Revisiting Econometric Models of the U.S. Apple Industry: 1971-2015

by

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Contents

1 Introduction

The mid to late twentieth century was host to a number of influential studies pertaining to economic modelling of the United States apple industry. Since then, few such research initiatives have been undertaken. Thus, there is a gap in the body of literature that is addressed by the analysis presented in this paper. A regional structural model of the U.S. apple industry is constructed. The model is defined by four sectors describing the production, allocation, consumption and pricing of apples. The benefits of a regional model, when compared to an aggregated national model, are threefold. First, heterogeneous technological progression between regions is explicitly accounted for. Second, a better understanding of the comparative advantage that certain regions possess in the production of apples may be ascertained. Finally, the regional supply response to severe crop damage in a major producing area can be investigated.

Apple production in the United States is characterised by several major states producing a large portion of the total annual production, while the remainder is contributed by a number of minor states. In 2016, Washington State, New York State, Michigan, Pennsylvania and Virginia accounted for more than 90% of the total U.S. apple production. These same states produced approximately 74% and 63% of the total 1990 and 1971 U.S. crops respectively. This suggests that production is being consolidated into the major producing regions, particularly since the 1990's, when the most recent industry models were published.

Total production in the United States has remained relatively constant since the 1990's, barring the expected seasonal fluctuations. Bearing acreage of apples, however, has been in steep decline over the same time period. From these contrasting trends, one can infer that overall, U.S. apple producers are capitalizing on advances in technology and practise in order to obtain higher yields per acre. For example, dwarfing root stocks and high density planting systems have not only enabled farmers to produce more volume per unit of land area, but also to improve fruit quality. Further, the decline in bearing acreage may possibly be explained by a combination of factors including: a higher opportunity costs of agricultural land, urban sprawl and a diminishing supply of orchard managers and farm labour.

Annual apple production is allocated to either fresh or processed fruit markets. In the processed market, apples are used to make goods such as apple pies, juice, sauces and dried preserves. Generally, prices paid to growers for fresh apples exceed that of processed apples. The ratio of fresh utilization to processed utilization remained relatively constant until the mid 1990's, after which, an increasing portion of production began to be sent to fresh markets. This may be due to the development of high value varieties, such as Honeycrisp, Fuji and Ambrosia that have been well received by consumers in the market for fresh fruit. Unsurprisingly, the premium paid to growers for fresh fruit has followed a trend similar to that of the fresh utilization ratio.

Average prices for fresh and processed apples are determined in their respective markets through an inverse demand relationship. The price of apples is determined by the per capita consumption of apples and alternative goods, as well as the incomes of consumers. Per capita consumption of apples, both fresh and processed, has increased at a relatively constant rate through the period of 1971 to 2015. In 1971 total per capita consumption of apples was equal to 30.73 pounds (farm weight), compared to 46.09 pounds in 2015. Contrasting this tendency is the per capita consumption of alternative goods such as fresh oranges, canned peaches and canned pears, which has declined during the same period. The personal consumption expenditure on food in the United States increased significantly, both nominally and in real terms. In 1971, food expenditures totalled 147.8 billion dollars, compared to a value of 1591.1 billion dollars in 2015.

The objective of this research is to provide an updated regional model of the United States apple industry. A model analogous to Roosen (1999) is specified in order to provide a comparisson of point estimates and to identify any shifts in the relationships between key model variables. A separate specification using a block recursive structure, as in Willett (1993), is then constructed where regional supply responses to crop failure in major producing areas are evaluated.

The remaining sections are organised as follows. Section 2 provides a review of the current literature and identifies key concepts. Section 3 provides data sources and describes the necessary variables transformations. The methodology is outlined in Section 4, with the estimation results and subsequent discussion being provided in Section 5. Finally, Section 6 concludes.

2 Literature Review

This section provides a synopsis of the various literature pertaining to apple industry modelling and price forecasting. The majority of the studies that are reviewed were conducted within the period 1960-1990. Since then, it appears that there is apathy among researcher toward economic modelling/forecasting of the apple industry, as few recent studies exist. This may be due to a lack of data which inhibits novel research into production processes. In general, existing studies can be organized into one of two categories: 1) structural models that treat the apple industry as a whole; and 2) sector-specifc models that focus on a particular segment of the apple industry for example, production, demand, trade and pricing relations. While these two general approaches are clearly distinguishable in the literature, they are not mutually exclusive. The industry models often implement sector-specific studies with the aim of representing the various components of the apple industry more accurately. Namely, the majority of supply sectors in industry models follow the theoretical framework of perennial crop production proposed by French and Matthews (1971).

2.1 Sector-Specific Studies

Crop load management refers to the processes by which apple producers control the volume of fruits present on trees throughout the orchard. Consequently, this practise is directly related to fruit size and quality during harvest. Gallardo et al. (2015) estimate the impact of sub-optimal crop load management on grower returns for Honeycrisp apples. Using a hedonic pricing model, the authors estimate the relationship between Honeycrisp prices and quantities by fruit size categories. They also conduct an experimental second-price auction in order to uncover consumer willingness to pay for various attributed to Honerycrisp quality, including aesthetic appearance, firmness and tartness. Results indicate that a Honeycrisp grower would experience a loss of \$5332 per acre if the production of 48-88 count boxes (large fruit) fell by 5% and the production of 100-163 count boxes (small fruit) increased by 5%. Further, they find that a one-unit decrease in soluble solid content, which serves as a proxy for sweetness, would result in a \$1362 per acre loss for growers.

French and Matthews (1971) construct a theoretical model of supply for perennial crops with an empirical application to the asparagus industry. This study provides the foundation upon which the supply sector is modelled in the majority of subsequent apple industry research including Willett (1993) and Roosen (1999). In terms of production, perennial crops are distinguished from annual crops by long gestation periods between initial planting and the first harvest. As well, multiple harvests are obtained from a single planting investment followed by a gradual decline in annual yields (productive capacity of the plants).

