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An Economic Analysis of the U.S. Honey Industry: Econometric Model

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**AN ECONOMIC ANALYSIS OF THE U.S. HONEY INDUSTRY:
ECONOMETRIC MODEL**

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ECONOMETRIC MODEL

Lois Schertz Willett*

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

ECONOMETRIC MODEL

INTRODUCTION

The U.S. honey industry is undergoing a period of rapid change. The industry has concern about the possible effects of the infiltration of Africanized honey bees into the United States and what those bees might mean for honey production and providing pollination services. Varroa mites have heightened the industry's awareness of the potential effects of spreading bee diseases and parasites on the migratory behavior of beekeepers and the package bee and queen bee industry. There is continuing concern about the influence of pesticides on bees as they forage for food and pollinate crops. The effects of changing the federal honey price support program has industry participants anxious about the ability to maintain a positive cash flow in the future. Industry support of the National Honey Board, which has taken a role in promoting the use of honey in domestic and export markets, is strong. Finally, honey producers, packers, importers and brokers want to insure that all consumers receive a high quality product that is void of chemical alteration or pesticide residues.

To assist in identifying these issues and other issues that are of concern to the U.S. honey industry, an economic study of the national honey industry was recommended and funded by the National Honey Board and the U.S. Department of Agriculture in 1989. This study, conducted by Cornell University, had two major components. The first emphasis was on a survey of the national honey industry. The purpose of the survey was to collect information to identify the needs and current economic status of the honey industry. The second emphasis of the research was to develop and expand an economic model of the national honey industry to aid in understanding the economic relationships in the industry. This model was to be used for simulation analysis of alternative

scenarios. The results were to be interpreted and implications for the industry were to be identified.

This report is one in a series of reports that summarizes the research on the economic analysis of the industry. In this report, the development of the economic model of the national honey industry is described. Data requirements and the estimation technique are identified. Model validation processes are explained. The assumptions for the simulation analysis of alternative scenarios and results of these simulations are described.

Other Cornell University reports included in the series that details the economic analysis of the industry include works (1) describing the survey sample and the type of mailing used, (2) summarizing the statistical frequency, mean, median, standard deviation, minimum and maximum of each question (3) identifying the raw data obtained from the survey, and (4) summarizing the data from the survey. Additional works are to be published through the U.S. Department of Agriculture's publication series and in beekeeping trade journals.

MODEL DEVELOPMENT

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. In this section, the model of the national honey industry is described. The model is divided into three related sectors: colony response, the supply and demand for beekeepers' products, and the demand facing honey processors and their marketing decisions. Each sector includes the relevant supply and demand relationships describing the economic factors facing the operators and affecting their annual decision making strategies. The purpose of the model presented here is to provide a framework for economic projections, sensitivity analyses and the analyses of specific scenarios.

A diagrammatic representation of the model can be found in Figure 1. All information flows and product flows between variables are indicated by arrows. All product flows are represented by bold lines. A complete listing of the model of the honey industry is in Table 1. Variable definitions are identified in Table 2. A more detailed and theoretical presentation of the model's development can be found in Willett, Lois Schertz. *An Econometric Analysis of Supply and Demand Relationships in the U.S. Honey Industry*. University of California, Davis, Ph.D. dissertation, 1987.

Colony Response

The primary products of the bee industry are honey, beeswax, and pollination services. The primary production inputs are packages of bees and queen bees, transportation services, extraction and handling equipment and labor. Some beekeepers generate replacement or expansion colonies from their own brood stock. Other beekeepers purchase replacement packages and queens. Economics assumes that all producers are profit maximizers. It is this notion that guides their production decisions and their input demand decisions. The number of colonies, an input to the production of honey, is determined by the prices of colony outputs and production inputs. In this model, these costs and product prices have been combined into a measure of joint profitability (ratios of revenue per colony to cost per colony) for beekeepers specializing in honey production, pollination services and bee production. These profitability measures, averaged over a two-year period, were included in the model estimation.

Major Relationships in the Economic Model of the U.S. Honey Industry



Table 1

Econometric Model of the U.S. Honey Industry¹

COLONY RESPONSE

Colony:

$$COL_{It} = 139.658 + 0.903 COL_{It-1} + 242.299 FACMT2_t \quad (\text{Durbin } h = 0.186)$$

(1.102) (34.323) (3.591)

Average Profitability (Lagged Endogenous):

$$FACMT2_t = (1/3) * [(FHOPMT_{t-1} + FHOPMT_{t-2})/2 + (FPOPMT_{t-1} + FPOPMT_{t-2})/2 + (FPKPMT_{t-1} + FPKPMT_{t-2})/2]$$

Honey Profitability:

$$FHOPMT_t = [PHMAXD_t * WHOHO + PWXD_t * WWXHO + PPOD_{Ct} * WPOHO + PPKD_{Ct} * WPKHO + PQND_{Ct} * WQNHO] / (PPKD_{Ct} * QPKHO + PQND_{Ct} * QQNHO + CHOPXD_t)$$

Bee Production Profitability:

$$FPKPMT_t = [PHMAXD_t * WHOPK + PWXD_t * WWXPK + PPOD_{Ct} * WPOPK + PPKD_{Ct} * WPKPK + PQND_{Ct} * WQNPk] / (PPKD_{Ct} * QPKPK + PQND_{Ct} * QQNPK + CPKPXD_t)$$

Pollination Profitability:

$$FPOPMT_t = [PHMAXD_t * WHOPO + PWXD_t * WWXPO + PPOD_{Ct} * WPOPO + PPKD_{Ct} * WPKPO + PQND_{Ct} * WQNPO] / (PPKD_{Ct} * QPKPO + PQND_{Ct} * QQNPO + CPOPXD_t)$$

Farm Price Maximum:

$$PHMAXD_t = \text{MAXIMUM}(PHFD_t, PHSD_t)$$

PRODUCT SUPPLY AND DEMAND

Honey Supply:

$$QHF_t = 121.935 + 0.049 COL_{It} + 117.232 FHOPMT_t - 73.478 FPKPMT_t - 230.157 FPOPMT_t - 867.204 X_t$$

(3.347) (5.749) (3.989) (-3.687) (-3.571) (-2.079) (DW = 2.330)

Wax Supply:

$$QWX_t = WXHOR_t * QHF_t$$

Pollination Price Setting:

$$PPOD_{Ct} = 11.063 + 0.423 PPOD_{Ct-1} + 0.0044 QPO_{Ct} - 0.0015 COL_{It-1} + 3.710 PHMAXD_{t-1} - 0.191 TRND_t$$

(4.300) (4.245) (5.377) (-3.471) (3.465) (-4.341) (Durbin h = 0.414)

¹ Coefficient t statistics, which indicate the level of significance of the variable, are in parenthesis under each coefficient. Durbin h and DW statistics measure the variation in the error term of each equation. They are all within reasonable statistical levels.

Table 1 (continued)

Econometric Model of the U.S. Honey Industry

Package Price Setting:

$$PPKD_{Ct} = 0.194 + 9.442 PHFD_{t-1} \quad (DW = 1.482)$$

(1.639) (19.302)

Queen Price Setting:

$$PQND_{Ct} = -0.229 + 0.865 PPKD_{Ct} + 3.045 QQNCOL_t \quad (DW = 1.469)$$

(-2.912) (24.562) (4.326)

Package Bee Demand:

$$QPKCOL_t = 0.035 - 0.026 PPKD_{Ct} + 0.243 PHMAXD_{t-1} + 0.933 QQNCOL_t - 0.894 X_t$$

(5.788) (-3.499) (2.944) (10.942) (-3.954)

$$+ 0.029 DUM65_t \quad (DW = 1.770)$$

(6.038)

Queen Demand:

$$QQNCOL_t = -0.113 - 0.022 PQND_{Ct} + 0.289 PHMAXD_{t-1} + 0.247 QPKCOL_t - 0.169 X_t$$

(-2.602) (-3.577) (4.489) (4.205) (-1.023)

$$+ 0.0023 TRND_t \quad (DW = 1.414)$$

(6.200)

Allocation of Honey between CCC and Processors:

$$QHC_t = AHC_t * QHF_t$$

$$AHC_t = POS(-1.217 + 1.441 PHSFARD_t)^{\frac{1}{2}} \quad (DW = 2.117)$$

(-3.059) (4.131)

$$PHSFARD_t = PHSD_t / PHFD_t$$

$$QHP_t = (1 - AHC_t) * QHF_t$$

Demand for Beekeepers' Honey:

$$PHFD_t = 0.263 - 0.0044 QSHPM_t - 0.0028 ICHPD_t + 0.249 PHRDF_{t-1} + 0.017 DHM_{t-1}$$

(4.796) (-0.393) (-5.714) (3.939) (1.205)

$$+ 0.613 PHID_t + 0.098 DUM73_t - 0.623 X_t \quad (DW = 1.526)$$

(13.629) (8.580) (-2.214)

$$QSHPM_t = QHP_t / M_t + SHP_t / M_t$$

Demand for Imported Honey:

$$IHM_t = 0.375 - 0.143 QSHPM_t + 0.827 PHMAXD_t + 0.068 PHRDF_{t-1} - 1.699 PHID_t$$

(3.570) (-4.735) (1.558) (0.282) (-4.035)

‡ The POS function takes the value in parenthesis or 0 whichever is larger.

Table 1 (continued)
Econometric Model of the U.S. Honey Industry

Package Price Setting:

$$PPKD_{Ct} = 0.194 + 9.442 PHFD_{t-1} \quad (DW = 1.482)$$

(1.639) (19.302)

Queen Price Setting:

$$PQND_{Ct} = -0.229 + 0.865 PPKD_{Ct} + 3.045 QQNCOL_t \quad (DW = 1.469)$$

(-2.912) (24.562) (4.326)

Package Bee Demand:

$$QPKCOL_t = 0.035 - 0.026 PPKD_{Ct} + 0.243 PHMAXD_{t-1} + 0.933 QQNCOL_t - 0.894 X_t$$

(5.788) (-3.499) (2.944) (10.942) (-3.954)

$$+ 0.029 DUM65_t \quad (DW = 1.770)$$

(6.038)

Queen Demand:

$$QQNCOL_t = -0.113 - 0.022 PQND_{Ct} + 0.289 PHMAXD_{t-1} + 0.247 QPKCOL_t - 0.169 X_t$$

(-2.602) (-3.577) (4.489) (4.205) (-1.023)

$$+ 0.0023 TRND_t \quad (DW = 1.414)$$

(6.200)

Allocation of Honey between CCC and Processors:

$$QHC_t = AHC_t * QHF_t$$

$$AHC_t = POS(-1.217 + 1.441 PHSFARD_t)^{\forall} \quad (DW = 2.117)$$

(-3.059) (4.131)

$$PHSFARD_t = PHSD_t / PHFD_t$$

$$QHP_t = (1 - AHC_t) * QHF_t$$

Demand for Beekeepers' Honey:

$$PHFD_t = 0.263 - 0.0044 QSHPM_t - 0.0028 ICHPD_t + 0.249 PHRDF_{t-1} + 0.017 DHM_{t-1}$$

(4.796) (-0.393) (-5.714) (3.939) (1.205)

$$+ 0.613 PHID_t + 0.098 DUM73_t - 0.623 X_t \quad (DW = 1.526)$$

(13.629) (8.580) (-2.214)

$$QSHPM_t = QHP_t / M_t + SHP_t / M_t$$

Demand for Imported Honey:

$$IHM_t = 0.375 - 0.143 QSHPM_t + 0.827 PHMAXD_t + 0.068 PHRDF_{t-1} - 1.699 PHID_t$$

(3.570) (-4.735) (1.558) (0.282) (-4.035)

[¥] The POS function takes the value in parenthesis or 0 whichever is larger.

Table 1 (continued)

Econometric Model of the U.S. Honey Industry

$$+ 0.143 \text{ DUM73}_t + 2.667 X_t \quad (\text{DW} = 1.848)$$

(2.562) (2.465)

Wax Demand:

$$\text{PWXD}_t = 0.151 - 5.713 \text{ QWXM}_t + 0.055 \text{ FHOPMT}_{t-1} + 0.786 \text{ PWXID}_t - 2.159 X_t \quad (\text{DW} = 1.500)$$

(3.447) (-4.930) (2.529) (25.915) (-3.648)

$$\text{QWXM}_t = \text{QWX}_t / M_t$$

PROCESSORS' MARKETING

Domestic Supply of Processed Honey:

$$\text{QDHMM}_t = -0.295 + 0.943 \text{ QSHPM}_t + 1.179 \text{ PHRDFX}_t - 0.250 \text{ PHMAXDX}_t$$

(-2.287)(15.472) (2.276) (-0.583)

$$+ 0.0058 \text{ TRND}_t - 5.049 X_t \quad (\text{DW} = 1.586)$$

(2.385) (-4.692)

$$\text{PHRDFX}_t = \text{PHRDF}_t - \text{PHRDF}_{t-1}$$

$$\text{PHMAXDX}_t = \text{PHMAXD}_t - \text{PHMAXD}_{t-1}$$

Demand for Processed Honey:

$$\text{PHRDF}_t = 0.423 - 0.043 \text{ DHM}_t + 0.213 \text{ DUM73}_t - 0.012 \text{ TRND73}_t - 0.993 X_t \quad (\text{DW} = 2.381)$$

(17.504) (-2.257) (21.798) (-9.338) (-2.340)

$$\text{DHM}_t = \text{QDHMM}_t + \text{IHM}_t - \text{EH}_t / M_t$$

Carry-over Stocks:

$$\text{SHP}_{t+1} = \text{QHP}_t + (\text{IHM}_t * M_t) + \text{SHP}_t - (\text{DHM}_t * M_t) - \text{EH}_t$$

