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The U.S. Honey Industry: An Economic Analysis

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THE U.S. HONEY INDUSTRY: AN ECONOMIC ANALYSIS*

INTRODUCTION

The U.S. apiary industry contributes to the nation's food supply in the production of honey and by providing a valuable pollination service to agricultural crops. In 1973, about 3.5 million acres of fruits, vegetables, oil seeds, and legume seed crops were produced in the U.S. that were dependent on insect pollination.¹ Production on another 63 million acres, not dependent on insect pollination, had an increase in yields because of insect pollination. In 1980, the total value of crops benefitting from pollinator activity was nearly \$19 billion, over one hundred thirty five times the \$140 million worth of honey and beeswax produced.² The single most important insect for pollination is the honey bee (*Apis mellifera ligustica*) originally imported from Europe. These bees are the most efficient pollinators because they do not destroy the plant by feeding on it in the pollination process and they continue to visit flowers to collect all the nectar and pollen.

There are several economic problems and concerns currently held by beekeepers and others associated with the honey industry. One of these problems is the high level of imports and large quantities of honey held by the Commodity Credit Corporation (CCC). Beekeepers default on their loans and the CCC receives their honey because of the high honey support price relative to the low domestic market price and the low world honey price. In view of the low prices is it necessary for the federal government to continue its honey support program to maintain a profitable national honey industry? Will the number of honey bee colonies necessary for pollination of the nation's agricultural crops be maintained in the absence of a honey support program?

Beekeepers are also concerned about the infiltration of the Africanized honey bees (*Apis mellifera adansonii*) into the United States. These bees, noted for their aggressiveness and tendency to sting and swarm are throughout South and Central America. The expansion of the Africanized honey bee into the U.S. could have serious economic consequences on the domestic honey industry. Will the Africanized honey bees lead to the elimination of hobbyists and part-time beekeepers? What will be the bees impact on the number of colonies maintained? Will the level of honey production change significantly? How will the Africanized honey bee impact the domestic queen rearing and package bee industry?

A third issue of concern to the honey industry is pesticides. During foraging, bees often come in contact with pesticides used on agricultural crops near or adjacent to the property where the beehives are located. These pesticides can lead to heavy losses of bees and a drastic reduction in a beekeeper's honey crop, ability to provide pollination services and rear queen and brood. From 1967 to 1979, the Federal government reimbursed beekeepers for honey bee losses due to pesticides through the Beekeeper Indemnity

*Summary of remarks presented at the Empire State Honey Producers' Association Meetings, Syracuse, New York, December 4, 1987.

¹This 1973 statistic is the latest estimate of acres dependent on crop pollination. It is from Hoff and Gray (1984) p. 1 and originally based on McGregor (1976).

²Levin (1984), p. 185.

Payment Program (BIPP). Does the use of pesticides pose a continuing threat to the honey industry? Is there a means for farmers to compensate beekeepers for their losses? Should beekeepers compensate farmers for restrictions on pesticide use designed to protect bees?

Beekeepers and honey processors are also concerned about other sweeteners, such as high fructose corn syrup, which are nearly perfect substitutes for honey in the industrial market. What is the potential impact of these sweeteners on the industrial market for honey? By promoting the flavor and unique production of the product could the industrial market for honey be expanded?

Finally, of increasing importance to beekeepers is the discovery of the Varroa mite in the United States. This parasitic mite has been discovered in several states including New York. It causes decreased brood and a general weakening of the entire colony. One might wonder if this discovery will halt migratory beekeeping in the United States. What impact will there be on the supply of pollination services in states like California who rely on migratory beekeepers? What impact will this mite have on queen and package bees sales throughout the United States and abroad?

In this paper I would like to explore with you the economic structure of the U.S. beekeeping and honey industry. First, I will provide an historical background of the honey industry and the federal support program for honey. Second, I will identify the economic structure of the honey industry and provide a brief description of an econometric model of the industry I have developed. I will summarize the impacts of an elimination of the support program as identified by the model. Finally, I will present a few concluding comments and identify ways beekeepers can assist the economic studies.

BACKGROUND OF THE U.S. HONEY INDUSTRY

The year the settlers first brought honey bees to the United States is not recorded, but it is believed to be around 1620. In 1638, honey bee colonies were recorded in Virginia. As the early settlers moved west, they brought their bees with them. The deliberate movement of honey bees and the natural swarming process contributed to the expansion of colonies through the central and western regions of the nation. Colonies were recorded in eastern Nebraska and Minnesota by 1820. In 1853 honey bees were first reported in California.

Although the number of beekeepers in the United States grew in the 1700's and early 1800's, the sale of honey on a commercial basis did not begin until after three inventions in the 1850's and 1860's. The first invention was the discovery of bee space allowing for easy removal of the frames for inspection or honey extraction. The second invention was the beeswax foundation. When placed on the hive frames, it is used by bees to build their combs of worker cells. The honey extractor using centrifugal force was the third invention to revolutionize the beekeeping industry. Following these inventions, the number of bee colonies increased, the United States' queen and package bee industry developed and there was an increase in pollination services provided.

The honey industry continued to expand at a moderate rate until World War II, when sugar rationing and the government's request for increased honey production caused a large increase in honey bee colonies and honey production. After the war, honey prices fell to near pre-war levels. The government's concern for the maintenance of adequate honey bee colonies for pollination of the nation's seed, fruit, nut and vegetable crops and

the government's concern for market stability for producers led to the establishment of a honey support program by the Agricultural Act of 1949.

Until 1980, most of the activity of the honey price support program was in loans to beekeepers rather than purchases by the CCC. Prior to 1981 the farm price of honey remained above the average support price of honey. In the 1970's both the farm price and the support price increased rapidly. But in the late 1970's and early 1980's, the support price increased more rapidly than the price received by farmers, even though the support price remained at 60 percent of the parity price. Finally in 1981, the support price for honey increased above the domestic honey price. Following 1981, the support price continued to increase while the domestic market price fell. Beekeepers defaulted on their loans with the CCC and domestic packers and processors found it more profitable to import the lower priced honey on the world market than to purchase honey from domestic beekeepers. The expansion of honey imports left the CCC with 70 percent of 1985's domestic production.

Concern about the high support price and the ever increasing stocks of honey held by the CCC led to sharp debate about the honey program in the discussion preceding the 1985 Food Security Act. In 1980 it cost the CCC 16.5 cents per pound. In 1983, the CCC paid 15.0 cents per pound for honey storage and processing. This value has decreased in recent years because of economies of scale in handling and processing large volumes of honey.³ From 1980 to 1985, the CCC had a net outlay of nearly \$275 million for the honey support program.⁴ The 1985 farm bill was a compromise. The bill kept the honey support program intact but scaled back the level of federal support. The average support rate for the 1986 honey crop was 64.0 cents per pound. The 1987 rate is 63.0 cents per pound. The support price will continue to decrease by five percent until 1990 when a new farm bill will be devised.

In addition to the decreasing level of honey support rates, the 1985 farm bill included a buy back option. This program allows producers to turn the honey in under the loan and then buy back the honey at the price support rate or a lower rate as determined by the secretary of agriculture. These buy back rates are lower than the 1986 average honey support price of \$0.64 per pound and are competitive with world market honey prices. Hence, beekeepers who participate in the program are able to market the honey they buy back and the CCC is able to reduce its stock level. The CCC does not incur the costs of storage, processing and transporting the honey crops and the honey goes back into the market without the CCC giving it away. This buy back program has met with considerable success. The level of imports in 1986 were 118.4 million pounds, nearly 20 million pounds less than in 1985. The level of imports in 1987 are projected to be only 60 million pounds, the lowest level of imports since 1980. In 1986 the honey taken by the government is estimated to be about 60 million pounds, 30 million pounds less than the 98 million pounds in 1985.