French and Matthews' model consists of five components which jointly describe the behaviour of a profit maximizing agent. In the first component of the model the farm agent chooses a desired level of production which is a function of the profitability of both the commodity in question and that of alternative land uses. Given expected long-run yields, farmers selects the amount of bearing acreage necessary to achieve the desired level of production. In component two, the farmer accounts for the current acreage which is not yet at a producing age and the expected acreage to be removed during the next k years (where k is the gestation period) to determine the amount of acreage which must be planted in period t in order to obtain the optimal bearing acreage in period $t+k$ which will result in the desired level of production in period $t+k$. In component three, the annual acreage removed is a function of the proportion of current acreage that exceeds a threshold age beyond which productivity declines, short run profitability expectations for the commodity in question and the profitability of alternative land uses. The fourth component explains the process by which producer expectations of profitability are formulated. The final component involves estimating a yield relationship that is a function of an orchards age structure, as well as technological, biological and weather driven factors. In practise, data for many of the variables required in this theoretical model are unavailable for apple production. Thus, adaptations are required in empirical applications to address data availability, or lack thereof.

Sparks, Seale, and Buxton (1990) estimate an empirical model of competition in trade between the United States and other exporters of fresh apples in four major markets, Canada, Hong Kong, Singapore and the United Kingdom, for the period of 1962-1987. A two-stage demand process for imported apples is proposed where the importing nation first allocates a portion of its total import expenditure to apple and then divides the apple expenditure among the competing exporters. Results indicate that imports of U.S. fresh apples will increase as each of the four markets grow, however, the U.S. market share will only increase slightly or fail to be maintained.

Conway, Yanagida, and Stellmacher (1985) estimate aggregate U.S. fruit price equations which are used to form conditional price forecasts. Inverse demand functions are estimated for fresh, canned, frozen and dried utilizations of fruit as a function of own per capita consumption, per capita disposable income and the CPI for non-durable goods (less food). For each utilization, the coefficient on the own per capita consumption variable is of the expected negative sign. In each case, the coefficient on per capita disposable income is positive which implies that each utilization of fruit is a normal good on the aggregate. Forecasts indicate that both fresh and processed real prices will increase in the United States during the period 1985 to 1989.

2.2 Industry Studies

The second branch of literature focuses on framing a complete model of an economy's apple industry. Examples of such studies include: Willett (1993), Roosen (1999), Goddard (1991), Hayward, Criner, and Skinner (1984) and Fuchs, Farrish, and Bohall (1974). Early research often involves specifying two-sector, supply and demand models while more recent expositions explicitly incorporate the allocation and foreign trade of utilized production. The models sectors jointly illustrate the interactions between the fundamental agents of an apple industry. In empirical work, the challenge is to produce structural point estimates in the presence of endogeneity throughout the model, if the sectors are assumed to be determined simultaneously.

Hayward, Criner, and Skinner (1984) fashion a structural model that accounts for the interaction between the apple industries of Maine and the rest of the United States (demand function is for 1960-1981, supply function is for 1944-1982). The authors incorporate the rate of size-controlled tree adoption (semi-dwarfing root stocks), which was a catalyst for yield growth throughout the 1970's and 1980's. The model follows a recursive structure that begins by separately estimating production for Maine and then the rest of the United States. A market clearing condition equates total U.S. production to total U.S. demand in order to determine the national average apple price. The national average price is then used as an explanatory variable to determine the average price for Maine. Supply equations for both Maine and the rest of the United States are specified as functions of the separate price expectation for dwarf and standard trees. Price expectations are weighted by the rate of dwarf tree adoption, the stock of old trees and lagged dependent variables. An inverse demand function is then estimated by regressing the average U.S. apple price on per capita disposable income and the U.S. apple supply. The average price of apples in Maine is determined by a simple regression of the U.S. price. Ordinary Least Squares estimation of the aforementioned equations was justified under the implications of a recursive structure, coupled with the assumption that residual covariance dissipates in the limit.

Willett (1993) builds upon the work of Hayward, Criner, and Skinner (1984) by formulating a three-sector model of the U.S. apple industry for the period 1971-1990. The supply sector describes the behaviour of orchardists who increase production by expanding the bearing area as apples become relatively more profitable. The allocation sector first sorts the utilized production into either fresh or processed categories and then further decomposes the processed sector into one of five uses: 1)canned, 2) juice, 3) dried, 4) frozen or 5) other. The allocation of processed fruit is dictated by the relative price of each utilization to the average price for processed fruit. Willett then estimate inverse demand functions for each utilization of fruit where per capita consumption and the personal consumption expenditure on food are independent variables. Estimated pricing relationships aggregate the prices for each allocation into a U.S. average price, which feeds back into the supply sector. The supply, allocation and demand sectors are simultaneously estimated using Zellner's Seemingly Unrelated Regression technique. The remainder of the model is assumed to be independent and therefore, estimated by Ordinary Least Squares.

Roosen (1999) estimates a regional model of the U.S. apple industry for the period 1971-1997 in order to account for differing rates of technological growth between states. The supply sector is divided into four regions: Northwest, Southwest, Central and Eastern. As with the previous two studies, the supply sector is a variation of the French and Matthews (1971) theoretical model of supply for perennial crops. Annual production is a function of variables representing the relative profitability of apples. Given data availability at the state level, the allocation sector only encompasses two utilizations of apples, fresh and processed, rather than further decomposing the processed fruit market. Total U.S. production is given by summing production over all regions. Roosen explicitly incorporates a trade sector where the net import of each utilization is estimated as a function of the import price, the domestic price and the domestic production. Net imports are added to U.S. production when determining the volume of apples available to be consumed domestically. Finally, the demand sector specifies price to be a function of own and competing per capita consumption and other demographic variables. The model is assumed to be determined simultaneously, and in recognition of resulting endogeneity throughout the model, the system is estimated using Three-Stage Least Squares.