Table 2
Model Variable Definitions²

Name	Definition	Measure
AHC	Allocation of Honey to the CCC	(proportion)
<u>CHOPXD</u>	Exogenous Input Costs for Honey Producer	(\$/colony)
*COL _I	Industry Colonies	(thousands)
<u>Constant</u>	Intercept	(1)
<u>CPKPXD</u>	Exogenous Input Costs for Package Bee Producer	(\$/colony)
<u>CPOPXD</u>	Exogenous Input Costs for Pollination Producer	(\$/colony)
*DHM	Disappearance of Honey	(lbs/person)
<u>DUM65</u>	Dummy in 1965 and After	(0 or 1)
<u>DUM73</u>	Dummy in 1973 and After	(0 or 1)
<u>EH</u>	Exports of Honey	(million lbs)
*FACMT2	Profitability Ratio for All Products in time t-1 and t-2	(dimensionless)
*FHOPMT	Profitability Ratio for Honey Production	(dimensionless)
*FPKPMT	Profitability Ratio for Package Bee Production	(dimensionless)
*FPOPMT	Profitability Ratio for Pollination Services	(dimensionless)
<u>ICHPD</u>	Index of Costs of Honey Processing	(1972=100)
IHM	Imports of Honey	(lbs/person)
<u>M</u>	Population	(millions)
*PHFD	Farm Price of Honey	(72\$/lb)
<u>PHID</u>	Price of U.S. Honey Imports	(72\$/lb)
*PHMAXD	Maximum Farm Price of Honey	(72\$/lb)
PHMAXDX	Farm Price of Honey Differential between t and t-1	(72\$/lb)
*PHRDF	Retail Price of Honey	(72\$/lb)
PHRDFX	Retail Price of Honey Differential between t and t-1	(72\$/lb)
<u>PHSD</u>	Price Support for Honey	(72\$/lb)
PHSFARD	Support to Farm Honey Price Ratio	(dimensionless)
PPKD _C	Price of Package Bees (California)	(72\$/lb)
*PPOD _C	Price of Pollination Services (California)	(72\$/service)
PQND _C	Price of Queen Bees (California)	(72\$/bee)
PWXD	Price of Wax	(72\$/lb)
<u>PWXID</u>	Price of Wax Imports	(72\$/lb)
QHC	Quantity of Honey to the CCC	(million lbs)
QHF	Quantity of Honey	(million lbs)
QDHMM	Quantity of Domestic Honey Marketed	(lbs/person)
QHP	Quantity of Honey to Processors	(million lbs)
QPKCOL	Ratio of Packages to Colonies in t-1	(lbs/colony)
**QPK(J)	Packages Used by (J) Producer, where	(lbs/colony)
	J = HO Honey	
	PK Package Bee	
	PO Pollination	

² Exogenous variables, those determined outside the model, are underlined. Lagged endogenous variables, those determined by the model in a previous period, are preceded by an asterisk. Parameters are identified by a double asterisk.

Table 2 (continued)

Model Variable Definitions

Name	Definition	Measure
<u>QPO_C</u>	Quantity of Pollination Services (California)	(thsnd services)
<u>QQN_{COL}</u>	Ratio of Queens to Colonies	(bees/colony)
<u>**QQN(J)</u>	Queens Used by (J) Producer, where J is as in QPK(J)	(bees/colony)
<u>QSHPM</u>	Total Domestic Quantity of Honey at the Processor	(lbs/person)
<u>QWX</u>	Quantity of Wax	(million lbs)
<u>QWXM</u>	Quantity of Wax	(lbs/person)
<u>*SHP</u>	Stocks of Honey	(million lbs)
<u>TRND</u>	Linear Time Trend	(year, 1952=3)
<u>TRND73</u>	Time Trend Beginning in 1973	(year, 1973=1)
<u>**WHO(J)</u>	Honey Produced by (J) Producer, where J is as in QPK(J)	(lbs/colony)
<u>**WPK(J)</u>	Packages Produced by (J) Producer, where J is as in QPK(J)	(lbs/colony)
<u>**WPO(J)</u>	Pollination Services Produced by (J) Producer, where J is as in QPK(J)	(services/colony)
<u>**WQN(J)</u>	Queens Produced by (J) Producer, where J is as in QPK(J)	(bees/colony)
<u>**WWX(J)</u>	Wax Produced by (J) Producer, where J is as in QPK(J)	(lbs/colony)
<u>WXHOR</u>	Wax to Honey Production Ratio	(lbs/lbs)
<u>X</u>	Dummy Variable for Support Program Effectiveness	(0 or 72\$/lb)

Product Supply and Demand

The supply and demand of bee products are influenced by the level of colonies maintained in the industry. The supply of honey is determined by the number of colonies available, the profitability of using these colonies for honey production, providing pollination services and producing bees. In addition, the federal support program has an impact on the quantity of honey produced. The supply of wax is proportional to honey production.

The supply of pollination services is determined jointly with considerations of the demand for pollination services. Because there is little or no substitution between pollination and other farm inputs and because the cost of pollination relative to the total value of crop production is quite small, the demand for pollination services is not very responsive to price changes. The primary factors determining the demand for pollination services are the area of land requiring pollination services and the number of pollination services used per acre. The latter increased over the period of study due in part to changes in the crop mix and farmers' greater awareness of the potential benefits of bees. Analysis revealed no significant effect of the pollination price on the pollination services used per acre over the range of observed data. Hence, the quantity of pollination services demanded by crop producers is determined outside the specified model.

The price of pollination services is determined by the model. It is expressed as a function of the price of the service charged in the previous year, the quantity of services demanded, the availability of colonies to provide these services, the price received to produce honey, and a time trend. The previous period's pollination price reflects inertia in the system and existing contractual arrangements between farmers and beekeepers. The inclusion of honey price reflects the trade-off between honey production and pollination services due to the foraging intensity of providing pollination services. The time trend variable accounts for secular increases in beekeepers' willingness to supply colonies for pollination services.

Package bee producers base the package price on the price of honey, and sell whatever packages are demanded at that price. The price of queen bees has been set based on the price of packages, with some modification reflecting the movement of queens relative to the number of colonies. The demands for package bees and queens are proportional to the number of colonies. However, the proportions vary with the product price, the level of the federal support program and shifts over time that are measured by time trend variables and shifter variables.

Beekeepers are assumed to forfeit their honey to the Commodity Credit Corporation (CCC) when the support price exceeds the market price. However, the allocation does not jump from zero percent to one hundred percent, but increases with increases in the ratio of the support price to the market price. Some honey may be allocated to the CCC even when the market price is below the support price due to market imperfections, differences in availability and accessibility of CCC storage facilities across the country, and differences in honey quality. The quantity sold to processors is the difference between the total production and the quantity forfeited to the CCC.

Honey processors obtain raw honey from both U.S. producers and from other countries. Imported honey is not a perfect substitute for U.S. produced honey because of market contracts, concern over dependence on imports, and variations in quality and type of honey. Under the competitive conditions assumed here, the profit-maximizing behavior of processors generates a demand equation for beekeepers' honey that expresses the price they pay as a function of the quantity of available honey, the costs of processing, the retail price of the processed honey, domestic honey consumption, the price of imported honey, the influence of the federal support program and a variable which captures the shift in prices which occurred in the mid-1970's.

The demand for imported honey is a function of the import price, the domestic honey price, and the price at which processors expect to sell the honey. The variable

reflecting the support program and a variable which captures the shift in prices which occurred in the mid-1970's was included in this relationship.

Beeswax is purchased by bee supply dealers and by manufacturing industries. Imported wax is a strong substitute for domestically produced wax. Hence, the demand facing beekeepers expresses the price of wax as a function of the quantity of wax, the profitability of honey production which accounts for changes in the wax demand from beekeepers, the price of imported wax, and the support program which may alter the demand.

Processors' Marketing

The annual supply of processed honey consists of the quantity of domestically produced raw honey which is converted to processed honey with little or no loss, the quantity of honey imported, and inventory carried into the current year. Processor decisions on the amount of the annual supply to market in the current year and to carry as inventory to the next year are made under conditions of uncertainty as to supply and demand conditions. There are no generally-accepted economic principles to predict processor behavior in the face of this uncertainty. This model's function describing the quantity of domestic honey marketed in the current year is specified as a function of the available supply of domestic honey, a change in the price of the product purchased from producers, and a change in the price of the processed honey. The trend variable accounts for a general increase in market allocation and reduced average inventory carry-over across the time period of the model. The variable capturing the impact of the support program is also included in the model.

Honey processors face a demand function derived from consumer, institutional and manufacturing uses. The demand for processed honey is expressed where price is a function of the total disappearance of honey and other variables that may influence the level of consumer demand. These variables include a trend variable and a dummy

variable to reflect changes in the data over the sample used for estimation. The variable capturing the federal support program is also included to capture possible effects of free distribution of CCC stocks beginning with their accumulations in 1981.

Carry-over stocks in the model are determined by the sum of the total honey processed, imports, carry-in stocks, disappearance and honey exports.

MODEL ESTIMATION AND VALIDATION

This model of the honey industry is a national model. Data used in the estimation are annual values for the period 1952 through 1984. Additional data are used for out-of-sample prediction testing. Data pertaining to bee colonies, honey quantities and prices are U.S. values. Data pertaining to costs of production, prices and quantities of pollination services, package bees and queen bees are for California since U.S. values are not reported. All monetary values in the model are deflated by the U.S. personal consumption expenditure deflator.

The model was estimated using econometric techniques. The three-stage least squares technique provides efficient, unbiased and consistent estimates of the coefficients while incorporating the simultaneous nature of the economic relationships. The model's coefficients and corresponding t statistics can be found in Table 1. The model was estimated on a VAX minicomputer using an econometric computer package called TSP (Time Series Processor).³ The program used for model estimation can be found in Appendix A.

The model of the honey industry was validated according to the performance of its complete dynamic system. After specifying the initial values of the model variables all future values are predicted using previous model predictions. Commonly used procedures for evaluating a model's ability to track historical values are to perform static and dynamic deterministic simulations for the time period of the data set (Kost). In the

³ TSP is produced by TSP International P. O. Box 61015, Station A Palo Alto, CA 94306.

static, or one-period-ahead, simulation the model computes the predicted values of current endogenous variables each period using the actual values of lagged endogenous variables. These one-period-ahead predictions serve mainly as an accuracy check. The dynamic simulation differs from the static simulation in that after the initial period the model's predicted values of lagged endogenous variables are used to generate future values of the endogenous variables. Measures of goodness of fit were calculated for the static and dynamic simulations. These measures indicated a sound econometric model.

The model's long run dynamic properties were evaluated using dynamic simulation. These properties indicated the model achieved stability when all variables determined outside the model system were held fixed at previous historical levels.

SIMULATION ANALYSES

Several questions can be answered using the economic model of the industry. In all model analyses, it is important to remember that it is the relative change in model variables, rather than the absolute magnitude of the variables, that is of importance. Because of the importance of the relative changes, a base case of the model should be established for comparison purposes. This base case will use the economic model, as estimated, to project beyond the data set of the model. In the projection, all variables specified outside the model (such as costs of production, costs of processing, etc.), are held at a fixed level. The base case can be used to gain an understanding of the model links and the importance of model sectors. Once the base case is established, other scenarios are used to analyze a single change in the industry. A comparison with the base case enables the model user to isolate the impacts of key factors. For this analysis, six scenarios were evaluated. The first scenario establishes the base case. The second scenario assumes the federal support program is ineffective. The remaining scenarios are coupled with the assumption that the federal support program remains ineffective. In other words all industry participants respond to market forces. An increase in honey

demand is assumed in the third scenario. The fourth simulation assumes there is an increase in the price paid to producers. Scenario five assumes higher costs of production for producers. The final scenario assumes that honey exports have expanded. The assumptions for each of these scenarios and the results of the model simulation are described. Simulation values for these analyses can be found in Table 3. This table includes the values for select model variables for the first five periods and the tenth period following initiation of the simulation. Computer programs for each scenario can be found in Appendices B through G.

Scenario 1 - Base Case

A base case was established where all variables specified outside the model are held at fixed levels. This base case was used to project past the time period of the model and to gain an understanding of the model links and the importance of model sectors. Its key purpose was to serve as a benchmark for comparisons with other scenarios. The comparison allows for isolation of the impacts of a single change in the industry.

Implementation of this scenario required that all external variables be held constant. These variables include the support price variables, time trend variables, costs of production, pollination services demanded, the price of imported beeswax, the price of imported honey, honey exports, population, and costs of honey processing. The variables are held at the final value of the data set used in the model estimation. The model was allowed to generate values of the internal model variables.

In this base case scenario, the model achieves a stationary equilibrium by the tenth time period. The level of colonies (COL_I) falls leading to a decrease in the honey supply (QHF). There is an increase in the price for pollination services ($PPOD_C$) since there are fewer colonies to provide the number of services. However, there is a decrease in the price for package bees ($PPKD_C$) and queens ($PQND_C$) since there is a drop in the demand for packages and queens. The ratios of packages to colonies ($QPKCOL$) and

Table 3
Simulation Analyses - Scenarios 1 through 6

		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
			Ineffective Federal Support Program	Ineffective Support and Increase in Honey Demand	Ineffective Support and Increase in Price Paid to Producers	Ineffective Support and Higher Costs of Production	Ineffective Support and Expansion of Honey Exports
	Period	Base Case					
96	Colony (COL _I) (thousands)	1	4,266	4,266	4,266	4,266	4,266
		2	4,235	4,226	4,226	4,208	4,226
		3	4,204	4,180	4,182	4,130	4,180
		4	4,177	4,143	4,150	4,063	4,143
		5	4,152	4,112	4,127	4,004	4,112
		10	4,068	4,003	4,097	3,800	4,003
	Honey supply (QHF) (million pounds)	1	185	213	213	230	213
		2	186	213	214	229	213
		3	183	207	208	222	207
		4	181	205	205	217	205
		5	179	202	202	213	202
		10	172	193	196	197	193
	Pollination price (PPOD _C) (1972\$/service)	1	8.58	8.58	8.58	8.58	8.58
		2	8.58	8.37	8.37	8.37	8.37
		3	8.63	8.41	8.44	8.44	8.41
		4	8.70	8.49	8.56	8.58	8.49
		5	8.77	8.58	8.69	8.74	8.58
		10	9.05	8.94	9.02	9.41	8.94
	Package price (PPKD _C) (1972\$/pound)	1	2.23	2.23	2.23	2.23	2.23
		2	2.13	2.34	2.34	2.33	2.34
		3	2.15	2.50	2.58	2.50	2.50
		4	2.15	2.49	2.64	2.49	2.49
		5	2.15	2.48	2.72	2.49	2.48
		10	2.15	2.48	2.87	2.48	2.48