ECONOMIC STRUCTURE

The domestic honey industry is composed of three levels: beekeepers, processors and consumers. Beekeepers can be classified into three categories according to the number of colonies they own. These categories are: hobbyists, part-time beekeepers and

³Hoff and Gray, (1984) p. 23.

⁴Ek, (1985) p. CRS-3.

commercial beekeepers. In 1975 ninety-five percent of all beekeepers were hobbyists as illustrated in Figure 1. These beekeepers own less than twenty-five colonies and usually do not deal in the commercial honey markets. Part-time beekeepers with twenty-five to three hundred colonies, usually sell their honey but beekeeping products are not their only source of income. The hobbyist and part-time beekeepers accounted for about one half of all the colonies and forty percent of the honey extracted in 1975. Commercial beekeepers have over three hundred colonies of honey bees. This category includes both migratory and nonmigratory beekeepers. In 1975, commercial beekeepers included only sixteen hundred beekeepers, less than one percent of the total number of beekeepers. Yet, they extracted over sixty percent of the total honey produced.⁵

As indicated in Figure 3, beekeepers earn revenue from four products: beeswax, honey, pollination services, and package and queen bees.⁶ Beekeepers sell their wax to bee supply dealers, to be used in comb foundation, or to manufacturers and druggists, where the wax can be used in cosmetics or candle making. Honey and beeswax are produced in relatively fixed proportions, but the beekeeper can choose the quantities of pollination services and queen and package bee production. Farmers demand pollination services from the beekeepers as another input to their crop production process. Other beekeepers who enter the industry or who are replenishing their colonies purchase queen bees and package bees from the beekeeper.

Beekeepers can distribute their honey output to four sources. If the beekeeper is a member of a cooperative association, the association packages and bottles the honey for the beekeeper. Alternatively, the beekeeper can use a broker or dealer to sell the honey. The broker and dealer are responsible for contacting a bottler and distributing the honey. Producers may decide to package and bottle their own honey. Finally the beekeeper may choose to forfeit on a loan with the CCC and give the honey to the federal government. The CCC distributes its honey through food assistance programs and the recently created buy back program.

Once honey is packaged and bottled it can be used in a variety of ways. Manufacturers and druggists use honey in several products ranging from cosmetics to hair lotions. Honey is used in baking goods and is used by food processors. Honey is ideal for bread baking because the honey retains moisture and extends the product's shelf life. Tobacco processors purchase honey for their final product. Wholesale grocers and chain stores purchase honey from brokers, cooperative associations and producers to sell in their retail stores to consumers. Consumers also purchase honey directly from the beekeeper at roadside stands.

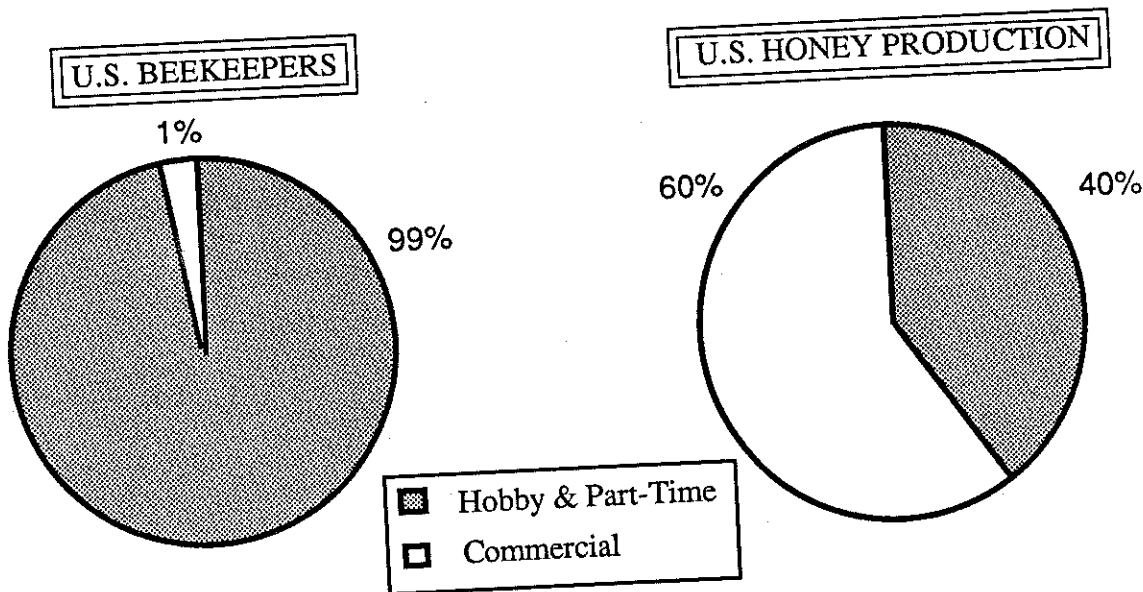
Colonies

As seen in Figure 2, from the 1950's until the early 1970's the number of honey bee colonies decreased despite the existence of the honey support program. Following 1970, the number of colonies averaged about 4.2 million colonies. Factors associated with the decline in colonies include changes in returns and costs of colony maintenance, urban expansion reducing the availability of bee pasturage, improved technology increasing

⁵United States. International Trade Commission, (1976) p. A-13.

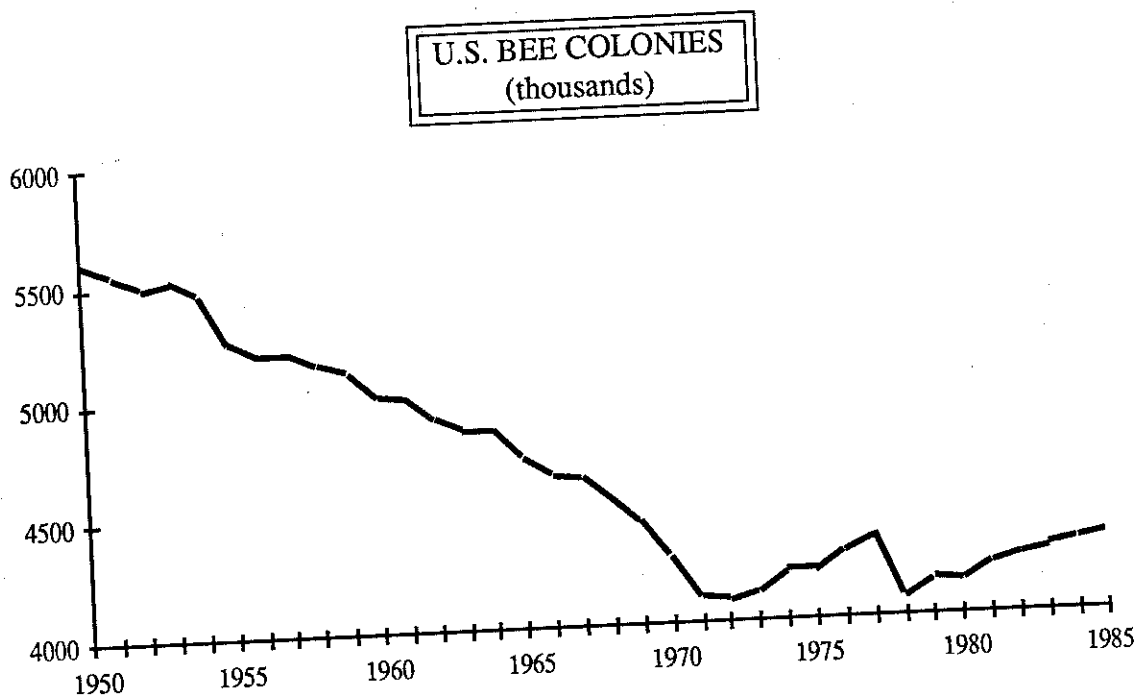
⁶Diagram is based on Garoyan and Taylor, (1980) p. 2 and Anderson, (1969) p. 25. Packers and brokers and dealers are the major importers because honey is usually blended or processed to remove wax, pollen and other foreign matter before it can be used in baking, food processing etc. Honey imported for direct retail sales is usually exotic honey that command a premium price.