Due to insufficient data availability, structural apple industry models for the Canadian context are scarce. Goddard (1991) constructs a model analogous to Willett (1993) using Canadian data for the period 1965-1988 in order to identify the implications of supply management policies. In Goddard's model, annual production is assigned to one of three markets, fresh, processed and export. The demand system for fresh apples and apple juice is estimated in a two-stage process. First, the aggregate consumption of all fruit types is determined, followed by the demand/consumption of each fruit type individually. Results suggest that only minor increases in producer revenue would be realized through restricting domestic production and imposing trade barriers.

3 Data Sources and Transformations

3.1 State-Level Data

State data are obtained from various publications of the United States Department of Agriculture (U.S.D.A). A detailed list of data sources for each variable can be found in the data section of the appendix.

Bearing acreage of commercial apple crops refer to the total area of land containing apple trees that contribute to the total commercial apple production[1]. Data are obtained from the U.S.D.A Fruit and Nuts Bearing Acreage 1947-1983 Report by Doyle C. Johnson for the time period 1971-1983. For the time period 1984-2010 data are sourced from the U.S.D.A Economic Research Service: Apple Statistics Tables. The Economic Research Service cites the U.S.D.A Noncitrus Fruits and Nuts Summary as the source of informa-

[1] Land containing apple trees that are not in production will not be included in this figure

tion for years subsequent to 1992; thus, data for the remaining period of 2011-2015 were retrieved from various issues of these reports.

The bearing acreage report produced by Doyle C. Johnson provided data for nearly every state throughout the previously mentioned time period, however, the Apple Statistics Tables failed to report values for a number of minor producing states for the years 1984 to 1986. This block of missing values resulted in a significant jump in bearing acreage between the years 1986 and 1987. For the states with missing values a quadratic time trend, with a linear component, was fit to the existing bearing acreage values for each state. The missing values are filled with the predicted values of this regression. Data were filled using this method for the following states and years: Arizona [1984-1988], Colorado [1984-1986], Connecticut [1984-1986], Delaware [1984-1986], Idaho [1984-1986], Illinois [1984-1986], Indiana [1984-1986], Kansas [1984-1986], Kentucky [1984-1986], Maine [1984-1986], Maryland [1984-1986], Massachusetts [1984-1986], Minnesota [1984-1986], Missouri [1984-1986], New Hampshire [1984-1986], New Mexico [1984-1986], Rhode Island [1984-1986], Utah [1984-1986], and Vermont [1984-1986]. The states that were so filled are only minor producing states and do not individually represent a significant portion of the bearing acreage data.

The remaining state level variables include: Total Production, Total Utilized Production, Fresh Utilization, Processed Utilization, Total Utilization Price, Fresh Utilization Price and Processed Utilization Price. Data on each of the aforementioned variables for the time period 1971-2015 are retrieved from various issues of the U.S.D.A Noncitrus Fruits and Nuts Summary. These reports are published annually and provide variable values for three years prior to the year of publication. For example, the 2010 report includes values for the years 2007, 2008 and 2009. Only the least recent values were collected from each report.

3.2 United States Aggregate Data

As previously stated, production and utilization data are found in various issues of the U.S.D.A Noncitrus Fruits and Nuts Summary. Per capita consumption values and population totals, however, are not listed in these reports. United States population totals, per capita consumption of fresh apples and per capita consumption of processed apples are collected from two separate publications of the United States Department of Agriculture. Data for the period 1971-1979 are from the Food Consumption, Prices and Expenditure 1970-1997 Report, while the Fruit and Tree Nuts Yearbook 2016 provides the remainder of the series. The population for a year is given by the January population in the following year. For example, the population used to calculate per capita consumption in 2014 is the January population in 2015. This adjustment was performed upon data entry and is therefore included in the data section of the appendix.

Per capita consumption variables are collected for the following goods that exist alongside apples in fresh and processed fruit markets: Fresh Bananas, Fresh Oranges and Temples, Canned Peaches, Canned Pears and Orange Juice. In the interest of consistency, per capita consumption values for the aforementioned items are obtained for the period 1971-1979 from the Food Consumption, Price and Expenditure 1970-1997 Report and from the Fruit and Nuts Situation and Outlook Yearbook 2016 for the period 1980-2015. Data for Fresh Bananas and Oranges are denominated in fresh/farm weight values. Canned Pears and Peaches are recorded in their product weight equivalent which may, if desired, be converted to farm/fresh weight using a constant conversion factor. Finally, per capita consumption of orange juice is reported in gallons, single strength equivalent.

An index of Prices Paid by Farmers with a base year of 1910-1914 (all commodities bought including interest, taxes and the wage rate) was collected from the U.S.D.A Agricultural Statistics publication. The index captures price movements for agricultural commodities and services, fuel, wages, taxes and interest expenditures. The index is an important component in the construction of an indicator variable for apple production profitability.

The United States' Personal Consumption Expenditures on Food is obtained from the U.S. Department of Commerce: Bureau of Economic Analysis. Willett uses values reported in the Economic Report of the President, which cites the U.S.D.C. as the source of data. In this study, the nominal expenditure is computed as the sum of expenditures on Food Services and Food and Beverages purchased for off-premises consumption. The series reported in the data appendix of this study provides nominal values. In order to convert to real values, one would ideally use the CPI for each food item that contributes to the total expenditure. However, an adequately disaggregated series could not be obtained; thus, the nominal expenditure is deflated using the GNP Deflator. Finally, the GNP Implicit Price Deflator was obtained from the Federal Reserve Bank of St.Louis, Economic Data (FRED).

3.3 Transformations and Variable Generation

The remainder of this section details the transformations that are performed on the raw data. Several alterations must be performed to the raw state and U.S. aggregate data prior to estimation. For example, nominal values must be deflated and state data must be combined to achieve regional values. The structural model contains four supply and allocation regions which are defined as follows:

Northwest Region: Washington, Oregon and Idaho

Southwest Region: Arizona, California, Colorado, Utah and New Mexico

Central Region: Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Ohio, Tennessee and Wisconsin

Eastern Region: Delaware, Georgia, Maine, Massachusetts, New Hampshire, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia and West Virginia and Connecticut.