Table 3 (continued)
Simulation Analyses - Scenarios 1 through 6

		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
			Ineffective Federal Support Program	Ineffective Support and Increase in Honey Demand	Ineffective Support and Increase in Price Paid to Producers	Ineffective Support and Higher Costs of Production	Ineffective Support and Expansion of Honey Exports
	Period	Base Case					
Queen price (PQND _C) (1972\$/bee)	1	2.11	2.17	2.17	2.17	2.17	2.18
	2	2.03	2.18	2.18	2.36	2.18	2.18
	3	2.04	2.32	2.39	2.68	2.32	2.32
	4	2.04	2.31	2.45	2.85	2.31	2.31
	5	2.04	2.31	2.52	3.03	2.31	2.31
	10	2.04	2.31	2.66	3.20	2.31	2.31
Package demand (QPKCOL) (pounds/colony)	1	0.162	0.218	0.218	0.218	0.218	0.218
	2	0.168	0.177	0.177	0.179	0.177	0.177
	3	0.167	0.179	0.179	0.182	0.178	0.179
	4	0.167	0.178	0.179	0.183	0.178	0.178
	5	0.167	0.178	0.180	0.185	0.178	0.178
	10	0.167	0.178	0.182	0.187	0.178	0.178
Queen demand (QQNCOL) (bees/colony)	1	0.132	0.154	0.154	0.154	0.154	0.154
	2	0.136	0.128	0.128	0.129	0.128	0.128
	3	0.135	0.129	0.130	0.133	0.129	0.129
	4	0.135	0.129	0.130	0.134	0.129	0.129
	5	0.135	0.129	0.131	0.136	0.129	0.129
	10	0.135	0.129	0.132	0.138	0.129	0.129
Allocation (AHC) (proportion)	1	0.780	0.000	0.000	0.000	0.000	0.000
	2	0.764	0.000	0.000	0.000	0.000	0.000
	3	0.765	0.000	0.000	0.000	0.000	0.000
	4	0.765	0.000	0.000	0.000	0.000	0.000
	5	0.765	0.000	0.000	0.000	0.000	0.000
	10	0.765	0.000	0.000	0.000	0.000	0.000

Table 3 (continued)
Simulation Analyses - Scenarios 1 through 6

		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
			Ineffective Federal Support Program	Ineffective Support and Increase in Honey Demand	Ineffective Support and Increase in Price Paid to Producers	Ineffective Support and Higher Costs of Production	Ineffective Support and Expansion of Honey Exports
Honey price (PHFD) (1972\$/pound)	Period	Base Case					
	1	0.205	0.227	0.227	0.248	0.227	0.227
	2	0.207	0.244	0.252	0.286	0.244	0.244
	3	0.207	0.243	0.259	0.306	0.243	0.243
	4	0.207	0.243	0.267	0.327	0.243	0.243
	5	0.207	0.243	0.276	0.348	0.243	0.243
	10	0.207	0.243	0.284	0.348	0.243	0.242
Honey Imports (IHM) (pounds/person)	1	0.539	0.280	0.280	0.296	0.269	0.280
	2	0.542	0.327	0.336	0.360	0.316	0.327
	3	0.543	0.329	0.341	0.380	0.319	0.329
	4	0.543	0.330	0.345	0.399	0.321	0.330
	5	0.544	0.331	0.349	0.417	0.324	0.331
	10	0.545	0.337	0.351	0.418	0.335	0.337
Honey Disappearance (DHM) (pounds/person)	1	0.717	1.374	1.374	1.394	1.429	1.368
	2	0.696	1.182	1.154	1.221	1.242	1.175
	3	0.692	1.167	1.139	1.221	1.221	1.161
	4	0.691	1.162	1.135	1.231	1.208	1.155
	5	0.689	1.153	1.130	1.240	1.193	1.147
	10	0.683	1.120	1.145	1.241	1.134	1.114
Honey processing price (PHRDF) (1972\$/pound)	1	0.422	0.434	0.468	0.433	0.432	0.435
	2	0.423	0.443	0.511	0.441	0.440	0.443
	3	0.425	0.443	0.546	0.441	0.441	0.443
	4	0.424	0.443	0.580	0.440	0.441	0.444
	5	0.424	0.444	0.614	0.440	0.442	0.444
	10	0.424	0.445	0.613	0.440	0.445	0.445

queens to colonies (QQNCOL) actually increase due to the fall in colony levels by the tenth time period. A small drop in the allocation of honey to the Commodity Credit Corporation (AHC) occurs. This decrease is not large since the honey price paid to producers (PHFD) remains below the federal support price specified in the model's base case.

The per capita demand for imported honey (IHM) remains strong since a significant amount of domestic honey is allocated to the Commodity Credit Corporation. The per capita disappearance of honey (DHM) decreases due to increases in the price of processed honey (PHRDF).

Scenario 2 - Ineffective Federal Support Program

This scenario eliminates the federal support program and allows the economic model to determine the prevailing market prices. This scenario does not assume the support program elimination is due to an increase in the price received by producers. Implementation of this scenario requires that all price support variables be set such that the federal support program is ineffective. These variables include the support price and a switching variable. The switching variable is turned off in this simulation. There are no other changes in the model variables. These scenario results will be compared with the Base Case.

In the first period of the simulation, the allocation of honey to the Commodity Credit Corporation (AHC) falls to 0. All honey is marketed through other channels. The honey price paid to producers (PHFD) rises by nearly seventeen (17) percent in the tenth period of simulation when compared to Scenario 1 - Base Case. By model equilibrium there is a thirty-three (33) percent decrease in the per capita quantity of honey imported (IHM). Since honey is not allocated to the Commodity Credit Corporation and thus not distributed by the CCC, there is an increase in the per capita disappearance of honey (DHM). This disappearance is actual honey marketed by producers. This expansion puts

upward pressure on the processed price of honey (PHRDF). The elimination of the effective support program leads to a small decrease in the number of colonies (COL_I). Due to the tradeoff between production of honey and other products such as packages, queens, wax and pollination services, this decrease in colonies is used to expand honey production (QHF). At equilibrium, there is a twelve (12) percent increase in the honey supply (QHF). The 64 percent increase in the per capita disappearance of honey (DHM) is consistent with the five (5) percent increase in the honey processing price at equilibrium (PHRDF).

Scenario 3 - Ineffective Federal Support Program and Increase in Honey Demand

In the economic model the price for processed honey is determined by the supply of honey and the demand for honey at the processed market level. The demand for honey is expressed by a function which relates the quantity demanded to price and other variables. In this scenario it is assumed there is a shift in the demand function for processed honey and an ineffective federal support program. The shift in demand could result from increased income of consumers, increased awareness by consumers of the benefits of honey and/or increased advertising. In this scenario, it is assumed the demand function for honey shifts outward over a five year period. Each year there is an eight (8) percent increase in the demand function for honey (i.e. a forty (40) percent total shift in the demand function). Even though there is a shift in the demand function for honey, all other model interactions remain intact. Hence, the model determines the producer price (PHFD), the processed market price (PHRDF), quantity of honey production (QHF), the per capita disappearance of honey (DHM) and per capita import levels (IHM), etc. that result from the shift in honey demand. The discussion of this model scenario includes a comparison with Scenario 2 - Ineffective Federal Support Program so that the impacts of a shift in honey demand are isolated.

As seen in Table 3, the shift in honey demand coupled with an ineffective support program leads to a thirty-eight (38) percent increase in the price for processed honey (PHRDF) when compared to Scenario 2 - Ineffective Federal Support Program. Some of this price increase is passed to producers. By the tenth period of analysis, the price to producers (PHFD) is seventeen (17) percent greater than under Scenario 2. The increased demand for honey leads to increases in the level of per capita imports (IHM). However, there is an initial decrease in the disappearance of honey (DHM) due to the higher processed honey price (PHRDF). Hence, the quantity of domestic honey that is sold by processors falls and stock levels increase. Higher honey prices increase the profitability of producing honey and give beekeepers incentive to expand their colony levels (COL_I). More queens and package bees are demanded driving up the price of these products (PQND_C and PPKD_C). Even though there is a two (2) percent increase in the number of colonies (COL_I) there is virtually no change in the production of domestic honey (QHF).

Scenario 4 - Ineffective Federal Support Program and Increase in Price Paid to Producers

The price paid to producers for honey is determined by the producer's supply of honey and the demand for producer's honey at the farm level. In this model of the honey industry, the demand function for producer honey is specified as a relationship between the price paid for producers' honey (PHFD) and the total honey supply (QSHPM) and other variables. The honey price is the dependent variable in the equation. In this scenario it is assumed there is an ineffective federal support program and a shift in this price function of producer honey. This shift in demand could result from changes in the costs of processing honey, or changes in the honey requirements of manufactured products. It is assumed the price function for producer price of honey shifts outward over a five year period. Each year there is an eight (8) percent increase in the price specification for honey (i.e. a forty (40) percent total shift in the price function). All other model interactions remain intact. Hence, the model determines the processed

market price (PHRDF), the quantity of honey production (QHF), the per capita disappearance of honey (DHM) and per capita import levels (IHM), etc. that result from the shift in the price function.

As seen in Table 3 there is a forty-three (43) percent increase in the price paid to producers (PHFD) by the tenth period of the simulation when compared to Scenario 2 - Ineffective Federal Support Program. The higher price increases the profitability of beekeeping and leads to a seven (7) percent increase in colony levels (COL_I). Higher colony levels generate new demand for queens and package bees leading to a forty (40) percent increase in the prices of these products (PQND_C and PPKD_C). The higher producer price (PHFD) makes imports more attractive to processors. A twenty-five (25) percent increase in per capita imports (IHM) results. The larger quantity of imports coupled with the increase in honey production yields an increase in the disappearance of honey (DHM). However, this increase in disappearance and the increase in supply yields a market condition where there is a small decrease in the processed price of honey (PHRDF).

Scenario 5 - Ineffective Federal Support Program and Higher Costs of Production

In this scenario a twenty (20) percent increase in beekeeper costs of production is evaluated. The cost increases could occur if there were increased regulation of the industry or increased management required due to the Africanized honey bee or mite infestations. These cost increases were coupled with an ineffective federal support program. To isolate the effects of increased costs of production, this scenario should be compared with Scenario 2 - Ineffective Federal Support Program. Implementation of this scenario is through a one time increase in the costs of production specified by the model. The higher costs of production remain in effect for the remainder of the simulation.

As seen in Table 3, a twenty (20) percent increase in beekeeper costs of production impacted the profitability of beekeeping. Five (5) percent fewer colonies

(COL_I) were maintained. There was a five (5) percent increase in the price charged for pollination services (PPOD_C). However, price for packages (PPKD_C) and the price for queen bees (PQND_C) remained virtually unchanged. The price received by producers for honey (PHFD) is similar to the price under Scenario 2. Hence, the increased costs of production are not covered by increased honey prices.

Scenario 6 - Ineffective Federal Support Program and Expansion of Honey Exports

In this scenario a twenty (20) percent increase in honey exports was analyzed. This expansion could occur if a targeted export program were in place. To isolate the effects of increased exports, this scenario should be compared with Scenario 2 - Ineffective Federal Support Program. Scenario implementation is through a one time increase in the level of honey exports. The increase will not be phased in over a five year period. The twenty (20) percent increase in honey exports is based on the final value of the data set used for model estimation. This expansion remains effective for the remainder of the scenario analysis.

As seen in Table 3, an increase in exports immediately reduces the disappearance of honey (DHM) since the disappearance of honey (DHM) reflects the domestic honey marketed plus imports less exports. There is some upward pressure on the processed price of honey (PHRDF) in the initial period of the simulation. However, this twenty (20) percent increase in exports is equivalent to a 1.5 million pound or one-half of one percent decrease in the total domestic disappearance of honey. Hence, this relatively large increase in honey exports is a fairly small change in the industry. The impacts are not significant.

CONCLUSIONS

The research reported here presents an economic model of the national honey industry. The data required for estimation and the estimation techniques were identified. Model validation processes were explained. The assumptions for simulation analysis of six scenarios were presented. These scenarios presented model results under a base case, an ineffective federal support program an increase in honey demand, an increase in price paid to producers, an increase in the costs of production and an expansion in exports.

All model analyses indicate that the complete effects of any of these changes, particularly the increase in honey demand and the increase in the price paid to producers, are mitigated by the economic interactions in the industry. Since the model consists of relationships that capture the economic factors influencing demand and supply, the price is established by these factors. The model allows the prices and other variables to reflect the economic situation in the complete industry. Hence, a forty percent increase in the demand for honey and a forty percent increase in the price paid to producers may be difficult to maintain since economic signals in the industry could cause industry adjustment that may lessen these effects.