FIGURE 1



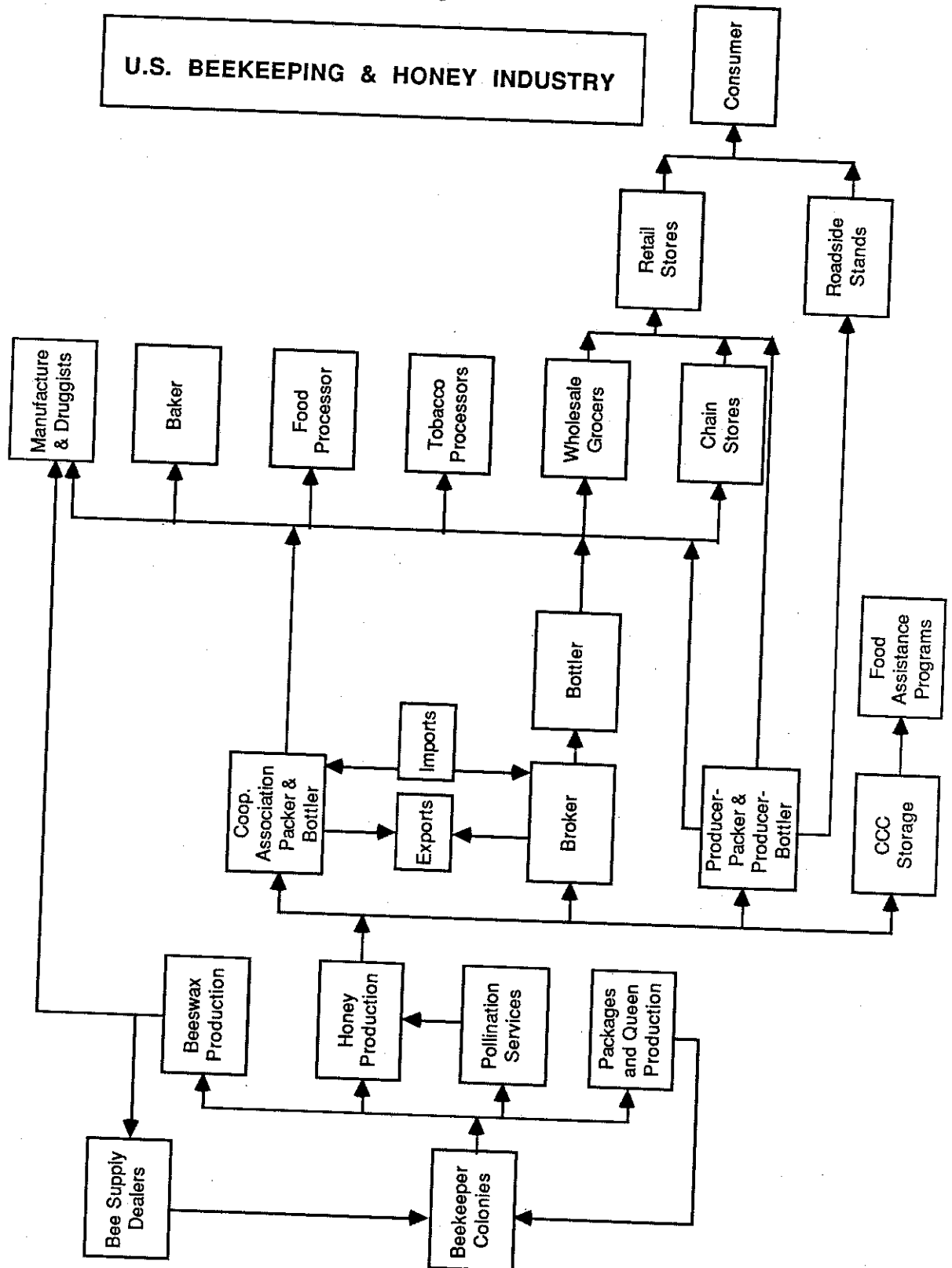
Source: United States International Trade Commission

FIGURE 2



Source: Hoff and Gray

FIGURE 3



product yield per colony, pesticides and diseases.

As seen in Figure 4 the beekeepers can also be grouped according to their location. Seven regions of the country can be identified: Northeast, North Central, Southeast, Plains, Mountain and West. Each region has unique floral sources, climate and terrain which contribute to the variety in beekeeping across the country.

In 1981, seven percent of the honey bee colonies in the United States were in the Northeast region of the country. Because of the cold winters, short summers and hilly terrain of this region only five percent of the nation's honey is produced here. The average yield per colony in 1981 was 32.1 pounds, 12.0 pounds less than the national average of 44.1 pounds per colony. The honey production in this region is from wild flowers, white clover, and black locust. Some pollination services are provided by beekeepers to growers of cranberries, blueberries and cucumbers.⁷

The costs for investment and maintenance of the colonies depend on the beekeeper's specialty. Initial investment in a bee colony was nearly \$80.00 in 1976.⁸ This initial investment includes expenses for the land to locate the colonies, a warehouse and equipment, a vehicle to transport the hives and the bees. Once a beekeeper makes the initial investment, the annual expenses for maintenance of the hive range from \$37 to \$45 per hive depending on the beekeeper's specialty. Expenses per hive for the honey producer were \$37.57 in 1976. As indicated in Figure 5, twenty-two percent of a honey producer's expenses would be for labor while nineteen percent is used for capital consumption (i.e. depreciation). Miscellaneous expenses, such as feed, supplies, insurance, location rent, taxes and electricity comprise twenty-six percent of the total. The honey producer uses ten percent of the total expenses on bees and packages.

Honey

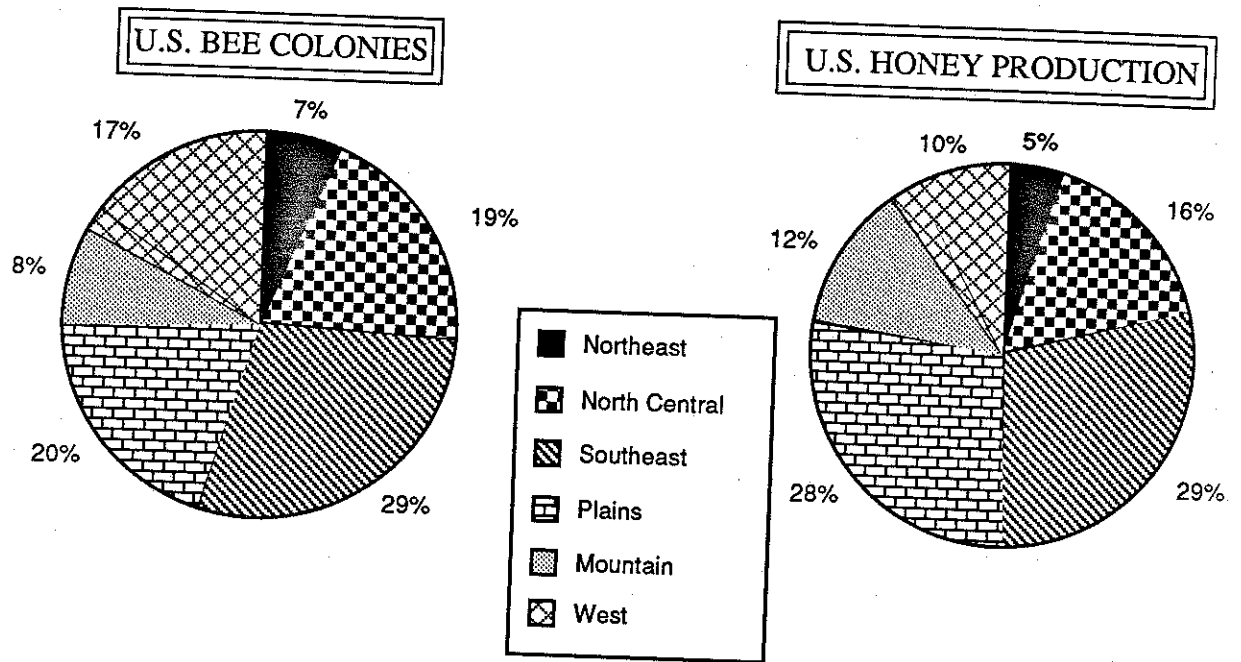
As indicated in Figure 6 honey production remained relatively stable at about 240 million pounds per year from 1950 to 1970 despite the reduction in the level of colonies. The associated increase in average yields from 43.5 pounds per colony in the early 1950's to 50.5 pounds per colony in the late 1960's could be due to better colony management by beekeepers and increased sources and availability of nectar. From 1970 to 1985, when the number of colonies was relatively stable, the average production of honey fell to 206 million pounds per year. The decrease in production was accompanied by a slight drop in the average yields from 51.1 pounds per colony in the early 1970's to 46.6 pounds per colony in the early 1980's. The decrease in the yields per colony could be attributed to pesticide use, continued adverse weather conditions or changing cropping patterns that reduce the number of nectar producing plants. The actual level of honey production is subject to some variability from year to year due to changing weather conditions.