3.3.1 Bearing Acreage, Total Production and Utilization

Regional variables for annual Bearing Acreage, Total Production, Total Utilized Production, Fresh Utilization and Processed utilization are calculated simply by summing state values over each state within the respective region. For example, the Northwest Bearing Acreage is the sum of bearing acreage for Washington, Oregon and Idaho.

3.3.2 Regional Prices

Regional prices are generated as the weighted average of the grower prices corresponding to each state within the region. Weights for the total average regional prices are given by the proportion of production that a state contributes within its region. Likewise, the weights for the fresh and processed regional prices are given by the contribution of each state to the region's total fresh and processed utilization respectively. This is formally expressed by the following equation where i refers to each state within region j, $SPROD$ denotes the total production for state i and $RPROD$ represents the total production for the region to which state i belongs:

$$w_i = \frac{SPROD_i}{RPROD_j} \tag{1}$$

The weighted average used to construct the regional prices is naturally given by the following formula.

$$RPRICE_j = \sum_{i=1}^{N} w_i SPRICE_i \tag{2}$$

where $RPRICE$ denotes the price for region j which is the sum of the weighted state price, $SPRICE$, over all N states belonging to region j.

Processed prices in the raw data are denominated in dollars per ton. The regional prices are multiplied by 100 and subsequently divided by 2000, yielding cent per pound prices.

3.3.3 Trade Variables

The volume (pounds) of domestic consumption for total, fresh and processed utilization is calculated as the product of per capita consumption and the population, corresponding to each category. Further, the total volume of consumption is equal to the utilized production plus imports minus exports. Thus, net imports for each utilization are given by subtracting total utilized production from the domestic consumption:

$$
\begin{aligned}
&\text{(Domestic Consumption)} = \text{(Total Utilized Production)} + \text{(Total Imports)} - \text{(Total Exports)} \\
\Longrightarrow\ &\text{(Domestic Consumption)} = \text{(Total Utilized Production)} + \text{(Net Imports)} \\
&\Longrightarrow\ \text{(Net Imports)} = \text{(Domestic Consumption)} - \text{(Total Utilized Production)}
\end{aligned} \tag{3}
$$

The net imports are then divided by the population in order to obtain the per capita net import, which is the variable referenced in the structural model.

3.3.4 Nominal Variables Deflated

Currently, the index of prices paid by farmers has a base year of 1910-1914. It may be unnecessary in terms of the estimation process, but the base year for the index is changed to 2009 by dividing the entire series by it's value in 2009. Consistency with the other model variables is the primary benefit of this transformation. The variable is then deflated using the GNP implicit price deflater.

The Personal Consumption Expenditure on Food obtained from the U.S. Department of Commerce: Bureau of Economic Analysis, is denominated in nominal values. Ideally, one would deflate each item contributing to the expenditure with it's specific Consumer Price Index. Unfortunately, a sufficiently disaggregated expenditure could not be obtained. The real expenditure is calculated by deflating the nominal data with the GNP deflator.

Nominal price values for each region are divided by the Gross National Product Deflator (and multiplying by 100) in order to produce the real regional prices which will be used to estimate the model.

Note: In the raw data, the Total Price and Fresh Price values are denominated in dollars per pound. These are converted to cents per pound simply by multiplying current values by 100.

3.3.5 Generating Regional Yield per Acre

Yield per acre variables were available for a portion of the time period 1971-2015; however, a complete series could not be sourced. This is not an issue, as the regional average yield per acre may be obtained by dividing the total regional production by the total regional bearing acreage:

$$Y_t = \frac{\text{Production}_t}{\text{Bearing Acres}_t} \tag{4}$$

Currently, bearing acreage data are level values while production is denominated in millions of pounds. Production must first be multiplied by 1,000,000 to get a level value prior to constructing the yield per acre. Yields are then dividing by 1000 to achieve more manageable yield values.

3.3.6 Three-Year Moving Average Variables

Three-year moving averages of the total regional prices and the index of prices paid by farmers were formulated in order to represent an orchard manager's expectation of future receipts and outlays. The relevant formulas are expressed in equations 5 and 6. In both cases, the three-year moving average is the sum of the current value of the variable and the previous two values, divided by three. A farmer is unlikely to undertake significant investment projects after a single year with higher than average profits, as this may be a result of a positive shock to growing conditions, or a negative shock in a competing region. Rather, a farmer may deem several years of high returns as an indicator of a favourable long term outlook and therefore, expand production.

$$TP3 = \frac{TP_t + TP_{t-1} + TP_{t-2}}{3} \tag{5}$$

$$IPPF3 = \frac{IPPF_t + IPPF_{t-1} + IPPF_{t-2}}{3} \tag{6}$$

3.3.7 Profitability Indicator

A profitability indicator is constructed as the ratio of the three-year moving average of regional prices to the three-year moving average of the index of prices paid by farmers. The relative profitability indicator, as the title suggests, serves as a proxy for the profitability of commercial apple production. The indicator is an explanatory variable in the behavioural supply equation describing the change in bearing acreage. Hypothetically, when apple farming is relatively more profitable, the orchardist will elect to plant more acres of apple orchard. This variable is lagged three years in the bearing acreage equation, to represent the gestation period between the time of planting and first year of production (when the planted acreage will be recorded as bearing acreage):

$$PI_t = \frac{TP3_{t-3}}{IPPF3_{t-3}} \tag{7}$$

Note: Time series graphs for a selection of the important variables are provided in Appendix B.