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APPENDICES

APPENDIX A
COMPUTER PROGRAM FOR
MODEL ESTIMATION

Appendix A: Computer Program for Model Estimation

```
NAME LSW 'ESTIMATION OF HONEY MODEL';
?
?
?
FREQ A;
SMPL 1952, 1984;
IN NEWHON;
?
?
OPTIONS PLOTS;
OLSQ AHC, C, PHSFARD;
?
PRINT AHC, PHSFARD;
?
?-----
FRML COLSUP COL=A0+A1*COL(-1)+A2*FACMT2;
?
FRML HONSUP   QHF = B0 + B1*COL + B2*FHOPMT + B3*FPKPMT +
B4*FPOPMT+B5*DUMPHSDF;
IDENT WAXSUP   QWX = WXHOR*QHF;
FRML POLSUP   PPOD=C0+C1*PPOD(-1) +C2*QPO+C3*COL(-1)+C4*PHMAXD(-
1)+C5*TRND;
FRML PPKPR     PPKD = D0 +D1*PHFD(-1);
FRML QQNPR     PQND = E0 + E1* PPKD + E2*QQNCOL;
IDENT ALLOC1   AHC = POS(F0 + F1*PHSFARD)*DUMALL;
IDENT ALLOC2   QHP = (1-AHC)*QHF;
FRML WAXDMD    PWXD = G0 + G1*QWXM+ G2*FHOPMT(-1) +
G3*PWXID+G4*DUMPHSDF;
FRML PPKDMD    QPKCOL = H0 + H1*PPKD + H2*QQNCOL + H3*PHMAXD(-1)
+ H4*DUM65 + H5*DUMPHSDF;
FRML QQNDMD    QQNCOL = I0+ I1* PQND+ I2*QPKCOL + I3*PHMAXD(-1) +
I4*TRND + I5*DUMPHSDF;
FRML HONDMD    PHFD = J0 + J1* QSHPM + J2*ICHPD+ J3*PHRDF(-1)+ J4*
PHID+J5*DUM73+J6*DUMPHSDF+J7*DHM(-1);
FRML IMPDMD    IHM = K0 +K1 * QSHPM+ K2* PHRDF(-1)+K3*PHID + K4*
PHMAXD + K5*DUM73+K6*DUMPHSDF;
IDENT HONPROF
FHOPMT=(PHMAXD*WHOHO+PWXD*WWXHO+PPOD*WPOHO+PPKD*WPKH
O+PQND*WQNHO) / (PPKD*QPKHO+PQND*QQNHO + CHOPXD);
IDENT PPKPROF  FPKPMT=
(PHMAXD*WHOPK+PWXD*WWXPK+PPOD*WPOPK+PPKD*WPKPK+PQND*W
QNPK) / (PPKD*QPKPK+PQND*QQNPK+CPKPKD);
IDENT POLPROF  FPOPMT=
(PHMAXD*WHOPO+PWXD*WWXPO+PPOD*WPOPO+PPKD*WPKPO+PQND*W
QNPO) / (PPKD*QPKPO+PQND*QQNPO+CPOPXD);
IDENT PRICE21  PHSFARD =PHSD/PHFD;
IDENT PRICE22  PPKDD73 =PPKD*DUM73;
IDENT QUANT21  QWXM=QWX/M;
IDENT QUANT22  QSHPM = (QHP+SHP)/M;
? IDENT QUANT23 QSIHPM=QHPM-IHM;
IDENT PRICE23 PHMAXD = PHFD + POS(PHSD-PHFD);
```


Appendix A: Computer Program for Model Estimation (continued)

```

IDENT DUMMY DUMPHSDF=POS(PHSD-PHFD(-1));
?
FRML PROALL1 QDHMM = L0 + L1* PHRDFX + L2* QSHPM + L3 *PHMAXDX
+ L4*TRND+L5*DUMPHSDF;
FRML PRODMD1 PHRDF = M0 + M1* DHM + M2*
DUM73+M3*DUMPHSDF+M4*TRND73;
IDENT PRICE31 PHRDFX = PHRDF - PHRDF(-1);
IDENT PRICE32 PHMAXDX=PHMAXD-PHMAXD(-1);
IDENT DISAP31 DHM = QDHMM+IHM-EH/M;
IDENT STOCK31 SHPF = SHP + QHP + IHM*M - EH - DHM*M;

PARAM A0, 114, A1, .93, A2, 180,
      B0, 111, B1, .05, B2, 75, B3, -52, B4, -171, B5, -995,
      C0, 8.4 C1, .48, C2, .004, C3, -.0011, C4, 3.6, C5, -.15,
      D0, .2, D1, 9.5,
      E0, -.2, E1, .8, E2, 3.3,
      G0, .18, G1, -6.4, G2, .05, G3, .77, G4, -2.3
      H0, .03, H1, -.02, H2, .79, H3, .26, H4, .04, H5, -.8,
      I0, -.009, I1, -.03, I2, .19, I3, .32, I4, .002, I5, -.38,
      J0, .22, J1, -.01, J2, -.002, J3, .26, J4, .67, J5, .08, J6, -.58, J7, .02,
      K0, .27, K1, -.13, K2, .18, K3, -2.05, K4, 1.3, K5, .08, K6, 2.78,
      L0, -.3, L1, 1.5, L2, .90, L3, -1.3, L4, .006, L5, -5.1,
      M0, .4, M1, -.005, M2, .21, M3, -.8, M4, -.01;
CONST WHOHO, 100, WPKHO, .6, WQNHO, 0, WPOHO, 1, WWXHO, 1, QPKHO,
1.3182, QQNHO, 0,
      WHOPK, 20, WPKPK, 8, WQNPK, 4, WPOPK, 1, WWXPK, 1, QPKPK, 0, QQNPK,
0,
      WHOPO, 25, WPKPO, .8, WQNPO, 0, WPOPO, 1.65, WWXPO, 1, QPKPO, 0,
QQNPO, 2.5357,
      F0, -1.217034, F1, 1.441219;
?
? 3SLS ESTIMATES
OPTIONS PLOTS;
LSQ (NOPRINT, INST =(C, DUMALL,DUMPHSDF,COL(-1), FACMT2, PHSD,
WXHOR, FHOPMT(-1), PHRDF(-1), ICHPD, PHID, CHOPXD, CPKPXD, CPOPXD,
M, SHP, QPO, TRND, TRND73,DUM73, EH, PHFD(-1), PPOD(-1), PWXID, DUM65,
DHM(-1), PHMAXD(-1)))COLSUP, HONSUP, POLSUP, PPKPR, QQNPR,
WAXDMD, PPKDMD, QQNDMD, HONDMD, IMPDMD, PROALL1, PRODMD1;
?
?
?-----
?
OPTIONS LIMPRN=132;
STOP; END;

```

APPENDIX B
COMPUTER PROGRAM FOR
SCENARIO 1 - BASE CASE

Appendix B: Computer Program for Scenario 1 - Base Case

```
NAME LSW 'SCENARIO 1';
?  BASE CASE
?
?
?
FREQ A;
SMPL 1950 1984;
IN NEWHON;
SMPL 1950 1984;
?
SMPL 1983 1983;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
?
SMPL 1984 1984;
PCOL=COL;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
PPHFD=PHFD;
PPHRDF=PHRDF;
PDHM=DHM;
PSHPF=SHPF;
PPHMAXD=PHMAXD;
PPPOD=PPOD;
?
SMPL 1985 2009;
?  THESE EXOGENOUS VARIABLES ARE SET TO 1984 VALUES
PHSD=0.28423;
DUM73=1;
TRND=35;
TRND73=12;
CPOPXD=24.82117;
CHOPXD=29.61123;
CPKPXD=41.35723;
QPO=1386.1;
WXHOR=0.02336;
PWXID=0.66924;
PHID=0.16069;
M=237.0;
EH=7.5;
ICHPD=121.33909;
DUM65=1;
?
PDMPHSDF=.04018;
?
SMPL 1985 2009;
?
?
?  INITIATING THE SIMULATION
```

Appendix B: Computer Program for Scenario 1 - Base Case (continued)

```

DO I=1985 TO 1995;
SMPL I I;
?-----
?  BLOCK 1--THE INITIAL SET OF EQUATIONS
A0=139.6578;
A1=.9033466;
A2=242.2987;
C0=11.06271;
C1=0.4232625;
C2=0.004378899;
C3=-0.001536991;
C4=3.710412;
C5=-0.1907491;
D0=0.1941980;
D1=9.441638;
?
PFACMT2=(1/6)*(PFHOPMT(-1)+PFPKPMT(-1)+PFPOPMT(-1)+PFHOPMT(-
2)+PFPKPMT(-2)+PFPOPMT(-2));
?
? PDMPHSDF=POS(PHSD-PPHFD(-1));
?
PPPKD=D0+D1*PPHFD(-1);
PCOL=A0+A1*PCOL(-1)+A2*PFACMT2;
PPPOD=C0+C1*PPPOD(-1)+C2*QPO+C3*PCOL(-1)+C4*PPHMAXD(-
1)+C5*TRND;
?-----
?  BLOCK 2--THE BIG GROUP
FRML HONSUP   QHF = B0 + B1*PCOL + B2*FHOPMT + B3*FPKPMT +
B4*FPOPMT+B5*PDMPHSDF;
IDENT WAXSUP   QWX = WXHOR*QHF;
FRML QQNPR    PQND = E0 + E1*PPPKD + E2*QQNCOL;
IDENT ALLOCA  AHCA=F0+F1*PHSFARD;
IDENT ALLOCB  AHCB=1-POS(1-AHCA);
IDENT ALLOC1  AHC=POS(AHCB);
IDENT ALLOC2  QHP=(1-AHC)*QHF;
FRML WAXDMD   PWXD = G0 + G1*QWXM+ G2*PFHOPMT(-1) + G3*PWXID +
G4*PDMPHSDF;
FRML PPKDMD   QPK = PCOL*(H0 + H1*PPPKD + H2*QQNCOL + H3 *
PPHMAXD(-1) + H4*DUM65+H5*PDMPHSDF);
FRML QQNDMD   QQN =PCOL*(I0+ I1* PQND+ I2*QPKCOL + I3*PPHMAXD(-1)
+ I4*TRND + I5* PDMPHSDF);
FRML HONDMD   PHFD = J0 +J1* QSHPM + J2*ICHPD + J3*PPHRDF(-1) + J4 *
PHID + J5*DUM73 + J6*PDMPHSDF + J7*PDHM(-1);
FRML IMPDMD   IHM = K0 +K1 * QSHPM+ K2* PPHRDF(-1)+ K3*PHID +
K4*PHMAXD + K5* DUM73 + K6*PDMPHSDF;
IDENT HONPROF
FHOPMT=(PHMAXD*WHOHO+PWXD*WWXHO+PPPOD*WPOHO+PPPKD*WPK
HO+PQND*WQNHO) / (PPPKD*QPKHO+PQND*QQNHO + CHOPXD);
IDENT PPKPROF  FPKPMT=
(PHMAXD*WHOPK+PWXD*WWXPK+PPPOD*WPOPK+PPPKD*WPKPK+PQND*
WQNPK) / (PPPKD*QPKPK+PQND*QQNPK+CPKPKXD);

```

Appendix B: Computer Program for Scenario 1 - Base Case (continued)

```
IDENT POLPROF FPOPMT=
(PHMAXD*WHOPO+PWXD*WWXPO+PPPOD*WPOPO+PPPKD*WPKPO+PQND*
WQNPO) / (PPPKD*QPKPO+PQND*QQNPO+CPOPXD);
IDENT PRICE21 PHSFARD =PHSD/PHFD;
IDENT PRICE23 PHMAXD=PHFD+POS(PHSD-PHFD);
IDENT QUANT21 QWXM=QWX/M;
IDENT QUANT22 QSHPM = (QHP+PSHPF(-1))/M;
IDENT QUANT24 QPKCOL=QPK/PCOL;
IDENT QUANT25 QQNCOL=QQN/PCOL;
?
PARAM B0, 121.9352, B1, 0.0495234, B2, 117.2318, B3, -73.47820, B4, -230.1567,
B5, -867.2041;
PARAM E0, -.2291193, E1, 0.8651651, E2, 3.045417, F0, -1.217034, F1, 1.441219;
PARAM G0, 0.1514005, G1, -5.713230, G2, 0.05483168, G3, 0.7859951, G4, -2.15914;
PARAM H0, 0.03461183, H1, -0.02594944, H2, 0.9333837, H3, 0.2434844,
H4, 0.02898729, H5, -0.8942856;
PARAM I0, -0.01134207, I1, -0.0220852, I2, 0.2887513, I3, 0.2471680, I4, 0.002280063,
I5, -0.1692295;
PARAM J0, 0.2634232, J1, -0.004378458, J2, -0.002831092, J3, 0.2490913,
J4, 0.6132352, J5, 0.09797321, J6, -0.6231662, J7, 0.0172977;
PARAM K0, 0.3747096, K1, -0.1438645, K2, 0.06809512, K3, -1.699113, K4, 0.8274489,
K5, 0.1425209, K6, 2.667295;
CONST WHOHO, 100, WPKHO, .6, WQNHO, 0, WPOHO, 1, WWXHO, 1, QPKHO,
1.3182, QQNHO, 0, WHOPK, 20, WPKPK, 8, WQNPK, 4, WPOPK, 1, WWXPK, 1,
QPKPK, 0, QQNPK, 0, WHOPO, 25, WPKPO, .8, WQNPO, 0, WPOPO, 1.65,
WWXPO, 1, QPKPO, 0, QQNPO, 2.5357;
?
?
? SIML THE BIG GROUP
SIML (TAG=S, ENDOG=(QHF, QWX, PQND, AHCA, AHCB, AHC, QHP, PWXD,
QPK, QQN, PHFD, IHM, FHOPMT, FPKPMT, FPOPMT, PHSFARD, QWXM,
QSHPM, QPKCOL, QQNCOL, PHMAXD), MAXIT=20, NOPRNDAT, NOPRNSIM,
DYNAM) HONSUP, WAXSUP, QQNPR, ALLOCA, ALLOCB, ALLOC1, ALLOC2,
WAXDMD, PPKDMD, QQNDMD, HONDMD, IMPDMD, HONPROF, PPKPROF,
POLPROF, PRICE21, PRICE23, QUANT21, QUANT22, QUANT24, QUANT25;
?
? RENAMING THE OUTPUT OF THIS SIMULATION
PQHF=QHFS;
PQWX=QWXS;
PPQND=PQNDS;
PAHCA=AHCAS;
PAHCB=AHCBS;
PAHC=AHCS;
PQHP=QHPS;
PPWXD=PWXDS;
PQPK=QPKS;
PQQN=QQNS;
PPHFD=PHFDS;
PIHM=IHMS;
PFHOPMT=FHOPMTS;
PPPKPMT=FPKPMTS;
```

Appendix B: Computer Program for Scenario 1 - Base Case (continued)

```
PFPOPMT=FPOPMTS;
PPHSFARD=PHSFARDS;
PQWXM=QWXMS;
PQSHPM=QSHPMs;
PQPKCOL=QPKCOLS;
PQQNCOL=QQNCOLS;
PPHMAXD=PHMAXDS;
?
PIH=PIHM*M;
?
?-----
?  BLOCK 3
?
PRINT I;
L0=-.2946686;
L1=1.179081;
L2=.9439934;
L3=-.2498637;
L4=0.005805494;
L5=-5.048632;
M0=0.4227957;
M1=-0.04269399;
M2=0.2130593;
M3=-.9930014;
M4=-0.01190572;
?  EQUATIONS
?
PPHMAXDX=PPHMAXD-PPHMAXD(-1);
?
PQDHMM = (1/(1-L1*M1))* (L0 + L1*M0 +L1*M1*PIHM - L1*M1*EH/M +
L1*M2*DUM73+ (L1*M3+L5)*PDMPHSDF+L1*M4*TRND73 - L1*PPHRDF(-1)+
L2*PQSHPM+ L3*PPHMAXDX + L4* TRND);
PDHM = PQDHMM +PIHM - EH/M;
PPHRDF = M0 + M1*PDHM + M2*DUM73+M3*PDMPHSDF+M4*TRND73;
PPHRDFX = PPHRDF - PPHRDF(-1);
PDH = PDHM * M;
PSHPF = PSHPF(-1) + PQHP + PIH - EH - PDH;
?
ENDDO;
?
?
SMPL 1985 1995;
PRINT PFACMT2, PDMPHSDF, PPPKD, PCOL, PPPOD;
PRINT PQHF, PQWX, PPQND, PAHCA, PAHCB, PAHC;
PRINT PQHP, PPWXd, QPK, QQN, PPHFD, PIHM;
PRINT PFHOPMT, PFPKPMt, PFPOPMT, PPHSFARD, PQWXM;
PRINT PQSHPM, QPKCOL, PQQNCOL, PPHMAXD, PIH;
PRINT PPHMAXDX, PQSHPM;
PRINT PQDHMM, PDHM, PPHRDF, PPHRDFX, PDH, PSHPF;
?
STOP; END;
```