Consumption of honey has also fluctuated since 1950 but has been above domestic honey production since the mid-1970's. Although there has been an increase in the consumption of honey domestically, the per capita consumption exhibits a decreasing trend from the early 1950's until 1981. The average per capita honey consumption in the United States was 1.51 pounds in the early 1950's. This average dropped to 1.07 in the early 1980's. The U.S. average is far below that of most European countries, particularly West Germany, whose population consumes about 2.6 pounds of honey per person per year.

⁷Regional colony, honey production and honey yield statistics are from Hoff and Gray, (1984).

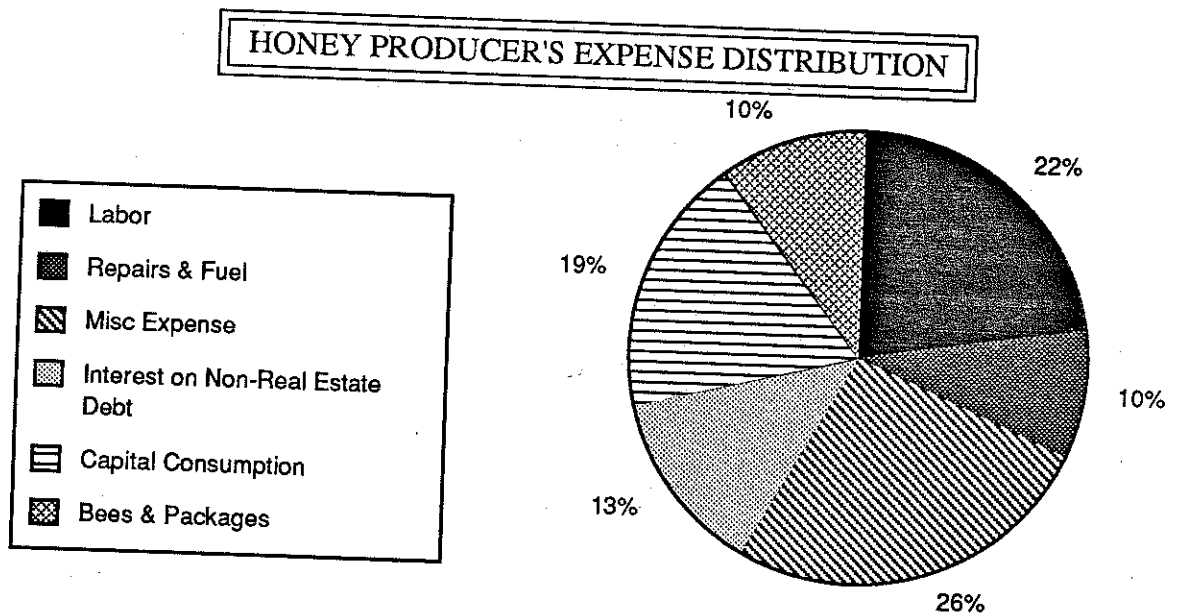
⁸Reed and Horel (1976), p. 10.