4 Methodology

Traditionally, structural models of the apple industry explicitly capture the behaviour of each fundamental decision-making agent by organising the industry into multiple sectors. This study models the U.S. apple industry as a unification of two frameworks existing within the literature; namely, the regional structure of supply is adopted from Roosen (1999) while the demand structure is similar to that of Willett (1993). The apple industry is defined by four sectors: 1) Supply, 2) Allocation, 3) Demand and 4) Price Determination.

The remainder of this section describes the behaviour of agents within each sector, which is related to the model specification in Section 5.

4.1 Supply Sector

The supply sector models the behaviour of U.S. apple producers at a regional level, following French and Matthews (1971). In any year, the product of a region's bearing acreage and the average yield per acre results in the total production within the region. Producers may adjust their production by planting additional acreage of plants and the decision to do so is a function of the profitability of apples, as well as that of alternative land uses within the region. However, given the biological nature of apple trees, newly planted acreage will not be recorded as bearing acreage until the end of a gestation period. The Augmented Dickey-Fuller test indicates the presence of a unit-root in the bearing acreage variable. To rectify this issue, the first difference is taken which serves as the dependent variable in the supply sector. Bearing acreage in each year is then given by the sum of bearing acreage in the previous year plus and the change in bearing acreage for the current year.

As stated, the change in bearing acreage is a function of the profitability of apple production relative to other land uses. Naturally, apple prices experience significant weather driven fluctuations. Thus, orchardists are unlikely to incur the significant investment that is necessary to increase the bearing area after a single year of elevated returns. Properly specified profitability variables must reflect the fact that it is more probable for farmers to consider expanding acreage when the mid to long term outlook is favourable. A favourable outlook is indicated by several years of elevated prices, barring an equivalent increase in the cost of production. As well, the presence of a gestation period between the planting of apple trees and the first harvest implies that the change in bearing area for the current year is reflective of the planting decision several years prior. Therefore, profitability measures enter the bearing acreage equation with a lag.

In general, producers have limited control over the yield per acre within a given year.

Over-cropping will not only limit fruit size and quality but may also shock the plants into "biennial production [2]" which are each undesirable features to an orchardist. The implications of over-cropping in terms of consumer willingness to pay are discussed at length in Gallardo et al. (2015). Advances in technology and practice, however, have enabled orchardists to obtain a higher volume of production per unit of land area. For example, higher tree planting density has perhaps caused the most marked improvements in yields within the last half century. The effect of technological progression often enters yield equations through the inclusion of a linear time trend. In general, the adoption of technology depends on the profitability of apples. Naturally, a farmer receiving an average return of one dollar per pound of apples is more likely to invest in production technology than a farmer receiving fifty cents per pound, all else equal. This assumption is represented by three-year moving averages of apple prices in the yield relationships.

4.2 Allocation Sector

The allocation sector describes the behaviour of agents such as packinghouses, that sort the annual supply of apples into various fruit markets. Thus, allocation is also defined at a regional level. Due to data availability (and the allocative nature) at the state level, this study considers only two possible allocations of annual production, fresh utilization and processed utilization. The volume of fresh utilization, for a given region, is a function of the expected price premium for fresh apples as well as the total annual production for the region. For years with elevated production, one would expect that more fruit will be allocated for to fresh markets in absolute terms (even if the ratio of fresh to processed remains constant). Alternatively, the price premium paid for fresh fruit entices both producers and packinghouses to allocate a higher proportion of apples to fresh markets compared to processed markets. As a prior, one would of course expect that a higher fresh price premium would result in more apples supplied to fresh fruit markets. By identity, the volume of

[2] Biennial production is characterised by low yields in the year following over-cropping

fruit allocated for processed uses is equal to the total utilized production, less the volume allocated for fresh utilization.

To transition from the regional allocation sector into the national demand sector, the total utilization of fresh and processed apples is summed over all regions. The resulting value represents the total volume of fresh and processed apples supplied domestically by U.S. farmers. Per capita utilization is calculated by dividing the total volumes by the population. Crucially, the per capita consumption of apples by U.S. citizens need not be equal to the per capita domestic utilization. A portion of annual apple production may be exported to foreign economies, driving per capita consumption below the per capita domestic utilization. Alternatively, consumers may augment their consumption by importing apples from other countries such as Canada, New Zealand and Chile. Thus, per capita net consumption is the sum of per capita utilization and per capita net imports. Trade is not modelled explicitly within this study; and therefore per capita net imports are assumed to be determined exogenously.

4.3 Demand Sector

Modern storage and transportation technologies result in regional apple supplies that are relatively mobile throughout the United States. Therefore, average prices for apples are determined at the national level, while grower prices within each region are determined by the national price. Inverse demand functions are specified for both the fresh and processed utilizations [3]. In both cases, explanatory variables represent well-known determinants of demand. The domestic price of fresh apples is a function of the per capita consumption of fresh apples, the per capita consumption of competing fruits, such as oranges and bananas, as well as the personal consumption expenditure on food. Likewise, the price of processed apples is a function of the per capita consumption of the processed apples, the

[3] Inverse demand functions are used to facilitate the connection between the supply and demand sectors for the purpose of possible simulations and forecasts.

per capita consumption of competing processed fruit, such as oranges juice, canned peaches and canned pears and the personal consumption expenditure on food. While theory and past empirical work assert that an increase in per capita consumption of apples should result in lower prices, the relationship between the demand for apples and that of alternative fruits depends on the nature of fresh and processed fruit markets. Namely, the sign of the coefficient on other fruits depends on whether the good is a complement or substitute good for apples in consumption. Further, the sign on the personal consumption expenditure variable will depend on whether apples are a normal or inferior good.

4.4 Regional Price Determination and Imports

Regional prices for each allocation, in each region, are a function of the U.S. aggregate prices determined in the demand sector. These price determination regressions serve to link the national demand sector to the supply sectors in each region. Naturally, higher U.S. aggregate prices should result in higher prices within each region on average.