APPENDIX C
COMPUTER PROGRAM FOR
SCENARIO 2 - Ineffective Federal Support Program

Appendix C: Computer Program for Scenario 2 - Ineffective Federal Support Program

```
NAME LSW 'SCENARIO 2';
?   INEFFECTIVE FEDERAL SUPPORT PROGRAM
?
?
?
FREQ A;
SMPL 1950 1984;
IN NEWHON;
SMPL 1950 1984;
?
SMPL 1983 1983;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
?
SMPL 1984 1984;
PCOL=COL;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
PPHFD=PHFD;
PPHRDF=PHRDF;
PDHM=DHM;
PSHPF=SHPF;
PPHMAXD=PHMAXD;
PPPOD=PPOD;
?
SMPL 1985 2009;
?   THESE EXOGENOUS VARIABLES ARE SET TO 1984 VALUES
PHSD=0.28423;
DUM73=1;
TRND=35;
TRND73=12;
CPOPXD=24.82117;
CHOPXD=29.61123;
CPKPXD=41.35723;
QPO=1386.1;
WXHOR=0.02336;
PWXID=0.66924;
PHID=0.16069;
M=237.0;
EH=7.5;
ICHPD=121.33909;
DUM65=1;
?
PDMPHSDF=.04018;
?
SMPL 1985 2009;
?   THESE SUPPORT VARIABLES ARE SET TO MAKE THE SUPPORT
?   PROGRAM INEFFECTIVE
PHSD=0.000;
```


Appendix C: Computer Program for Scenario 2 - Ineffective Federal Support Program
(continued)

```

PDMPHSDF=0;
?
?  NOW LETS GET STARTED WITH THE SIMULATION
DO I=1985 TO 1995;
SMPL I I;
?-----
?  BLOCK 1--THE INITIAL SET OF EQUATIONS
A0=139.6578;
A1=.9033466;
A2=242.2987;
C0=11.06271;
C1=0.4232625;
C2=0.004378899;
C3=-0.001536991;
C4=3.710412;
C5=-0.1907491;
D0=0.1941980;
D1=9.441638;
?
PFACMT2=(1/6)*(PFHOPMT(-1)+PFPKPMT(-1)+PFPOPMT(-1)+PFHOPMT(-
2)+PFPKPMT(-2)+PFPOPMT(-2));
?
?  PDMPHSDF=POS(PHSD-PPHFD(-1));
?
PPPKD=D0+D1*PPHFD(-1);
PCOL=A0+A1*PCOL(-1)+A2*PFACMT2;
PPPOD=C0+C1*PPPOD(-1)+C2*QPO+C3*PCOL(-1)+C4*PPHMAXD(-
1)+C5*TRND;
?-----
?  BLOCK 2--THE BIG GROUP
FRML HONSUP   QHF = B0 + B1*PCOL + B2*FHOPMT + B3*FPKPMT +
B4*FPOPMT+B5*PDMPHSDF;
IDENT WAXSUP   QWX = WXHOR*QHF;
FRML QQNPR    PQND = E0 + E1* PPPKD + E2*QQNCOL;
IDENT ALLOCA  AHCA=F0+F1*PHSFARD;
IDENT ALLOCB  AHCB=1-POS(1-AHCA);
IDENT ALLOC1  AHC=POS(AHCB);
IDENT ALLOC2  QHP=(1-AHC)*QHF;
FRML WAXDMD   PWXD = G0 + G1*QWXM+ G2*PFHOPMT(-1) + G3*PWXID +
G4*PDMPHSDF;
FRML PPKDMD   QPK = PCOL*(H0 + H1*PPPKD + H2*QQNCOL + H3 *
PPHMAXD(-1) + H4*DUM65+H5*PDMPHSDF);
FRML QQNDMD   QQN =PCOL*(I0+ I1* PQND+ I2*QPKCOL + I3*PPHMAXD(-1)
+ I4*TRND + I5* PDMPHSDF);
FRML HONDMD   PHFD = J0 +J1* QSHPM + J2*ICHPD + J3*PPHRDF(-1) + J4 *
PHID + J5*DUM73 + J6*PDMPHSDF + J7*PDHM(-1);
FRML IMPDMD   IHM = K0 +K1 * QSHPM+ K2* PPHRDF(-1)+ K3*PHID +
K4*PHMAXD + K5* DUM73 + K6*PDMPHSDF;

```

Appendix C: Computer Program for Scenario 2 - Ineffective Federal Support Program
(continued)

IDENT HONPROF

FHOPMT=(PHMAXD*WHOHO+PWXD*WWXHO+PPPPOD*WPOHO+PPPKD*WPKHO+PQND*WQNHO) / (PPPKD*QPKHO+PQND*QQNHO + CHOPXD);

IDENT PPKPROF FPKPMT=

(PHMAXD*WHOPK+PWXD*WWXPK+PPPPOD*WPOPK+PPPKD*WPKPK+PQND*WQNPK) / (PPPKD*QPKPK+PQND*QQNPK+CPKPYD);

IDENT POLPROF FPOPMT=

(PHMAXD*WHOPO+PWXD*WWXPO+PPPPOD*WPOPO+PPPKD*WPKPO+PQND*WQNPO) / (PPPKD*QPKPO+PQND*QQNPO+CPOPYD);

IDENT PRICE21 PHSFARD =PHSD/PHFD;

IDENT PRICE23 PHMAXD=PHFD+POS(PHSD-PHFD);

IDENT QUANT21 QWXM=QWX/M;

IDENT QUANT22 QSHPM = (QHP+PSHPF(-1))/M;

IDENT QUANT24 QPKCOL=QPK/PCOL;

IDENT QUANT25 QQNCOL=QQN/PCOL;

?

PARAM B0, 121.9352, B1, 0.0495234, B2, 117.2318, B3, -73.47820, B4, -230.1567, B5, -867.2041;

PARAM E0, -.2291193, E1, 0.8651651, E2, 3.045417, F0, -1.217034, F1, 1.441219;

PARAM G0, 0.1514005, G1, -5.713230, G2, 0.05483168, G3, 0.7859951, G4, -2.15914;

PARAM H0, 0.03461183, H1, -0.02594944, H2, 0.9333837, H3, 0.2434844,

H4, 0.02898729, H5, -0.8942856;

PARAM I0, -0.01134207, I1, -0.0220852, I2, 0.2887513, I3, 0.2471680, I4, 0.002280063, I5, -0.1692295;

PARAM J0, 0.2634232, J1, -0.004378458, J2, -0.002831092, J3, 0.2490913,

J4, 0.6132352, J5, 0.09797321, J6, -0.6231662, J7, 0.0172977;

PARAM K0, 0.3747096, K1, -0.1438645, K2, 0.06809512, K3, -1.699113, K4, 0.8274489, K5, 0.1425209, K6, 2.667295;

CONST WHOHO, 100, WPKHO, .6, WQNHO, 0, WPOHO, 1, WWXHO, 1, QPKHO, 1.3182, QQNHO, 0, WHOPK, 20, WPKPK, 8, WQNPK, 4, WPOPK, 1, WWXPK, 1, QPKPK, 0, QQNPK, 0, WHOPO, 25, WPKPO, .8, WQNPO, 0, WPOPO, 1.65, WWXPO, 1, QPKPO, 0, QQNPO, 2.5357;

?

?

? SIML THE BIG GROUP

SIML (TAG=S, ENDOG=(QHF, QWX, PQND, AHCA, AHCBS, AHC, QHP, PWXD, QPK, QQN, PHFD, IHM, FHOPMT, FPKPMT, FPOPMT, PHSFARD, QWXM, QSHPM, QPKCOL, QQNCOL, PHMAXD), MAXIT=20, NOPRNDAT, NOPRNSIM, DYNAM) HONSUP, WAXSUP, QQNPR, ALLOCA, ALLOCB, ALLOC1, ALLOC2, WAXDMD, PPKDMD, QQNDMD, HONDMD, IMPDMD, HONPROF, PPKPROF, POLPROF, PRICE21, PRICE23, QUANT21, QUANT22, QUANT24, QUANT25;

?

? RENAMING THE OUTPUT OF THIS SIMULATION

PQHF=QHFS;

PQWX=QWXS;

PPQND=PQNDS;

PAHCA=AHCA;

PAHCB=AHCBS;

PAHC=AHCS;

PQHP=QHPS;

Appendix C: Computer Program for Scenario 2 - Ineffective Federal Support Program
(continued)

```
PPWXD=PWXDS;
PQPK=QPKS;
PQQN=QQNS;
PPHFD=PHFDS;
PIHM=IHMS;
PFHOPMT=FHOPMTS;
PFPKPMT=FPKPMTS;
PFPOPMT=FPOPMTS;
PPHSFARD=PHSFARDS;
PQWXM=QWXMS;
PQSHPM=QSHPMs;
PQPKCOL=QPKCOLS;
PQQNCOL=QQNCOLS;
PPHMAXD=PHMAXDS;
?
PIH=PIHM*M;
?
?
?-----
?  BLOCK 3
?
PRINT I;
L0=-.2946686;
L1=1.179081;
L2=.9439934;
L3=-.2498637;
L4=0.005805494;
L5=-5.048632;
M0=0.4227957;
M1=-0.04269399;
M2=0.2130593;
M3=-.9930014;
M4=-0.01190572;
?  EQUATIONS
?
PPHMAXDX=PPHMAXD-PPHMAXD(-1);
?
PQDHMM = (1/(1-L1*M1))* (L0 + L1*M0 +L1*M1*PIHM - L1*M1*EH/M +
L1*M2*DUM73+ (L1*M3+L5)*PDMPHSDF+L1*M4*TRND73 - L1*PPHRDF(-1)+
L2*PQSHPM+ L3*PPHMAXDX + L4* TRND);
PDHM = PQDHMM +PIHM - EH/M;
PPHRDF = M0 + M1*PDHM + M2*DUM73+M3*PDMPHSDF+M4*TRND73;
PPHRDFX = PPHRDF - PPHRDF(-1);
PDH = PDHM * M;
PSHPF = PSHPF(-1) + PQHP + PIH - EH - PDH;
?
ENDDO;
?
?
SMPL 1985 1995;
```

Appendix C: Computer Program for Scenario 2 - Ineffective Federal Support Program
(continued)

```
PRINT PFACMT2, PDMPHSDF, PPPKD, PCOL, PPPOD;  
PRINT PQHF, PQWX, PPQND, PAHCA, PAHCB, PAHC;  
PRINT PQHP, PPWXD, PQPK, PQQN, PPHFD, PIHM;  
PRINT PFHOPMT, PFPKPMT, PFPOPMT, PPHSFARD, PQWXM;  
PRINT PQSHPM, PQPKCOL, PQQNCOL, PPHMAXD, PIH;  
PRINT PPHMAXDX, PQSHPM;  
PRINT PQDHMM, PDHM, PPHRDF, PPHRDFX, PDH, PSHPF;  
?  
STOP; END;
```

APPENDIX D
COMPUTER PROGRAM FOR
SCENARIO 3- Ineffective Federal Support Program and Increase in Honey Demand

Appendix D: Computer Program for Scenario 3 - Ineffective Federal Support Program
and Increase in Honey Demand

```
NAME LSW 'SCENARIO 3';
?   INEFFECTIVE FEDERAL SUPPORT PROGRAM AND INCREASE IN
?   HONEY DEMAND
?
?
?
FREQ A;
SMPL 1950 1984;
IN NEWHON;
SMPL 1950 1984;
?
SMPL 1983 1983;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
?
SMPL 1984 1984;
PCOL=COL;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
PPHFD=PHFD;
PPHRDF=PHRDF;
PDHM=DHM;
PSHPF=SHPF;
PPHMAXD=PHMAXD;
PPPOD=PPOD;
?
SMPL 1985 2009;
?   THESE EXOGENOUS VARIABLES ARE SET TO 1984 VALUES
PHSD=0.28423;
DUM73=1;
TRND=35;
TRND73=12;
CPOPXD=24.82117;
CHOPXD=29.61123;
CPKPXD=41.35723;
QPO=1386.1;
WXHOR=0.02336;
PWXID=0.66924;
PHID=0.16069;
M=237.0;
EH=7.5;
ICHPD=121.33909;
DUM65=1;
?
PDMPHSDF=.04018;
?
SMPL 1985 2009;
?   THESE SUPPORT VARIABLES ARE SET TO MAKE THE SUPPORT
```