FIGURE 4



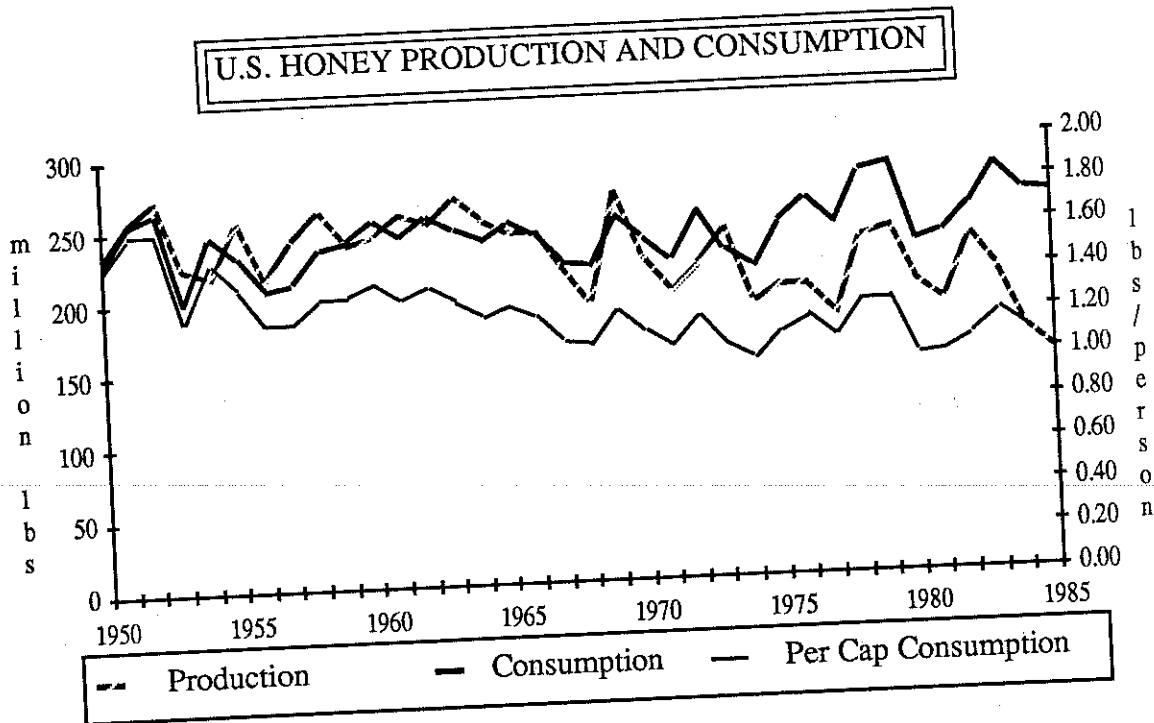
Source: Hoff and Gray

FIGURE 5



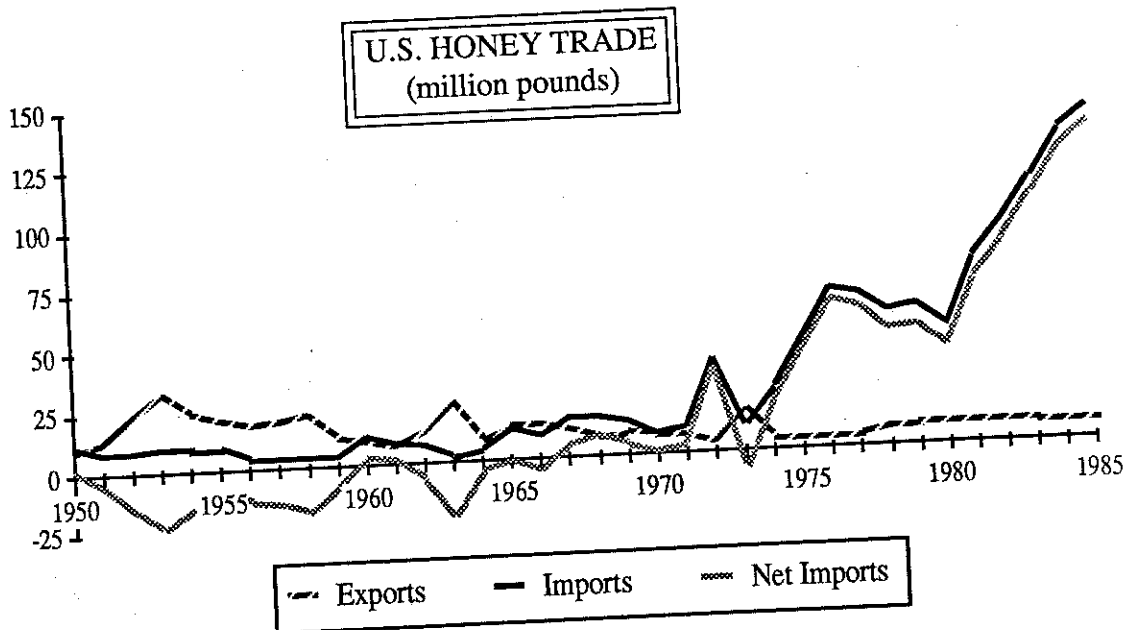
Source: Reed and Horel

FIGURE 6



Source: Hoff and Gray

FIGURE 7



Source: Hoff and Gray

The gap between domestic honey consumption and production since the mid-1970's has been made up by increasing imports, as seen in Figure 7. Honey imported into the United States falls under item 155.70 of the Tariff Schedules of the United States (TSUS). A rate of \$0.01 per pound is applicable to honey imports from all countries except for nonmarket-economy countries. Designated nonmarket-economy countries are assessed a \$0.03 per pound duty. The \$0.01 per pound rate is an agreement made by the United States in the General Agreement on Tariffs and Trade (GATT) effective January 1, 1948.⁹

The honey imported into the United States is a mixture of industrial grade honey and table grade honey. Of course, some exotic honeys from unique floral sources are imported and sold at premium prices. As seen in Table 1, the honey the United States imports comes from four main countries: Mexico, Argentina, China and Canada. Since 1965, Mexican imports comprised an average of 43 percent of the total honey imported into the United States. Twenty percent comes from Argentina; sixteen percent is from Canada. China sent us 8 percent of our imports since 1965. Thirteen percent is from other countries. Since 1973, when the significant increase in honey imports began, the average share of imports from each country has altered slightly. The United States imports from Mexico are just over a third of the total imports. Argentina, Canada and other countries send us about 17 percent of our imports. The U.S. imports from China increased to where an average of thirteen percent of the total imports came from this country since 1973.

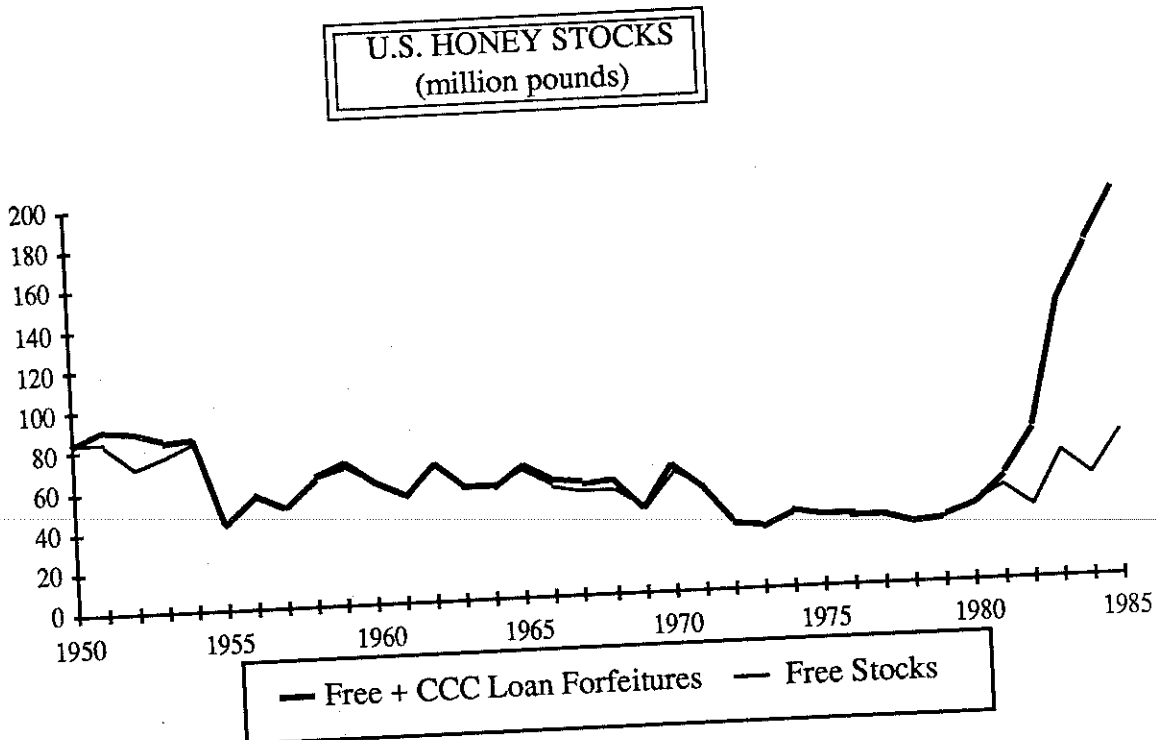
TABLE 1
U.S. IMPORT SHARES OF HONEY

YEAR	MEXICO (%)	ARGENTINA (%)	CHINA (%)	CANADA (%)	OTHER (%)	U.S. IMPORTS (million pounds)
1965	50.4	44.4	0.0	0.8	4.5	13.3
1970	66.3	15.7	0.0	15.7	2.2	8.9
1975	29.1	26.7	1.1	15.7	27.4	46.4
1980	17.1	2.9	35.7	35.5	8.8	49.0
1985	24.4	22.7	16.4	23.2	13.3	138.2

As seen in Figure 8, the general level of honey stocks held in the United States decreased from 1950 to 1980. The variation in stocks prior to 1970 could be attributed to production and price variability. Beginning stocks of 40.9 million pounds in 1969 are from a smaller than average production of 191.4 million pounds in 1968. The level of stocks held from 1970 to 1980 is only 16.5 percent of domestic consumption, far lower than the 31.4 percent held during the 1950's. Rising honey prices and increasing costs of storage encouraged stock holders to liquidate their inventories. Since 1980, the stocks held