4.5 Specifications Estimated

The estimation section to folllow provides two alternative model specifications, each of which, while differing in foundational assumption (which will be discussed), abides by the methodological framework that has just been set-forth. The initial model is specified as accurately as possible to that of Roosen (1999), but is estimated using the data described in Section 3. Several estimation techniques are employed including: Ordinary Least Squares, Two-Stage Least Squares and Three-Stage Least Squares. Estimation results are provided and discussed in Subsections 5.1.1, 5.1.2 and 5.1.3 respectively. All empirical work for this study, including model estimation, is conducted in Stata.

5 Estimation and Discussion

5.1 Specification 1: Roosen's Formulation

The model specification presented in this section is identical to that provided by Roosen (1999), save for the inclusion of an import sector. The estimation period for the Northwest, Central and Eastern regions is 1971-2015. The Southwest region is estimated only for the period 1971-2011, due to the presence of missing values for key variables in the final years of the series. Roosen's analysis is based on a foundational assumption that each sector is determined contemporaneously, and therefore, the collection of sectors jointly constitute a Simultaneous Equations Model. Thus, the model is estimated using Two-and Three-Stage Least Squares.

In the equation describing regional changes in bearing acreage, an indicator of profitability is formed as the ratio of the three-year moving average of total prices received by growers for apples to the three-year moving average of prices paid by farmers. The variable reflects the fact that farmers require several years of high returns before deciding to expand the future bearing area. The profitability measure enters the bearing acreage equation with a lag of three years, accounting for the gestation period between planting and the initial year of production.

The dummy variables $D867$, $D879$ and $D81$ are included in the bearing acreage equations for the Northwest, Southwest and Central regions, respectively. The variable $D867$ represents a significant increase in bearing acreage that took place in Washington during the years 1986 and 1987. In the Southwest equation, $D879$ captures the sharp increase in bearing acreage that took place in California during the late 1980's, when the Fuji variety was developed. Until the year 1981, the Central region experience steadily decreasing bearing acreage. The dummy variable $D81$ represents the year when the region was able to curb this trend (Roosen, 1999).

Yield per acre may differ across regions due to heterogeneous rates of technological progression and acceptance of novel production practices. Yield is a function of the three-year moving average of total apple prices and a linear time trend. Generally, improvements in technology and practise have enabled farmers to increase the volume and quality of production per unit of bearing area over time. This tendency is represented through the inclusion of a linear time trend variable. The three-year moving average of total apple prices enters the yield equation with a lag of one year to represent that farmers have incentives to improve yields when prices are high and will be better financially equipped to do so. While farmers, for the most part, have little control over yields within a given year, a region with higher average returns will be more likely to invest in technology aimed at improving yields. The dummy variable $D967$ was included to account for an apparent structural change in the yield-price relationship during the years 1996 and 1997 (Roosen, 1999).

In the allocation sector, the total amount of apples cited for the fresh market is a function of the premium paid for fresh fruit and the total production within a given region for the current year. In this specification, both of these regressors are considered endogenous and are instrumented for in the Two-Stage and Three-Stage Least Squares estimation that follows in Sections 5.1.2 and 5.1.3. The fresh price premium is generated as the difference between the region's average fresh price and average processed price. One would expect that an increase in this premium would result in a greater amount of apples being allocated to fresh fruit markets. The second explanatory variable, total regional production, is indicative of the a priori assumption that with greater production, more apples should enter fresh markets.

Once the regional utilizations of fresh and processed apples have been aggregated to the national level, inverse demand functions are specified in accordance with the foundational price-quantity relationship and well documented determinants of demand. Separate equations are estimated for the fresh and processed markets. In each case, the regressors include the own per capita consumption, per capita consumption of alternative goods within the same market definition, the U.S. personal consumption expenditure on food and a linear time trend. In the fresh demand function, the per capita consumption of fresh oranges is included. Likewise, the per capita consumption of orange juice serves as an alternative to apple-containing goods in the processed demand function. In the demand sector for this initial specification, the own per capita consumption variables are considered to be endogenous.

The price determination sector links the national demand sector to the regional supply sectors. For each utilization, the regional average price is a function of the national price determined by the market demand for apples. Naturally, with a higher national prices, one would expect for regional prices to follow suit. Once again, the national price variables determined in the demand sector are endogenous in the price determination sector for this specification. The Southwest fresh price equation contains the additional explanatory variable $D86$, in observation of a large increase in fresh prices that persisted in the Southwestern U.S. since 1986.

A brief description of each variable used throughout the model is provided for reference in Table 1. Descriptive statistics are provided for each of these variables in Table 2 [4]. The structural model for Specification 1, including behavioural equations and identities are defined below. The inclusion of regression coefficients and error terms indicate behavioural equations, which are to be estimated, whereas the remaining equations are identities.

[4]The descriptive statistics, represent the values of the transformed variable, after operations such as deflation have been performed.

Sector One: Supply

Bearing Acreage

Northwest Region

$$\Delta NWBA_t = \beta_0 + \beta_1 (NWTP3_{t-3}/IPP3_{t-3}) + \beta_2 D867 + u_{1t} \quad (1)$$
$$NWBA_t = NWBA_{t-1} + \Delta NWBA_t$$

Southwest Region

$$\Delta SWBA_t = \beta_0 + \beta_1 (SWTP3_{t-3}/IPP3_{t-3}) + \beta_2 D879 + u_{2t} \quad (2)$$
$$SWBA_t = SWBA_{t-1} + \Delta SWBA_t$$

Central Region

$$\Delta CBA_t = \beta_0 + \beta_1 (CTP3_{t-3}/IPP3_{t-3}) + \beta_2 D81 + u_{3t} \quad (3)$$
$$CBA_t = CBA_{t-1} + \Delta CBA_t$$

Eastern Region

$$\Delta EBA_t = \beta_0 + \beta_1 (ETP3_{t-3}/IPP3_{t-3}) + u_{4t} \quad (4)$$
$$EBA_t = EBA_{t-1} + \Delta EBA_t$$