Appendix D: Computer Program for Scenario 3 - Ineffective Federal Support Program
and Increase in Honey Demand (continued)

```
? PROGRAM INEFFECTIVE
PHSD=0;
PDMPHSDF=0;
?
SMPL 1985 2003;
?
? NOW LETS GET STARTED WITH THE SIMULATION
DO I=1985 TO 1995;
SMPL I I;
?-----
? BLOCK 1--THE INITIAL SET OF EQUATIONS
A0=139.6578;
A1=.9033466;
A2=242.2987;
C0=11.06271;
C1=0.4232625;
C2=0.004378899;
C3=-0.001536991;
C4=3.710412;
C5=-0.1907491;
D0=0.1941980;
D1=9.441638;
?
PFACMT2=(1/6)*(PFHOPMT(-1)+PFPKPMT(-1)+PFPOPMT(-1)+PFHOPMT(-
2)+PFPKPMT(-2)+PFPOPMT(-2));
?
? PDMPHSDF=POS(PHSD-PPHFD(-1));
?
PPPKD=D0+D1*PPHFD(-1);
PCOL=A0+A1*PCOL(-1)+A2*PFACMT2;
PPPOD=C0+C1*PPPOD(-1)+C2*QPO+C3*PCOL(-1)+C4*PPHMAXD(-
1)+C5*TRND;
?-----
? BLOCK 2--THE BIG GROUP
FRML HONSUP QHF = B0 + B1*PCOL + B2*FHOPMT + B3*FPKPMT +
B4*FPOPMT+B5*PDMPHSDF;
IDENT WAXSUP QWX = WXHOR*QHF;
FRML QQNPR PQND = E0 + E1*PPPKD + E2*QQNCOL;
IDENT ALLOCA AHCA=F0+F1*PHSFARD;
IDENT ALLOCB AHCB=1-POS(1-AHCA);
IDENT ALLOC1 AHC=POS(AHCB);
IDENT ALLOC2 QHP=(1-AHC)*QHF;
FRML WAXDMD PWXD = G0 + G1*QWXM+ G2*PFHOPMT(-1) + G3*PWXID +
G4*PDMPHSDF;
FRML PPKDMD QPK = PCOL*(H0 + H1*PPPKD + H2*QQNCOL + H3 *
PPHMAXD(-1) + H4*DUM65+H5*PDMPHSDF);
FRML QQNDMD QQN =PCOL*(I0+ I1* PQND+ I2*QPKCOL + I3*PPHMAXD(-1)
+ I4*TRND + I5* PDMPHSDF);
FRML HONDMD PHFD = J0 +J1* QSHPM + J2*ICHPD + J3*PPHRDF(-1) + J4 *
PHID + J5*DUM73 + J6*PDMPHSDF + J7*PDHM(-1);
```

Appendix D: Computer Program for Scenario 3 - Ineffective Federal Support Program
and Increase in Honey Demand (continued)

```

FRML IMPDMD   IHM = K0 +K1 * QSHPM+ K2* PPHRDF(-1)+ K3*PHID +
K4*PHMAXD + K5* DUM73 + K6*PDMPHSDF;
IDENT HONPROF
FHOPMT=(PHMAXD*WHOHO+PWXD*WWXHO+PPPPOD*WPOHO+PPPKD*WPK
HO+PQND*WQNHO) / (PPPKD*QPKHO+PQND*QQNHO + CHOPXD);
IDENT PPKPROF  FPKPMT=
(PHMAXD*WHOPK+PWXD*WWXPK+PPPPOD*WPOPK+PPPKD*WPKPK+PQND*
WQNPK) / (PPPKD*QPKPK+PQND*QQNPK+CPKPXD);
IDENT POLPROF  FPOPMT=
(PHMAXD*WHOPO+PWXD*WWXPO+PPPPOD*WPOPO+PPPKD*WPKPO+PQND*
WQNPO) / (PPPKD*QPKPO+PQND*QQNPO+CPOPXD);
IDENT PRICE21   PHSFARD =PHSD/PHFD;
IDENT PRICE23   PHMAXD=PHFD+POS(PHSD-PHFD);
IDENT QUANT21   QWXM=QWX/M;
IDENT QUANT22   QSHPM = (QHP+PSHPF(-1))/M;
IDENT QUANT24   QPKCOL=QPK/PCOL;
IDENT QUANT25   QQNCOL=QQN/PCOL;
?
PARAM B0, 121.9352, B1, 0.0495234, B2, 117.2318, B3, -73.47820, B4, -230.1567,
B5, -867.2041;
PARAM E0, -.2291193, E1, 0.8651651, E2,3.045417 , F0, -1.217034, F1, 1.441219;
PARAM G0, 0.1514005, G1, -5.713230, G2, 0.05483168, G3, 0.7859951, G4, -2.15914;
PARAM H0, 0.03461183, H1, -0.02594944, H2,0.9333837, H3, 0.2434844,
H4,0.02898729 , H5,-0.8942856 ;
PARAM I0, -0.01134207, I1,-0.0220852 , I2,0.2887513 , I3,0.2471680, I4, 0.002280063,
I5, -0.1692295 ;
PARAM J0, 0.2634232, J1,-0.004378458 , J2,-0.002831092 , J3,0.2490913 ,
J4,0.6132352 , J5, 0.09797321, J6, -0.6231662, J7, 0.0172977;
PARAM K0,0.3747096, K1,-0.1438645 , K2,0.06809512 , K3,-1.699113 , K4,0.8274489
, K5, 0.1425209, K6, 2.667295;
CONST WHOHO, 100, WPKHO, .6, WQNHO, 0, WPOHO, 1, WWXHO, 1, QPKHO,
1.3182, QQNHO, 0, WHOPK, 20, WPKPK, 8, WQNPK,4, WPOPK, 1, WWXPK, 1,
QPKPK, 0, QQNPK, 0, WHOPO, 25, WPKPO, .8, WQNPO, 0, WPOPO, 1.65,
WWXPO, 1, QPKPO, 0, QQNPO, 2.5357;
?
?
?  SIML THE BIG GROUP
SIML (TAG=S, ENDOG=(QHF, QWX, PQND, AHCA, AHCB, AHC, QHP, PWXD,
QPK, QQN, PHFD, IHM, FHOPMT, FPKPMT, FPOPMT, PHSFARD, QWXM,
QSHPM, QPKCOL, QQNCOL, PHMAXD), MAXIT=20, NOPRNDAT, NOPRNSIM,
DYNAM) HONSUP, WAXSUP, QQNPR, ALLOCA, ALLOCB, ALLOC1, ALLOC2,
WAXDMD, PPKDMD, QQNDMD, HONDMD, IMPDMD, HONPROF, PPKPROF,
POLPROF, PRICE21, PRICE23, QUANT21, QUANT22, QUANT24, QUANT25;
?
?  RENAMING THE OUTPUT OF THIS SIMULATION
PQHF=QHFS;
PQWX=QWXS;
PPQND=PQNDS;
PAHCA=AHCAS;
PAHCB=AHCBS;

```


Appendix D: Computer Program for Scenario 3 - Ineffective Federal Support Program
and Increase in Honey Demand (continued)

```
PAHC=AHCS;
PQHP=QHPS;
PPWXD=PWXDS;
PQPK=QPKS;
PQQN=QQNS;
PPHFD=PHFDS;
PIHM=IHMS;
PFHOPMT=FHOPMTS;
PFPKPMT=FPKPMTS;
PFPOPMT=FPOPMTS;
PPHSFARD=PHSFARDS;
PQWXM=QWXMS;
PQSHPM=QSHPMs;
PQPKCOL=QPKCOLS;
PQQNCOL=QQNCOLS;
PPHMAXD=PHMAXDS;
?
PIH=PIHM*M;
?
?
?-----
?  BLOCK 3
?
PRINT I;
L0=-.2946686;
L1=1.179081;
L2=.9439934;
L3=-.2498637;
L4=0.005805494;
L5=-5.048632;
M0=0.4227957;
M1=-0.04269399;
M2=0.2130593;
M3=-.9930014;
M4=-0.01190572;
?  EQUATIONS
?
PPHMAXDX=PPHMAXD-PPHMAXD(-1);
?
?  THESE ARE THE PARAMETERS TO INCREASE HONEY DEMAND
SMPL 1985 1985;
N9=1.08;
SMPL 1986 1986;
N9=1.16;
SMPL 1987 1987;
N9=1.24;
SMPL 1988 1988;
N9=1.32;
SMPL 1989 2003;
N9=1.4;
```

Appendix D: Computer Program for Scenario 3 - Ineffective Federal Support Program
and Increase in Honey Demand (continued)

SMPL I I;

?

$PQDHMM = (1/(1-L1*M1)) * (L0 + L1*M0 + L1*M1*PIHM - L1*M1*EH/M +$
 $L1*M2*DUM73 + (L1*M3+L5)*PDMPHSDF + L1*M4*TRND73 - L1*PPHRDF(-1) +$
 $L2*PQSHPM + L3*PPHMAXDX + L4*TRND);$

$PDHM = PQDHMM + PIHM - EH/M;$

$PPHRDF = M0*N9 + M1*PDHM + M2*DUM73 + M3*PDMPHSDF + M4*TRND73;$

$PPHRDFX = PPHRDF - PPHRDF(-1);$

$PDH = PDHM * M;$

$PSHPF = PSHPF(-1) + PQHP + PIH - EH - PDH;$

?

ENDDO;

?

?

SMPL 1985 1995;

PRINT PFACMT2, PDMPHSDF, PPPKD, PCOL, PPPOD;

PRINT PQHF, PQWX, PPQND, PAHCA, PAHCB, PAHC;

PRINT PQHP, PPWXD, PQPK, PQQN, PPHFD, PIHM;

PRINT PFHOPMT, PFPKPM, PFPOPMT, PPHSFARD, PQWXM;

PRINT PQSHPM, PQPKCOL, PQQNCOL, PPHMAXD, PIH;

PRINT PPHMAXDX, PQSHPM;

PRINT PQDHMM, PDHM, PPHRDF, PPHRDFX, PDH, PSHPF;

?

STOP; END;

APPENDIX E
COMPUTER PROGRAM FOR
SCENARIO 4- Ineffective Federal Support Program and
Increase in Price Paid to Producers

Appendix E: Computer Program for Scenario 4 - Ineffective Federal Support Program
and Increase in Price Paid to Producers

```
NAME LSW 'SCENARIO 4';
?   INEFFECTIVE FEDERAL SUPPORT PROGRAM AND
?   INCREASE IN PRICE PAID TO PRODUCERS
?
?
?
FREQ A;
SMPL 1950 1984;
IN NEWHON;
SMPL 1950 1984;
?
SMPL 1983 1983;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
?
SMPL 1984 1984;
PCOL=COL;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
PPHFD=PHFD;
PPHRDF=PHRDF;
PDHM=DHM;
PSHPF=SHPF;
PPHMAXD=PHMAXD;
PPPOD=PPOD;
?
SMPL 1985 2003;
?   THESE EXOGENOUS VARIABLES ARE SET TO 1984 VALUES
PHSD=0.28423;
DUM73=1;
TRND=35;
TRND73=12;
CPOPXD=24.82117;
CHOPXD=29.61123;
CPKPXD=41.35723;
QPO=1386.1;
WXHOR=0.02336;
PWXID=0.66924;
PHID=0.16069;
M=237.0;
EH=7.5;
ICHPD=121.33909;
DUM65=1;
?
PDMPHSDF=.04018;
?
SMPL 1985 2003;
?   THESE SUPPORT VARIABLES ARE SET TO MAKE THE SUPPORT
```

Appendix E: Computer Program for Scenario 4 - Ineffective Federal Support Program
and Increase in Price Paid to Producers (continued)

```
? PROGRAM INEFFECTIVE
PHSD=0;
PDMPHSDF=0;
?
? THESE ARE THE PARAMETERS TO INCREASE
? PRICES PAID TO PRODUCERS
SMPL 1985 1985;
N9=1.08;
SMPL 1986 1986;
N9=1.16;
SMPL 1987 1987;
N9=1.24;
SMPL 1988 1988;
N9=1.32;
SMPL 1989 2003;
N9=1.4;
?
SMPL 1985 2003;
?
? NOW LETS GET STARTED WITH THE SIMULATION
DO I=1985 TO 1995;
SMPL I I;
?-----
? BLOCK 1--THE INITIAL SET OF EQUATIONS
A0=139.6578;
A1=.9033466;
A2=242.2987;
C0=11.06271;
C1=0.4232625;
C2=0.004378899;
C3=-0.001536991;
C4=3.710412;
C5=-0.1907491;
D0=0.1941980;
D1=9.441638;
?
PFACMT2=(1/6)*(PFHOPMT(-1)+PFPKPMT(-1)+PFPOPMT(-1)+PFHOPMT(-
2)+PFPKPMT(-2)+PFPOPMT(-2));
?
? PDMPHSDF=POS(PHSD-PPHFD(-1));
?
PPPKD=D0+D1*PPHFD(-1);
PCOL=A0+A1*PCOL(-1)+A2*PFACMT2;
PPPOD=C0+C1*PPPOD(-1)+C2*QPO+C3*PCOL(-1)+C4*PPHMAXD(-
1)+C5*TRND;
?-----
? BLOCK 2--THE BIG GROUP
FRML HONSUP QHF = B0 + B1*PCOL + B2*FHOPMT + B3*FPKPMT +
B4*FPOPMT+B5*PDMPHSDF;
IDENT WAXSUP QWX = WXHOR*QHF;
```