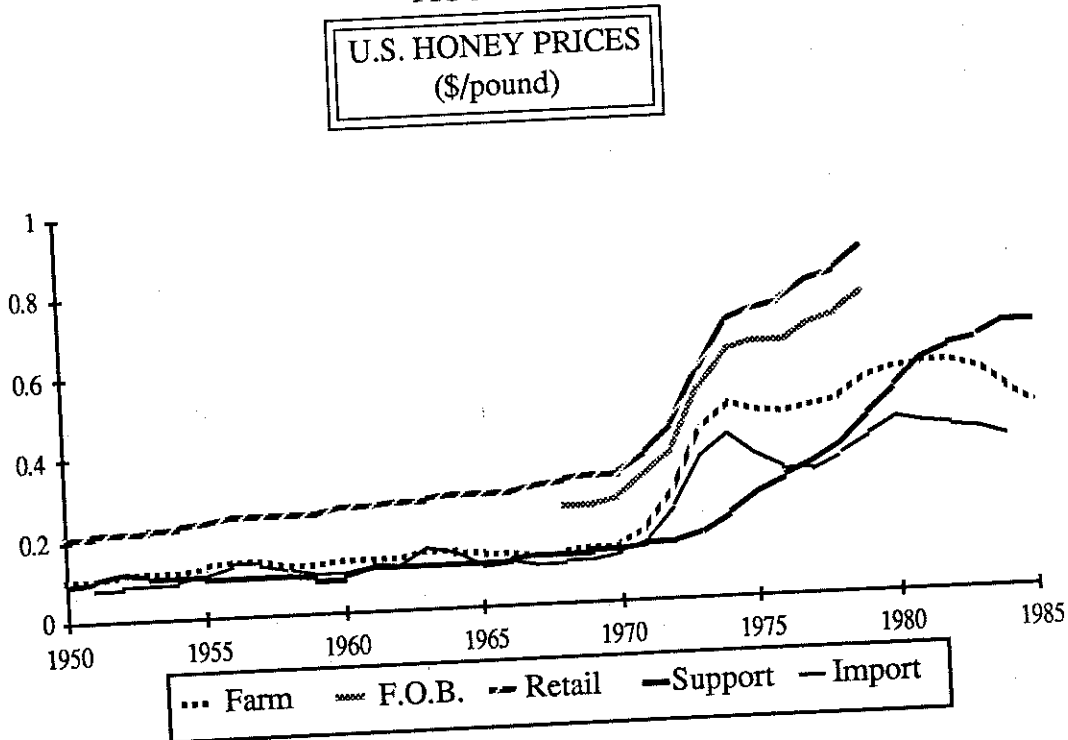
⁹United States. International Trade Commission, (1976) p. A-24.

FIGURE 8



Source: Hoff and Gray

FIGURE 9



Source: Hoff and Gray, USDA/AMS

by the CCC and the level of free stocks have increased dramatically. One explanation for this increase can be seen by a comparison of the honey price received by producers, the United States imported honey price and the support price, seen in Figure 9.

Until 1980, most of the activity of the honey price support program was in loans to beekeepers. In 1981 the support price rose above the domestic honey price even though the support price was still set at sixty percent of parity. Because of this price discrepancy the domestic packers of honey found it more profitable to purchase the lower priced imported honey rather than purchase honey from domestic producers. Hence, the domestic beekeepers forfeited on their loans with the CCC. The CCC received the beekeepers' production and held the honey in storage until it could be distributed through government sponsored programs. Additional free stocks were held after 1981 because of the falling domestic price of honey and the speculation of higher prices in the future.

Beeswax

Beeswax, while a secondary output to honey, is of importance to the beekeeping industry. The production of beeswax is in fixed proportions to the colony's honey production. In recent years, about one pound of wax has been produced for every 50 pounds of honey. Figure 10 indicates that national beeswax production showed some variation since 1950 but followed a decreasing trend particularly since the mid 1960's. The actual output of wax is subject to changes in production practices and colony management. The price of beeswax followed a similar trend as the price of honey. It remained relatively stable until the early 1970's when the price of wax began to increase significantly.

Pollination

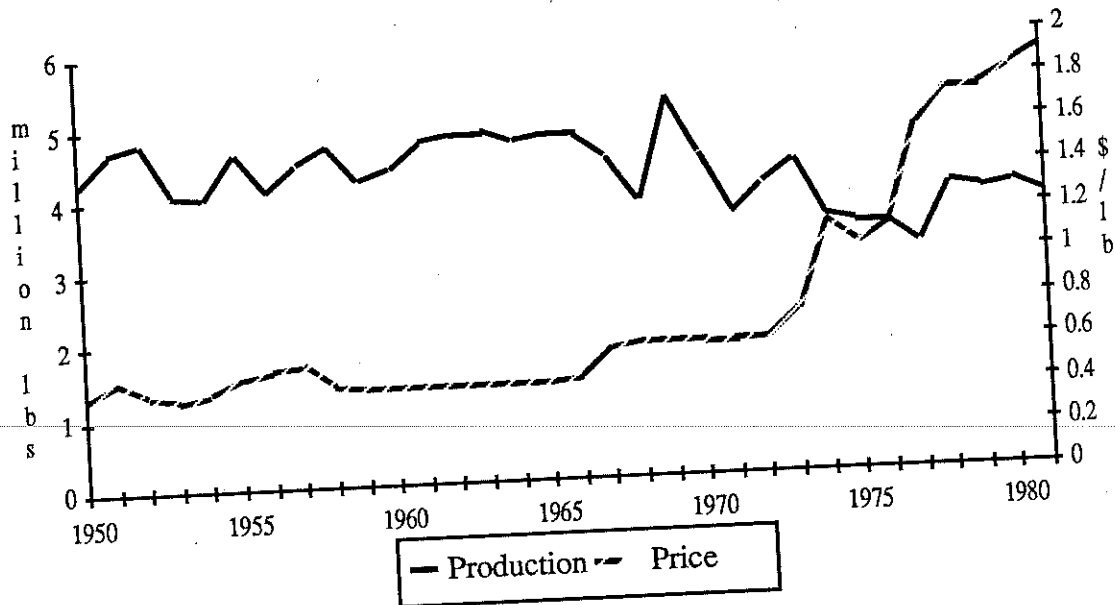
There are a variety of crops requiring bee pollination. These crops include fruits and nuts, forage seeds, vegetable and oil seeds, vegetables, and tree seeds. The recommended number of colonies used for pollination varies from crop to crop. Bee experts recommend 1.5 to 3 colonies per acre for pollination of almonds. Melons require 1.5 to 2 colonies per acre. Most vegetable and vegetable seed crops need at least 1 colony per acre for adequate pollination. Experts recommend 1.5 colonies per acre for pollination of ladino clover seed and 3 colonies per acre for alfalfa seed pollination. Because bees do not find the nectar from onion seed fields attractive, experts recommend using 6 to 10 colonies per acre for pollination.

Data on pollination activity and prices are very scarce. There are no national data available and very few states collect information on this beekeeping product of the beekeeper. Figure 11 illustrates the average price of pollination activity and the number of pollination services within the state of California. The average is based on the total value and the total number of services in California. The actual price for pollination activities varies by crop and region within the state. The variation reflects differences in weather conditions and colony supply patterns within the state.