Yield

Northwest Region

$$NWY_t = \beta_0 + \beta_1 NWTP3_{t-1} + \beta_2 T + u_{5t} \quad (5)$$

Southwest Region

$$SWY_t = \beta_0 + \beta_1 SWTP3_{t-1} + \beta_2 T + u_{6t} \quad (6)$$

Central Region

$$CY_t = \beta_0 + \beta_1 CTP3_{t-1} + \beta_2 D967 + \beta_3 T + u_{7t} \quad (7)$$

Eastern Region

$$EY_t = \beta_0 + \beta_1 ETP3_{t-1} + \beta_2 T + u_{8t} \quad (8)$$

Total Production

Northwest Region

$NWPROD_t = NWBA_t \times NWY_t$

Southwest Region

$SWPROD_t = SWBA_t \times SWY_t$

Central Region

$CPROD_t = CBA_t \times CY_t$

Eastern Region

$EPROD_t = EBA_t \times EY_t$

Sector Two: Allocation

Fresh Utilization

Northwest Region

$$NWFU_t = \beta_0 + \beta_1(NWFP_t - NWPP_t) + \beta_2 NWPROD_t + u_{9t} \quad (9)$$

Southwest Region

$$SWFU_t = \beta_0 + \beta_1(SWFP_t - SWPP_t) + \beta_2 SWPROD_t + u_{10t} \quad (10)$$

Central Region

$$CFU_t = \beta_0 + \beta_1(CFP_t - CPP_t) + \beta_2 CPROD_t + u_{11t} \quad (11)$$

Eastern Region

$$EFU_t = \beta_0 + \beta_1(EFP_t - EPP_t) + \beta_2 EPROD_t + u_{12t} \quad (12)$$

Processed Utilization

Northwest Region

$NWPU_t = NWPROD_t - NWFU_t$

Southwest Region

$SWPU_t = SWPROD_t - SWFU_t$

Central Region

$CPU_t = CPROD_t - CFU_t$

Eastern Region

$EPU_t = EPROD_t - EFU_t$

Aggregate to U.S. Total Utilization

$USFU_t = NWFU_t + SWFU_t + CFU_t + EFU_t$
$USPU_t = NWPU_t + SWPU_t + CPU_t + EPU_t$

Per Capita Consumption

$QUF_t = USFU_t / population_t + NIF_t$
$QUP_t = USPU_t / population_t + NIP_t$

where the NIF and NIP variables are already denominated as per capita values.

Sector Three: Demand

Fresh Demand

$$FPUS_t = \beta_0 + \beta_1 QUF_t + \beta_2 QUFO_t + \beta_3 PCED1_t + \beta_4 T + u_{13t} \tag{13}$$

Processed Demand

$$PPUS_t = \beta_0 + \beta_1 QUP_t + \beta_2 QUJO_t + \beta_4 PCED1_t + \beta_5 T + u_{14t} \tag{14}$$

Sector Four: Regional Price Determination

Fresh Price

Northwest Region

$$NWFP_t = \beta_0 + \beta_1 FPUS_t + u_{15t} \tag{15}$$

Southwest Region

$$SWFP_t = \beta_0 + \beta_1 FPUS_t + \beta_2 D86 + u_{16t} \tag{16}$$

Central Region

$$CFP_t = \beta_0 + \beta_1 FPUS_t + u_{17t} \tag{17}$$

Eastern Region

$$EFP_t = \beta_0 + \beta_1 FPUS_t + u_{18t} \tag{18}$$

Processed Price

Northwest Region

$$NWPP_t = \beta_0 + \beta_1 PPUS_t + u_{19t} \tag{19}$$

Southwest Region

$$SWPP_t = \beta_0 + \beta_1 PPUS_t + u_{20t} \tag{20}$$

Central Region

$$CPP_t = \beta_0 + \beta_1 PPUS_t + u_{21t} \tag{21}$$

Eastern Region

$$EPP_t = \beta_0 + \beta_1 PPUS_t + u_{22t} \tag{22}$$

Total Price

Northwest Region

$$NWTP_t = (NWFU_t \times NWFP_t + NWPU_t \times NWPP_t)/NWPROD_t$$

Southwest Region

$$SWTP_t = (SWFU_t \times SWFP_t + SWPU_t \times SWPP_t)/SWPROD_t$$

Central Region

$$CTP_t = (CFU_t \times CFP_t + CPU_t \times CPP_t)/CPROD_t$$

Eastern Region

$$ETP_t = (EFU_t \times EFP_t + EPU_t \times EPP_t)/EPROD_t$$

Table 1: Variable Definitions

Variable		Unit
QUT	per capita consumption of apples (total)	pounds, farm weight
QUF	per capita consumption of apples (fresh)	pounds, farm weight
QUP	per capita consumption of apples (processed)	pounds, farm weight
population	population of the united states	millions of people
IPPF	index of prices paid by farmers	base year = 2009
PCED1	personal consumption expenditure: food	billions of dollars
QUFB	per capita consumption of fresh banana	pounds, farm weight
QUFO	per capita consumption of fresh oranges	pounds, farm weight
QUCPEACH	per capita consumption of canned peach	pounds, product weight
QUCPEAR	per capita consumption of canned pear	pounds, product weight
QUJO	per capita consumption of orange juice	gallons, single strength equivalent
NWBA	northwest bearing acreage	acres (thousands)
SWBA	southwest bearing acreage	acres (thousands)
CBA	central bearing acreage	acres (thousands)
EBA	eastern bearing acreage	acres (thousands)
NWPROD	northwest production	millions of pounds
SWPROD	southwest production	millions of pounds
CPROD	central production	millions of pounds
EPROD	eastern production	millions of pounds
NWUTIL	northwest utilized production	millions of pounds
SWUTIL	southwest utilized production	millions of pounds
CUTIL	central utilized production	millions of pounds
EUTIL	eastern utilized production	millions of pounds
NWFU	northwest fresh utilization	millions of pounds
SWFU	southwest fresh utilization	millions of pounds
CFU	central fresh utilization	millions of pounds
EFU	eastern fresh utilization	millions of pounds
NWPU	northwest processed utilization	millions of pounds
SWPU	southwest processed utilization	millions of pounds
CPU	central processed utilization	millions of pounds
EPU	eastern processed utilization	millions of pounds
NWTP	northwest total price	cents per pound
SWTP	southwest total price	cents per pound
CTP	central total price	cents per pound
ETP	eastern total price	cents per pound
NWFP	northwest fresh price	cents per pound
SWFP	southwest fresh price	cents per pound
CFP	central fresh price	cents per pound
EFP	eastern fresh price	cents per pound