Appendix E: Computer Program for Scenario 4 - Ineffective Federal Support Program
and Increase in Price Paid to Producers (continued)

```

FRML QQNPR    PQND = E0 + E1* PPPKD + E2*QQNCOL;
IDENT ALLOCA  AHCA=F0+F1*PHSFARD;
IDENT ALLOCB  AHCB=1-POS(1-AHCA);
IDENT ALLOC1  AHC=POS(AHCB);
IDENT ALLOC2  QHP=(1-AHC)*QHF;
FRML WAXDMD   PWXD = G0 + G1*QWXM+ G2*PFHOPMT(-1) + G3*PWXID +
G4*PDMPHSDF;
FRML PPKDMD   QPK = PCOL*(H0 + H1*PPPKD + H2*QQNCOL + H3 *
PPHMAXD(-1) + H4*DUM65+H5*PDMPHSDF);
FRML QQNDMD   QQN =PCOL*(I0+ I1* PQND+ I2*QPKCOL + I3*PPHMAXD(-1)
+ I4*TRND + I5* PDMPHSDF);
FRML HONDMD   PHFD = J0*N9 +J1* QSHPM + J2*ICHPD + J3*PPHRDF(-1) + J4
* PHID + J5*DUM73 + J6*PDMPHSDF + J7*PDHM(-1);
FRML IMPDMD   IHM = K0 +K1 * QSHPM+ K2* PPHRDF(-1)+ K3*PHID +
K4*PHMAXD + K5* DUM73 + K6*PDMPHSDF;
IDENT HONPROF
FHOPMT=(PHMAXD*WHOHO+PWXD*WWXHO+PPPPOD*WPOHO+PPPKD*WPK
HO+PQND*WQNHO) / (PPPKD*QPKHO+PQND*QQNHO + CHOPXD);
IDENT PPKPROF  FPKPMT=
(PHMAXD*WHOPK+PWXD*WWXPK+PPPPOD*WPOPK+PPPKD*WPKPK+PQND*
WQNPK) / (PPPKD*QPKPK+PQND*QQNPK+CPKPXD);
IDENT POLPROF  FPOPMT=
(PHMAXD*WHOPO+PWXD*WWXPO+PPPPOD*WPOPO+PPPKD*WPKPO+PQND*
WQNPO) / (PPPKD*QPKPO+PQND*QQNPO+CPOPXD);
IDENT PRICE21  PHSFARD =PHSD/PHFD;
IDENT PRICE23  PHMAXD=PHFD+POS(PHSD-PHFD);
IDENT QUANT21  QWXM=QWX/M;
IDENT QUANT22  QSHPM = (QHP+PSHPF(-1))/M;
IDENT QUANT24  QPKCOL=QPK/PCOL;
IDENT QUANT25  QQNCOL=QQN/PCOL;
?
?
PARAM B0, 121.9352, B1, 0.0495234, B2, 117.2318, B3, -73.47820, B4, -230.1567,
B5, -867.2041;
PARAM E0, -.2291193, E1, 0.8651651, E2,3.045417 , F0, -1.217034, F1, 1.441219;
PARAM G0, 0.1514005, G1, -5.713230, G2, 0.05483168, G3, 0.7859951, G4, -2.15914;
PARAM H0, 0.03461183, H1, -0.02594944, H2,0.9333837, H3, 0.2434844,
H4,0.02898729 , H5,-0.8942856 ;
PARAM I0, -0.01134207, I1,-0.0220852 , I2,0.2887513 , I3,0.2471680, I4, 0.002280063,
I5, -0.1692295 ;
PARAM J0, 0.2634232, J1,-0.004378458 , J2,-0.002831092 , J3,0.2490913 ,
J4,0.6132352 , J5, 0.09797321, J6, -0.6231662, J7, 0.0172977;
PARAM K0,0.3747096, K1,-0.1438645 , K2,0.06809512 , K3,-1.699113 , K4,0.8274489
, K5, 0.1425209, K6, 2.667295;
CONST WHOHO, 100, WPKHO, .6, WQNHO, 0, WPOHO, 1, WWXHO, 1, QPKHO,
1.3182, QQNHO, 0, WHOPK, 20, WPKPK, 8, WQNPK,4, WPOPK, 1, WWXPK, 1,
QPKPK, 0, QQNPK, 0, WHOPO, 25, WPKPO, .8, WQNPO, 0, WPOPO, 1.65,
WWXPO, 1, QPKPO, 0, QQNPO, 2.5357;
?
?

```

Appendix E: Computer Program for Scenario 4 - Ineffective Federal Support Program
and Increase in Price Paid to Producers (continued)

? SIML THE BIG GROUP

SIML (TAG=S, ENDOG=(QHF, QWX, PQND, AHCA, AHCB, AHC, QHP, PWXD,
QPK, QQN, PHFD, IHM, FHOPMT, FPKPMT, FPOPMT, PHSFARD, QWXM,
QSHPM, QPKCOL, QQNCOL, PHMAXD), MAXIT=20, NOPRNDAT, NOPRNSIM,
DYNAM) HONSUP, WAXSUP, QQNPR, ALLOCA, ALLOCB, ALLOC1, ALLOC2,
WAXDMD, PPKDMD, QQNDMD, HONDMD, IMPDMD, HONPROF, PPKPROF,
POLPROF, PRICE21, PRICE23, QUANT21, QUANT22, QUANT24, QUANT25;

?

?

? RENAMING THE OUTPUT OF THIS SIMULATION

PQHF=QHFS;

PQWX=QWXS;

PPQND=PQNDS;

PAHCA=AHCAS;

PAHCB=AHCBS;

PAHC=AHCS;

PQHP=QHPS;

PPWXD=PWXDS;

PQPK=QPKS;

PQQN=QQNS;

?

PPHFD=PHFDS;

?

PIHM=IHMS;

PFHOPMT=PHOPMTS;

PFPKPMT=FPKPMTS;

PFPOPMT=FPOPMTS;

PPHSFARD=PHSFARDS;

PQWXM=QWXMS;

PQSHPM=QSHPMs;

PQPKCOL=QPKCOLS;

PQQNCOL=QQNCOLS;

PPHMAXD=PHMAXDS;

?

PIH=PIHM*M;

?

?

?-----

? BLOCK 3

?

PRINT I;

L0=-.2946686;

L1=1.179081;

L2=.9439934;

L3=-.2498637;

L4=0.005805494;

L5=-5.048632;

M0=0.4227957;

M1=-0.04269399;

M2=0.2130593;

Appendix E: Computer Program for Scenario 4 - Ineffective Federal Support Program
and Increase in Price Paid to Producers (continued)

```
M3=-.9930014;
M4=-0.01190572;
? EQUATIONS
?
PPHMAXDX=PPHMAXD-PPHMAXD(-1);
?
PQDHMM = (1/(1-L1*M1))* (L0 + L1*M0 +L1*M1*PIHM - L1*M1*EH/M +
L1*M2*DUM73+ (L1*M3+L5)*PDMPHSDF+L1*M4*TRND73 -L1*PPHRDF(-1)+
L2*PQSHPM+ L3*PPHMAXDX + L4* TRND);
PDHM = PQDHMM +PIHM - EH/M;
PPHRDF = M0 + M1*PDHM + M2*DUM73+M3*PDMPHSDF+M4*TRND73;
PPHRDFX = PPHRDF - PPHRDF(-1);
PDH = PDHM * M;
PSHPF = PSHPF(-1) + PQHP + PIH - EH - PDH;
?
ENDDO;
?
?
SMPL 1985 1995;
PRINT PFACMT2, PDMPHSDF, PPPKD, PCOL, PPPOD;
PRINT PQHF, PQWX, PPQND, PAHCA, PAHCB, PAHC;
PRINT PQHP, PPWXD, PQPK, PQQN, PPHFD, PIHM;
PRINT PFHOPMT, PFPKPM, PFPOPMT, PPHSFARD, PQWXM;
PRINT PQSHPM, PQPKCOL, PQQNCOL, PPHMAXD, PIH;
PRINT PPHMAXDX, PQSHPM;
PRINT PQDHMM, PDHM, PPHRDF, PPHRDFX, PDH, PSHPF;
?
STOP; END;
```


APPENDIX F
COMPUTER PROGRAM FOR
SCENARIO 5- Ineffective Federal Support Program and Higher Costs of Production

Appendix F: Computer Program for Scenario 5 - Ineffective Federal Support Program
and Higher Costs of Production

```
NAME LSW 'SCENARIO 5';
?   INEFFECTIVE FEDERAL SUPPORT PROGRAM AND
?   HIGHER COSTS OF PRODUCTION
?
?
?
FREQ A;
SMPL 1950 1984;
IN NEWHON;
SMPL 1950 1984;
?
SMPL 1983 1983;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
?
SMPL 1984 1984;
PCOL=COL;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
PPHFD=PHFD;
PPHRDF=PHRDF;
PDHM=DHM;
PSHPF=SHPF;
PPHMAXD=PHMAXD;
PPPOD=PPOD;
?
SMPL 1985 2009;
?   THESE EXOGENOUS VARIABLES ARE SET TO 1984 VALUES
PHSD=0.28423;
DUM73=1;
TRND=35;
TRND73=12;
?   THESE ARE ORIGINAL COSTS
? CPOPXD=24.82117;
? CHOPXD=29.61123;
? CPKPXD=41.35723;
?   THESE ARE NEW COSTS
CPOPXD=29.785404;
CHOPXD=35.533476;
CPKPXD=49.628676;
QPO=1386.1;
WXHOR=0.02336;
PWXID=0.66924;
PHID=0.16069;
M=237.0;
EH=7.5;
ICHPD=121.33909;
DUM65=1;
```

Appendix F: Computer Program for Scenario 5 - Ineffective Federal Support Program
and Higher Costs of Production (continued)

```

?
PDMPHSDF=.04018;
?
SMPL 1985 2003;
? THESE SUPPORT VARIABELS ARE SET TO MAKE THE SUPPORT
? PROGRAM INEFFECTIVE
PHSD=0;
PDMPHSDF=0;
?
SMPL 1985 2003;
?
? NOW LETS GET STARTED WITH THE SIMULATION
DO I=1985 TO 1995;
SMPL I I;
?-----
? BLOCK 1--THE INITIAL SET OF EQUATIONS
A0=139.6578;
A1=.9033466;
A2=242.2987;
C0=11.06271;
C1=0.4232625;
C2=0.004378899;
C3=-0.001536991;
C4=3.710412;
C5=-0.1907491;
D0=0.1941980;
D1=9.441638;
?
PFACMT2=(1/6)*(PFHOPMT(-1)+PFPKPMT(-1)+PFPOPMT(-1)+PFHOPMT(-
2)+PFPKPMT(-2)+PFPOPMT(-2));
?
? PDMPHSDF=POS(PHSD-PPHFD(-1));
?
PPPKD=D0+D1*PPHFD(-1);
PCOL=A0+A1*PCOL(-1)+A2*PFACMT2;
PPPOD=C0+C1*PPPOD(-1)+C2*QPO+C3*PCOL(-1)+C4*PPHMAXD(-
1)+C5*TRND;
?-----
? BLOCK 2--THE BIG GROUP
FRML HONSUP QHF = B0 + B1*PCOL + B2*FHOPMT + B3*FPKPMT +
B4*FPOPMT+B5*PDMPHSDF;
IDENT WAXSUP QWX = WXHOR*QHF;
FRML QQNPR PQND = E0 + E1* PPPKD + E2*QQNCOL;
IDENT ALLOCA AHCA=F0+F1*PHSFARD;
IDENT ALLOCB AHCB=1-POS(1-AHCA);
IDENT ALLOC1 AHC=POS(AHCB);
IDENT ALLOC2 QHP=(1-AHC)*QHF;
FRML WAXDMD PWXD = G0 + G1*QWXM+ G2*PFHOPMT(-1) + G3*PWXID +
G4*PDMPHSDF;

```

Appendix F: Computer Program for Scenario 5 - Ineffective Federal Support Program
and Higher Costs of Production (continued)

```

FRML PPKDMD   QPK = PCOL*(H0 + H1*PPPKD + H2*QQNCOL + H3 *
PPHMAXD(-1) + H4*DUM65+H5*PDMPHSDF);
FRML QQNDMD   QQN =PCOL*(I0+ I1* PQND+ I2*QPKCOL + I3*PPHMAXD(-1)
+ I4*TRND + I5* PDMPHSDF);
FRML HONDMD   PHFD = J0 +J1* QSHPM + J2*ICHPD + J3*PPHRDF(-1) + J4 *
PHID + J5*DUM73 + J6*PDMPHSDF + J7*PDHM(-1);
FRML IMPDMD   IHM = K0 +K1 * QSHPM+ K2* PPHRDF(-1)+ K3*PHID +
K4*PHMAXD + K5* DUM73 + K6*PDMPHSDF;
IDENT HONPROF
FHOPMT=(PHMAXD*WHOHO+PWXD*WWXHO+PPPPOD*WPOHO+PPPKD*WPK
HO+PQND*WQNHO) / (PPPKD*QPKHO+PQND*QQNHO + CHOPXD);
IDENT PPKPROF  FPKPMT=
(PHMAXD*WHOPK+PWXD*WWXPK+PPPPOD*WPOPK+PPPKD*WPKPK+PQND*
WQNPK) / (PPPKD*QPKPK+PQND*QQNPK+CPKFXD);
IDENT POLPROF  FPOPMT=
(PHMAXD*WHOPO+PWXD*WWXPO+PPPPOD*WPOPO+PPPKD*WPKPO+PQND*
WQNPO) / (PPPKD*QPKPO+PQND*QQNPO+CPOPXD);
IDENT PRICE21  PHSFARD =PHSD/PHFD;
IDENT PRICE23  PHMAXD=PHFD+POS(PHSD-PHFD);
IDENT QUANT21  QWXM=QWX/M;
IDENT QUANT22  QSHPM = (QHP+PSHPF(-1))/M;
IDENT QUANT24  QPKCOL=QPK/PCOL;
IDENT QUANT25  QQNCOL=QQN/PCOL;
?
PARAM B0, 121.9352, B1, 0.0495234, B2, 117.2318, B3, -73.47820, B4, -230.1567,
B5, -867.2041;
PARAM E0, -.2291193, E1, 0.8651651, E2,3.045417 , F0, -1.217034, F1, 1.441219;
PARAM G0, 0.1514005, G1, -5.713230, G2, 0.05483168, G3, 0.7859951, G4, -2.15914;
PARAM H0, 0.03461183, H1, -0.02594944, H2,0.9333837, H3, 0.2434844,
H4,0.02898729 , H5,-0.8942856 ;
PARAM I0, -0.01134207, I1,-0.0220852 , I2,0.2887513 , I3,0.2471680, I4, 0.002280063,
I5, -0.1692295 ;
PARAM J0, 0.2634232, J1,-0.004378458 , J2,-0.002831092 , J3,0.2490913 ,
J4,0.6132352 , J5, 0.09797321, J6, -0.6231662, J7, 0.0172977;
PARAM K0,0.3747096, K1,-0.1438645 , K2,0.06809512 , K3,-1.699113 , K4,0.8274489
, K5, 0.1425209, K6, 2.667295;
CONST WHOHO, 100, WPKHO, .6, WQNHO, 0, WPOHO, 1, WWXHO, 1, QPKHO,
1.3182, QQNHO, 0, WHOPK, 20, WPKPK, 8, WQNPK,4, WPOPK, 1, WWXPK, 1,
QPKPK, 0, QQNPK, 0, WHOPO, 25, WPKPO, .8, WQNPO, 0, WPOPO, 1.65,
WWXPO, 1, QPKPO, 0, QQNPO, 2.5357;
?
?
?  SIML THE BIG GROUP
SIML (TAG=S, ENDOG=(QHF, QWX, PQND, AHCA, AHCB, AHC, QHP, PWXD,
QPK, QQN, PHFD, IHM, FHOPMT, FPKPMT, FPOPMT, PHSFARD, QWXM,
QSHPM, QPKCOL, QQNCOL, PHMAXD), MAXIT=20, NOPRNDAT, NOPRNSIM,
DYNAM) HONSUP, WAXSUP, QQNPR, ALLOCA, ALLOCB, ALLOC1, ALLOC2,
WAXDMD, PPKDMD, QQNDMD, HONDMD, IMPDMD, HONPROF, PPKPROF,
POLPROF, PRICE21, PRICE23, QUANT21, QUANT22, QUANT24, QUANT25;
?