The increase in the number of pollination services in California since 1950 comes from two sources. One is the expansion in the number of acres planted with crops dependent on honey bee pollination. The acreage of the single most important crop, almonds, has expanded an average of 6.3 percent per year since 1950. The second source is from higher concentrations of colonies used for pollination services. In the 1950's there was an average of one colony used for every three acres. Awareness of the contribution of honey bees to agricultural productivity has increased this usage to nearly 2 colonies per acre

FIGURE 10

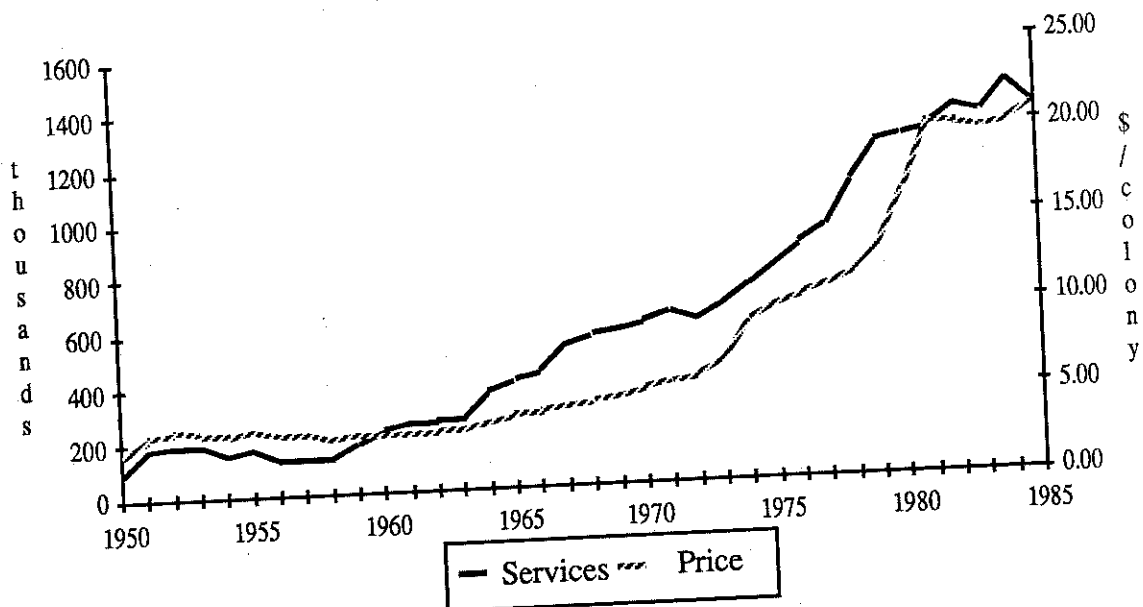
U.S. BEESWAX



Source: Hoff and Gray

FIGURE 11

CALIFORNIA POLLINATION



Source: California County Agricultural Commissioners

in the 1980's.

Queen Bees and Package Bees

The queen bee is the single most important bee in a colony. It is her qualities and characteristics that are bred into every worker bee and drone in the brood. The importance of this bee has led to the development of the queen and package bee industry. The industry's focus is to supply other beekeepers with queen bees and package bees. The beekeepers will use the queens and packages to establish new colonies, replace dead colonies, replace colonies that were not overwintered, or rejuvenate colonies. To meet the demand for queens and packages, the nation's queen and package bee industry is concentrated in areas that have a mild winter. The majority of the nation's queens and packages are produced in California, but beekeepers in Texas, Georgia, Florida, Alabama, Mississippi and Louisiana also produce these products. Statistics on the industry in states other than California are not available.

Figure 12 indicates the price of package bees in California increased slightly from 1950 to the early 1970's. In the early 1970's the package price increased from \$1.72 per pound in 1972 to \$5.11 per pound in 1975. This price increase could be from increased honey prices or increased costs of production, especially transportation costs. From 1950 to the early 1980's, the production of package bees in California expanded as more beekeepers adopted a practice of not overwintering their colonies.

The majority of the packages produced in California are shipped to the western provinces of Canada for replenishment of their colonies. As seen in Figure 12 the level of Canadian imports of package bees has continued to increase since 1956. There is a great deal of discussion in the Canadian provinces about whether to close the Canadian border to all imports of American bees. Their concern stems from the existence of mites in several bee producing regions of the United States. Should the whole border close, the American queen and package bee industry will need to look elsewhere for a market for its product.

THE U.S. HONEY INDUSTRY MODEL

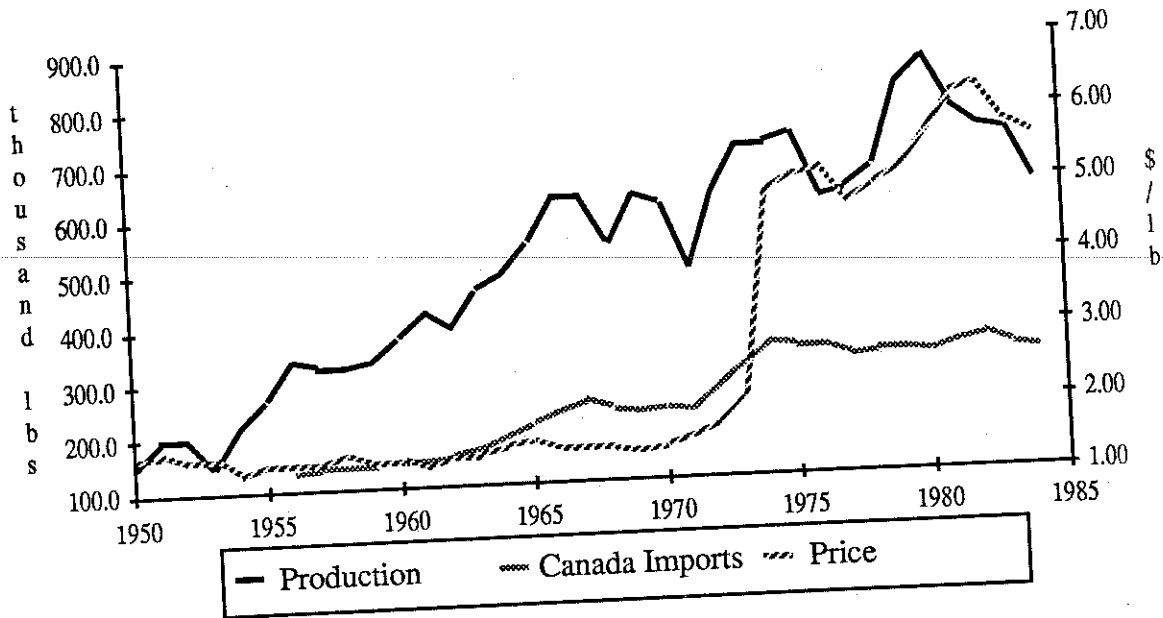
The purpose of an economic model is to represent the key relationships in an economic system while eliminating non-essential relationships. Hence, it is necessary to simplify reality into equations that contain the essence of the industry's behavioral relationships. A model of an industry is useful because it provides a means to run experiments. With a model one can forecast into the future under different scenarios. In addition, one can analyze what could happen if there were changes in policy parameters such as the support price or changes in exogenous variables, such as population, income or expenses of the beekeeper.

The econometric model of the U.S. honey industry I developed is divided into three related sectors: the Colony Response sector, the Product Supply and Demand sector, and the Processor's Marketing sector.¹⁰ Each sector includes the relevant supply and demand relationships describing the economic factors facing the operators and affecting their annual decision making strategies. Equations in the Colony Response sector describe the current level of colonies maintained by the industry and the measure of profitability for each of the

¹⁰See Willett for a thorough development of the model.

FIGURE 12

CALIFORNIA PACKAGE BEES



Source: California County Agricultural Commissioners

three beekeeping industry specializations: honey, pollination services and package and queen production. At the national level there is an additional decision about the output mix of honey and wax production, pollination services and package bee and queen bee rearing. These decisions are reflected by the equations in the Product Supply and Demand sector of the model. In addition this model sector includes relationships describing the demand for each of the beekeepers' products: honey, wax, pollination services, queen bees and package bees. This sector also includes equations describing the demand for imported honey, the quantity of honey beekeepers allocate to the CCC and that honey which is sold to the processors. In the Processors' Marketing sector, the demand for the processed honey product, the quantity of the processed product marketed each year and the stocks carried into the next year are simultaneously determined.

IMPACT OF AN ELIMINATION OF THE HONEY SUPPORT PROGRAM

In this section the impacts of a possible reduction in the honey support price on key endogenous variables in the model will be analyzed by comparing the model's dynamic predictions under a change in policy to the model's dynamic predictions in a base case. The analysis presented here compares the predictions of the model if the support price had been set so that it was ineffective beginning in 1984 with the predictions of the model in a base case scenario where all exogenous variables are set equal to their 1983 values. The only difference between the two scenarios is the change in the support price. In the base case, the support price is effective throughout the simulation. In the policy scenario, the support price is no longer effective. In each scenario the model's endogenous variables are simulated for fifteen years at which time a long run equilibrium is achieved. In this analysis it is the directions and magnitudes of the change rather than the actual point predictions of the key endogenous variables in the model that are of interest.

