	\$172	\$235	\$88	\$495
Total Value Added	\$448	\$612	\$230	\$1,290
Labor Income				
Direct Labor Income	\$144	\$197	\$74	\$415
Indirect Labor Income	\$64	\$88	\$33	\$185
Induced Labor Income	\$97	\$132	\$50	\$278
Total Labor Income	\$305	\$417	\$156	\$879
Employment	<i>Number of Jobs</i>			
Direct Employment	7,642	10,443	3,915	22,000
Indirect Employment	1,208	1,651	619	3,478
Induced Employment	1,900	2,597	974	5,470
Total Employment	10,750	14,691	5,508	30,948

Source: Values were estimated by UC AIC staff by applying beekeeping input-output multipliers generated in IMPLAN and using gross revenue data provided by USDA NASS.

¹ Bee byproducts include sales of beeswax, queens, nucs and other non-honey byproducts.

Table 2.4: Estimates of Direct Output for U.S. Honey Importers and U.S. Honey Packers, 2017

<i>Honey Importers</i>		<i>Honey Packers</i>	
Volume of imported honey (lbs)	448.7 million	Volume of U.S. honey production (lbs)	147.6 million
Import price (\$/lbs)	\$1.28	34% volume of honey imports (lbs)	150.5 million
Total value	\$574 million	Total volume (lbs)	298.1 million
Importer revenue from service (10% total import value)	\$57.4 million	Wholesale price (\$/lbs)	\$5.31
		Packer revenue	\$1.583 billion

Import price and volume data come from USDA AMS National Honey Report, February 2018. Volume of U.S. honey production data comes from 2017 USDA NASS Annual Honey Report. The 2017 wholesale price is the average monthly wholesale price estimated from data provided by the National Honey Board.

Table 2.5: Economic Impacts of Honey Packing and Honey Import Industry by Output.

<i>Impact Measure</i>	<i>Honey Import Service</i>	<i>Honey Packing</i>
Value of Sector Output	<i>\$1,000,000</i>	
Direct Output	\$57	\$1,583
Indirect Output	\$29	\$1,770
Induced Output	\$46	\$1,388
Total Output	\$133	\$4,742
Value Added		
Direct Value Added	\$38	\$511
Indirect Value Added	\$17	\$800
Induced Value Added	\$26	\$776
Total Value Added	\$81	\$2,087
Labor Income		
Direct Labor Income	\$20	\$423
Indirect Labor Income	\$11	\$513
Induced Labor Income	\$14	\$437
Total Labor Income	\$45	\$1,372
Employment	<i>Number of Jobs</i>	
Direct Employment	236	4,624
Indirect Employment	169	8,879
Induced Employment	283	8,581
Total Employment	688	22,084

Source: Values were estimated by UC AIC staff by applying appropriate input-output multipliers generated in IMPLAN to estimated gross revenues generated through honey import services and honey packing.

Table 2.6: Contribution of U.S. Honey Production, Packing and Importing to U.S. Employment and Gross Domestic Product, 2017

	<i>Beekeeping</i>	<i>Honey Importing</i>	<i>Honey Packing</i>	<i>Total Honey</i>
U.S. Honey Employment Impacts				
Direct	7,642	236	4,624	12,502
Full Effect	10,750	688	22,084*	
U.S. Value Added (GDP) Impacts				
Direct (millions)	\$169	\$38	\$511	\$718
Full Effect (millions)	\$448	\$81	\$2,087*	

* Includes the contribution of beekeeping for honey production, honey importing and honey packing. Packing sales include the value of honey production by U.S. beekeepers and the value of honey import services as an input for U.S. honey packers. These figures include other non-honey output values driven by honey production and packing in the U.S.

Table 2.7: Economic Impacts of Honey In Food Processing Sector.

<i>Impact Measure</i>	<i>Food Processing Sectors</i>
Value of Sector Output	<u>\$1,000,000</u>
Direct Output	\$737
Indirect Output	\$898
Induced Output	\$525
Total Output	\$2,160
Value Added	
Direct Value Added	\$277
Indirect Value Added	\$369
Induced Value Added	\$293
Total Value Added	\$939
Labor Income	
Direct Labor Income	\$124
Indirect Labor Income	\$226
Induced Labor Income	\$165
Total Labor Income	\$515
Employment	<u>Number of Jobs</u>
Direct Employment	2,192
Indirect Employment	3,045
Induced Employment	2,731
Total Employment	7,968

Source: Values were estimated by UC AIC staff by applying appropriate input-output multipliers generated in IMPLAN to estimated gross revenues generated in food processing sectors. Sectors included in this analysis include breakfast cereal manufacturing, bread bakery products, cookie and cracker manufacturing, flavoring syrup and concentrate manufacturing, dressing and sauce manufacturing and general snack food manufacturing.

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