```

Appendix F: Computer Program for Scenario 5 - Ineffective Federal Support Program
and Higher Costs of Production (continued)

? RENAMING THE OUTPUT OF THIS SIMULATION

PQHF=QHFS;
PQWX=QWXS;
PPQND=PQNDS;
PAHCA=AHCAS;
PAHCB=AHCBS;
PAHC=AHCS;
PQHP=QHPS;
PPWXD=PWXDS;
PQPK=QPKS;
PQQN=QQNS;
PPHFD=PHFDS;
PIHM=IHMS;
PFHOPMT=FHOPMTS;
PFPKPMT=FPKPMTS;
PFPOPMT=FPOPMTS;
PPHSFARD=PHSFARDS;
PQWXM=QWXMS;
PQSHPM=QSHPMs;
PQPKCOL=QPKCOLS;
PQQNCOL=QQNCOLS;
PPHMAXD=PHMAXDS;

?

PIH=PIHM*M;

?

?

?

?

? BLOCK 3

?

PRINT I;

L0=-.2946686;

L1=1.179081;

L2=.9439934;

L3=-.2498637;

L4=0.005805494;

L5=-5.048632;

M0=0.4227957;

M1=-0.04269399;

M2=0.2130593;

M3=-.9930014;

M4=-0.01190572;

? EQUATIONS

?

PPHMAXDX=PPHMAXD-PPHMAXD(-1);

?

PQDHMM = (1/(1-L1*M1))* (L0 + L1*M0 +L1*M1*PIHM - L1*M1*EH/M +
L1*M2*DUM73+ (L1*M3+L5)*PDMPHSDF+L1*M4*TRND73 - L1*PPHRDF(-1)+
L2*PQSHPM+ L3*PPHMAXDX + L4* TRND);

PDHM = PQDHMM +PIHM - EH/M;

PPHRDF = M0 + M1*PDHM + M2*DUM73+M3*PDMPHSDF+M4*TRND73;

Appendix F: Computer Program for Scenario 5 - Ineffective Federal Support Program
and Higher Costs of Production (continued)

```
PPHRDFX = PPHRDF - PPHRDF(-1);
PDH = PDHM * M;
PSHPF = PSHPF(-1) + PQHP + PIH - EH - PDH;
?
ENDDO;
?
?
SMPL 1985 1995;
PRINT PFACMT2, PDMPHSDF, PPPKD, PCOL, PPPOD;
PRINT PQHF, PQWX, PPQND, PAHCA, PAHCB, PAHC;
PRINT PQHP, PPWXD, PQPK, PQQN, PPHFD, PIHM;
PRINT PFHOPMT, PFPKPMT, PFPOPMT, PPHSFARD, PQWXM;
PRINT PQSHPM, PQPKCOL, PQQNCOL, PPHMAXD, PIH;
PRINT PPHMAXDX, PQSHPM;
PRINT PQDHMM, PDHM, PPHRDF, PPHRDFX, PDH, PSHPF;
?
STOP; END;
```

APPENDIX G
COMPUTER PROGRAM FOR
SCENARIO 6- Ineffective Federal Support Program and Expansion of Honey Exports

Appendix G: Computer Program for Scenario 6 - Ineffective Federal Support Program
and Expansion of Honey Exports

```
NAME LSW 'SCENARIO 6';
?   INEFFECTIVE FEDERAL SUPPORT PROGRAM AND
?   EXPANSION OF HONEY EXPORTS
?
?
?
FREQ A;
SMPL 1950 1984;
IN NEWHON;
SMPL 1950 1984;
?
SMPL 1983 1983;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
?
SMPL 1984 1984;
PCOL=COL;
PFHOPMT=FHOPMT;
PFPKPMT=FPKPMT;
PFPOPMT=FPOPMT;
PPHFD=PHFD;
PPHRDF=PHRDF;
PDHM=DHM;
PSHPF=SHPF;
PPHMAXD=PHMAXD;
PPPOD=PPOD;
?
SMPL 1985 2009;
?   THESE EXOGENOUS VARIABLES ARE SET TO 1984 VALUES
PHSD=0.28423;
DUM73=1;
TRND=35;
TRND73=12;
CPOPXD=24.82117;
CHOPXD=29.61123;
CPKPXD=41.35723;
QPO=1386.1;
WXHOR=0.02336;
PWXID=0.66924;
PHID=0.16069;
M=237.0;
?   THESE ARE OLD EXPORTS
? EH=7.5;
?   THESE ARE NEW EXPORTS
EH=9;
ICHPD=121.33909;
DUM65=1;
?
PDMPHSDF=.04018;
```


Appendix G: Computer Program for Scenario 6 - Ineffective Federal Support Program
and Expansion of Honey Exports (continued)

```

?
SMPL 1985 2003;
? THESE SUPPORT VARIABELS ARE SET TO MAKE THE SUPPORT
? PROGRAM INEFFECTIVE
PHSD=0;
PDMPHSDF=0;
?
SMPL 1985 2003;
?
? NOW LETS GET STARTED WITH THE SIMULATION
DO I=1985 TO 1995;
SMPL I I;
?-----
? BLOCK 1--THE INITIAL SET OF EQUATIONS
A0=139.6578;
A1=.9033466;
A2=242.2987;
C0=11.06271;
C1=0.4232625;
C2=0.004378899;
C3=-0.001536991;
C4=3.710412;
C5=-0.1907491;
D0=0.1941980;
D1=9.441638;
?
PFACMT2=(1/6)*(PFHOPMT(-1)+PFPPKPM(-1)+PFPOPMT(-1)+PFHOPMT(-
2)+PFPPKPM(-2)+PFPOPMT(-2));
?
? PDMPHSDF=POS(PHSD-PPHFD(-1));
?
PPPKD=D0+D1*PPHFD(-1);
PCOL=A0+A1*PCOL(-1)+A2*PFACMT2;
PPPOD=C0+C1*PPPOD(-1)+C2*QPO+C3*PCOL(-1)+C4*PPHMAXD(-
1)+C5*TRND;
?-----
? BLOCK 2--THE BIG GROUP
FRML HONSUP QHF = B0 + B1*PCOL + B2*FHOPMT + B3*FPKPM +
B4*FPOPMT+B5*PDMPHSDF;
IDENT WAXSUP QWX = WXHOR*QHF;
FRML QQNPR PQND = E0 + E1*PPPKD + E2*QQNCOL;
IDENT ALLOCA AHCA=F0+F1*PHSFARD;
IDENT ALLOCB AHCB=1-POS(1-AHCA);
IDENT ALLOC1 AHC=POS(AHCB);
IDENT ALLOC2 QHP=(1-AHC)*QHF;
FRML WAXDMD PWXD = G0 + G1*QWXM+ G2*PFHOPMT(-1) + G3*PWXID +
G4*PDMPHSDF;
FRML PPKDMD QPK = PCOL*(H0 + H1*PPPKD + H2*QQNCOL + H3 *
PPHMAXD(-1) + H4*DUM65+H5*PDMPHSDF);

```

Appendix G: Computer Program for Scenario 6 - Ineffective Federal Support Program
and Expansion of Honey Exports (continued)

```

FRML QQNDMD   QQN =PCOL*(I0+ I1* PQND+ I2*QPKCOL + I3*PPHMAXD(-1)
+ I4*TRND + I5* PDMPHSDF);
FRML HONDMD   PHFD = J0 +J1* QSHPM + J2*ICHPD + J3*PPHRDF(-1) + J4 *
PHID + J5*DUM73 + J6*PDMPHSDF + J7*PDHM(-1);
FRML IMPDMD   IHM = K0 +K1 * QSHPM+ K2* PPHRDF(-1)+ K3*PHID +
K4*PHMAXD + K5* DUM73 + K6*PDMPHSDF;
IDENT HONPROF
FHOPMT=(PHMAXD*WHOHO+PWXD*WWXHO+PPPPOD*WPOHO+PPPKD*WPK
HO+PQND*WQNHO) / (PPPKD*QPKHO+PQND*QQNHO + CHOPXD);
IDENT PPKPROF  FPKPMT=
(PHMAXD*WHOPK+PWXD*WWXPK+PPPPOD*WPOPK+PPPKD*WPKPK+PQND*
WQNPK) / (PPPKD*QPKPK+PQND*QQNPK+CPKFXD);
IDENT POLPROF  FPOPMT=
(PHMAXD*WHOPO+PWXD*WWXPO+PPPPOD*WPOPO+PPPKD*WPKPO+PQND*
WQNPO) / (PPPKD*QPKPO+PQND*QQNPO+CPOPXD);
IDENT PRICE21  PHSFARD =PHSD/PHFD;
IDENT PRICE23  PHMAXD=PHFD+POS(PHSD-PHFD);
IDENT QUANT21  QWXM=QWX/M;
IDENT QUANT22  QSHPM = (QHP+PSHPF(-1))/M;
IDENT QUANT24  QPKCOL=QPK/PCOL;
IDENT QUANT25  QQNCOL=QQN/PCOL;
?
PARAM B0, 121.9352, B1, 0.0495234, B2, 117.2318, B3, -73.47820, B4, -230.1567,
B5, -867.2041;
PARAM E0, -.2291193, E1, 0.8651651, E2,3.045417 , F0, -1.217034, F1, 1.441219;
PARAM G0, 0.1514005, G1, -5.713230, G2, 0.05483168, G3, 0.7859951, G4, -2.15914;
PARAM H0, 0.03461183, H1, -0.02594944, H2,0.9333837, H3, 0.2434844,
H4,0.02898729 , H5,-0.8942856 ;
PARAM I0, -0.01134207, I1,-0.0220852 , I2,0.2887513 , I3,0.2471680, I4, 0.002280063,
I5, -0.1692295 ;
PARAM J0, 0.2634232, J1,-0.004378458 , J2,-0.002831092 , J3,0.2490913 ,
J4,0.6132352 , J5, 0.09797321, J6, -0.6231662, J7, 0.0172977;
PARAM K0,0.3747096, K1,-0.1438645 , K2,0.06809512 , K3,-1.699113 , K4,0.8274489
, K5, 0.1425209, K6, 2.667295;
CONST WHOHO, 100, WPKHO, .6, WQNHO, 0, WPOHO, 1, WWXHO, 1, QPKHO,
1.3182, QQNHO, 0, WHOPK, 20, WPKPK, 8, WQNPK,4, WPOPK, 1, WWXPK, 1,
QPKPK, 0, QQNPK, 0, WHOPO, 25, WPKPO, .8, WQNPO, 0, WPOPO, 1.65,
WWXPO, 1, QPKPO, 0, QQNPO, 2.5357;
?
?
?  SIML THE BIG GROUP
SIML (TAG=S, ENDOG=(QHF, QWX, PQND, AHCA, AHCB, AHC, QHP, PWXD,
QPK, QQN, PHFD, IHM, FHOPMT, FPKPMT, FPOPMT, PHSFARD, QWXM,
QSHPM, QPKCOL, QQNCOL, PHMAXD), MAXIT=20, NOPRNDAT, NOPRNSIM,
DYNAM) HONSUP, WAXSUP, QQNPR, ALLOCA, ALLOCB, ALLOC1, ALLOC2,
WAXDMD, PPKDMD, QQNDMD, HONDMD, IMPDMD, HONPROF, PPKPROF,
POLPROF, PRICE21, PRICE23, QUANT21, QUANT22, QUANT24, QUANT25;
?
?  RENAMING THE OUTPUT OF THIS SIMULATION
PQHF=QHFS;

```

Appendix G: Computer Program for Scenario 6 - Ineffective Federal Support Program
and Expansion of Honey Exports (continued)

```
PQWX=QWXS;
PPQND=PQNDS;
PAHCA=AHCAS;
PAHCB=AHCBS;
PAHC=AHCS;
PQHP=QHPS;
PPWXD=PWXDS;
PQPK=QPKS;
PQQN=QQNS;
PPHFD=PHFDS;
PIHM=IHMS;
PFHOPMT=FHOPMTS;
PFKPMT=FPKPMTS;
PFPOPMT=FPOPMTS;
PPHSFARD=PHSFARDS;
PQWXM=QWXMS;
PQSHPM=QSHPMs;
PQPKCOL=QPKCOLS;
PQQNCOL=QQNCOLS;
PPHMAXD=PHMAXDS;
?
PIH=PIHM*M;
?
?
?-----
? BLOCK 3
?
PRINT I;
L0=-.2946686;
L1=1.179081;
L2=.9439934;
L3=-.2498637;
L4=0.005805494;
L5=-5.048632;
M0=0.4227957;
M1=-0.04269399;
M2=0.2130593;
M3=-.9930014;
M4=-0.01190572;
? EQUATIONS
?
PPHMAXDX=PPHMAXD-PPHMAXD(-1);
?
PQDHMM = (1/(1-L1*M1))* (L0 + L1*M0 +L1*M1*PIHM - L1*M1*EH/M +
L1*M2*DUM73+ (L1*M3+L5)*PDMPHSDF+L1*M4*TRND73 - L1*PPHRDF(-1)+
L2*PQSHPM+ L3*PPHMAXDX + L4* TRND);
PDHM = PQDHMM +PIHM - EH/M;
PPHRDF = M0 + M1*PDHM + M2*DUM73+M3*PDMPHSDF+M4*TRND73;
PPHRDFX = PPHRDF - PPHRDF(-1);
PDH = PDHM * M;
```

Appendix G: Computer Program for Scenario 6 - Ineffective Federal Support Program
and Expansion of Honey Exports (continued)

```
PSHPF = PSHPF(-1) + PQHP + PIH - EH - PDH;  
?  
ENDDO;  
?  
?  
SMPL 1985 1995;  
PRINT PFACMT2, PDMPHSDF, PPPKD, PCOL, PPPOD;  
PRINT PQHF, PQWX, PPQND, PAHCA, PAHCB, PAHC;  
PRINT PQHP, PPWXD, POPK, PQQN, PPHFD, PIHM;  
PRINT PFHOPMT, PFPKPM, PFPOPMT, PPHSFARD, PQWXM;  
PRINT PQSHPM, QPKCOL, QQNCOL, PPHMAXD, PIH;  
PRINT PPHMAXDX, PQSHPM;  
PRINT PQDHMM, PDHM, PPHRDF, PPHRDFX, PDH, PSHPF;  
?  
STOP; END;
```

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