This policy scenario indicates a drop in the support price decreases the level of colonies maintained and the quantity of honey produced. The real price of honey sold by the beekeepers increases by approximately 2.5 cents per pound (1972\$) in the long run when the support price is made ineffective. The model indicates a termination of the support program does not affect the level of pollination services demanded from the beekeepers, yet the price for these pollination services increases by about 75 cents (1972\$). One can conclude there would be about 430 thousand fewer colonies available throughout the nation to provide these services since the level of colonies is reduced when the support program is ineffective. The model indicates the price of package bees and queen bees increases when the support program becomes ineffective and the quantities produced of queens and packages falls. A decrease in the profitability of beekeepers who specialize in honey production when the support price is ineffective is suggested by the model. The profitabilities of beekeepers who specialize in bee production and those beekeepers who focus on providing pollination services increase in the long run.

It is difficult to assess the impact of a possible elimination of the support program on the general profitability of the beekeeping industry because statistics on the proportion of the nation's colonies used primarily for honey production, pollination services or bee production are not available. However, since these data and production costs of each beekeeping product are not reported the gross revenue for the industry was assessed.

In determining the beekeeping industry's gross revenue, the nation's prices and quantities of each beekeeping product were evaluated. The model predictions indicate the long run stationary equilibrium real value of revenue received from honey and wax

production throughout the nation decreased from \$63.8 million to \$45.8 million since beekeepers were no longer receiving the high honey support price for their product. The data available and used in the model of the U.S. honey industry do not include statistics on the price and quantity of pollination services, package bees and queen bees throughout the nation. Rather, representative series from California were used in the analysis. The long run value of revenue received from pollination services, and package and queen production in California increased from \$15.0 million to \$15.6 million due to higher prices for these three products.

If one assumed the revenue received from packages, queens and pollination services in states other than California were zero, the model indicates the stationary value of the total real revenue of the beekeeping industry would decrease by about \$17 million. At the other extreme if one assumed the revenue received from packages, queens and pollination services in states other than California were four times the level of California's revenue from these products, the model indicates the equilibrium value of the total real revenue of the beekeeping industry would decrease by about \$15 million dollars. Hence, according to model predictions a possible elimination of the support program would reduce the long run equilibrium value of the revenue received by the nation's honey industry by \$15 million to \$17 million.

With an ineffective support price the model indicates processors decrease their purchases of imported honey by about 65 million pounds, increase their purchases of honey from the domestic beekeepers by about 94 million pounds and allocate no honey to the Commodity Credit Corporation in the long run. The CCC does not purchase honey and does not incur the costs of handling, storing and disposing of the honey. Hence, with an elimination of the support program, the model suggests the federal government would save about \$50 million per year by not purchasing honey from domestic beekeepers and incurring the handling, storage and disposal costs.

The model results indicate a savings of about \$50 million to the federal government and a decrease in revenue of \$15 million to \$17 million received by the nation's beekeeping industry if the federal government eliminated the honey support program. If the money used to maintain the honey support program were used to compensate beekeepers for the elimination of the program, these long run equilibrium values of the model suggest over \$33 million could be saved each year if the honey support program were ineffective.

If the federal government does not maintain stocks of honey, they are unable to dispose of the honey through food assistance programs. Hence, the amount of honey demanded from the processors expands. The model suggests the per capita consumption of purchased honey would increase from 0.80 pounds per person to 0.92 pounds per person in the long run. The long run stationary equilibrium value of the retail price received by processors for honey would increase by 4.5 cents per pound from 45.3 cents to 49.8 cents (1972\$).

Recall, this policy analysis assumes there has been a complete elimination of the honey support program. It does not evaluate a phase-out of the honey support program or a honey buy-back program as legislated by the 1985 farm bill. In addition, no other exogenous variables are allowed to change in the analysis. Hence, population, income, exogenous costs of production, etc. are not allowed to change. If a buy-back program were evaluated and exogenous variables were allowed to vary the results of the analysis would change.

CONCLUDING COMMENTS

In this paper I have identified five economic issues of concern to the beekeeping industry. An historical perspective of the economics of the beekeeping was presented and the economic structure of the industry was identified. An econometric model of the industry was described and the results of an analysis of a possible elimination of the honey support program were presented. The model of the U.S. honey industry can be used for other analyses including the evaluation of economic projections. The model could be used as a forecasting tool if assumptions about the changes in the model's exogenous variables were incorporated. These variables include population, income, costs of production the beekeeper incurs, the quantity of pollination services, the price of imported honey and the level of honey exports.

Of interest to policy makers in their evaluation of the honey support program is the impact of a tariff on imports of honey. A model scenario could be analyzed in which the cost of imports increases by the amount of the tariff. The ramifications of this change can be assessed with and without the honey support program in effect.

Finally, the model might be used to assess the potential impacts of the infiltration of the Africanized honey bee or the Varroa mite. If it is assumed the Africanized honey bee or the Varroa mite would increase the costs of production for the beekeeper the model could be used to simulate the effects of increasing costs on the endogenous variables in the industry. However, to be most useful for this purpose, it would be desirable to obtain regional data pertaining to areas most likely to be impacted by the spread of the Africanized honey bee and/or the Varroa mite.

In order to perform good economic analysis, data are essential. Economists need data relating to production and marketing experiences of beekeepers. Data concerning beekeepers' expenses, how colonies are used and the prices received for the beekeeping products would be helpful. In addition, data concerning the amount of inventory and the costs of holding such inventory would be useful in economic analysis. Better economic analysis can lead to identifying ways beekeepers and honey processors can remain competitive within a region and throughout the nation.

LITERATURE CITED

- Anderson, Earl D. An Appraisal of the Beekeeping Industry. United States. Department of Agriculture. Agricultural Research Service. ARS 42-152. Beltsville: GPO, 1969.
- Ek, Carl W. Honey Price Support: Background and Policy Issues for the 1985 Farm Bill. United States. Congressional Research Service. Environment and Natural Resources Policy Division. 85-984 ENR. Washington: Library of Congress, October 24, 1985.
- Garoyan, Leon and Stephen Taylor. Economic Trends in the U.S. Honey Industry. University of California. Division of Agricultural Sciences. Leaflet 21219. Berkeley: University of California Press, 1980.
- Hoff, Fred L., and Frederick Gray. Honey Background for 1985 Farm Legislation. United States. Department of Agriculture. Economic Research Service. National Economics Division. Agriculture Information Bulletin Number 465. Washington: GPO, 1984.
- Levin, M. D. "Value of Bee Pollination to United States Agriculture." American Bee Journal 124 (1984): 184-186.
- McGregor, S.E. Insect Pollination of Cultivated Crop Plants. United States. Department of Agriculture. Agricultural Research Service. Agriculture Handbook No. 496. Washington: GPO, 1976.
- Reed, A. D., and L. A. Horel. Bee Industry Economic Analysis for California. University of California. Division of Agricultural Sciences. Leaflet 2345. Berkeley: University of California Press, 1976.
- United States. International Trade Commission. Honey Report to the President on Investigation No. TA-201-14 under section 201 of the Trade Act of 1974. USITC Publication 781. Washington: GPO, 1976.
- United States. Department of Agriculture. Agricultural Marketing Service. Fruit and Begetable Division. National Honey Market News. Washington: GPO, Monthly Reports.
- Willett, Lois Schertz. An Econometric Analysis of Supply and Demand Relationships in the U.S. Honey Industry. Ph.D. dissertation. University of California, Davis, 1987.