Table 1: Variable Definitions Continued

Variable		Unit
NWPP	northwest processed price	cents per pound
SWPP	southwest processed price	cents per pound
CPP	central processed price	cents per pound
EPP	eastern processed price	cents per pound
NIT	net import of apples (total)	pounds per person
NIF	net import of apples (fresh)	pounds per person
NIP	net import of apples (processed)	pounds per person
NWY	northwest yield per acre	thousand of pounds
SWY	southwest yield per acre	thousand of pounds
CY	central yield per acre	thousand of pounds
EY	eastern yield per acre	thousand of pounds
T	linear time trend	1971 = 1
NWTP3	three year moving average of northwest total price	cents per pound
SWTP3	three year moving average of southwest total price	cents per pound
CTP3	three year moving average of central total price	cents per pound
ETP3	three year moving average of eatern total price	cents per pound
IPPF3	three year moving average of ippf	base year = 2009
L_NWTP3	lagged three year moving average of northwest total price	cents per pound
L_SWTP3	lagged three year moving average of southwest total price	cents per pound
L_CTP3	lagged three year moving average of central total price	cents per pound
L_ETP3	lagged three year moving average of eatern total price	cents per pound
L3_NWPI	three year lag of northwest profitability indicator	
L3_SWPI	three year lag of southwest profitability indicator	
L3_CPI	three year lag of central profitability indicator	
L3_EPI	three year lag of eatern profitability indicator	
NWPREM	northwest fresh premium	cents per pound
SWPREM	southwest fresh premium	cents per pound
CPREM	central fresh premium	cents per pound
EPREM	eastern fresh premium	cents per pound
D81	indicator after 1981	
D86	indicator after 1986	
D867	indicator 1986,87	
D879	indicator 1987, 88,89	
D967	indicator 1996,1997	

Note: The regional price variables and the personal consumption expenditure variables are deflated with the GNP deflator for the purpose of estimation.

Table 2: Descriptive Statistics of Model Variables

	N	mean	sd	min	max
YEAR	45	1993.0000	13.1339	1971.0000	2015.0000
DEF	45	69.3960	25.7620	23.8970	110.0880
IPPF	45	87.9603	11.1578	70.6288	117.6910
PCED1	45	988.8376	237.9915	618.4877	1445.2983
QUT	45	42.6885	6.3415	28.0300	50.7171
QUF	45	17.6764	1.4586	15.2852	21.2191
QUP	45	25.0130	5.9755	12.5200	33.4103
POPULATION	45	263.8110	35.5727	208.9170	322.9530
QUFB	45	24.2707	3.4307	17.6000	30.7000
QUFO	45	12.0864	2.0948	7.4600	15.9000
QUCPEAR	45	3.2240	0.7931	1.9300	4.6400
QUJO	45	4.5169	0.7427	2.8500	5.8200
NWBA	45	140.0006	34.1461	75.1000	186.5000
SWBA	45	34.8263	9.4511	15.2000	50.2000
CBA	45	81.9001	16.0168	48.6500	104.0000
EBA	45	149.4240	34.6451	94.9300	193.2000
NWPROD	45	4561.2200	1636.8166	1421.0000	7868.2998
SWPROD	45	656.6978	266.6651	161.0000	1255.0000
CPROD	45	1222.4756	261.7319	272.6000	1672.0000
EPROD	45	2669.8244	381.5317	1755.7000	3367.0000
NWUTIL	45	4523.2178	1587.4088	1415.0000	7265.0000
SWUTIL	45	648.9822	263.8872	159.9000	1243.0000
CUTIL	45	1190.9867	253.9043	250.4000	1634.9000
EUTIL	45	2617.4667	387.4729	1711.9000	3362.0000
NWFU	45	3416.9444	1258.5065	1108.0000	6066.0000
SWFU	42	265.5286	120.7957	26.6000	490.7000
CFU	45	527.4867	125.5181	114.3000	794.0000
EFU	45	1126.4644	173.0908	668.6000	1478.7000
NWPU	45	1106.2733	439.1696	307.0000	1944.0000
SWPU	43	381.8977	170.4143	10.9000	785.0000
CPU	45	595.1333	152.3591	93.6000	912.2000
EPU	45	1454.8933	242.7746	904.0000	1898.7001
TPUS	45	22.7996	5.0005	14.3762	35.2203
NWTP	45	25.0301	6.6975	12.2381	36.6417
SWTP	45	22.3075	3.4787	16.0045	29.9962
CTP	45	22.0299	5.6261	15.9373	42.9859
ETP	45	19.9223	4.5419	14.4166	35.0938
FPUS	45	30.9977	5.8544	20.3168	43.0048
NWFP	45	30.0879	7.0779	17.4071	43.2695
SWFP	42	36.8154	6.1706	26.7361	50.6240
CFP	45	30.8725	6.3737	22.5678	51.8878
EFP	45	31.2486	5.8861	22.9289	48.2012
PPUS	45	10.0860	3.5633	5.7634	23.7724
NWPP	45	8.8086	4.8750	2.3934	21.8623
SWPP	42	11.4135	3.6161	6.3267	20.5303
CPP	45	11.3560	4.1959	7.2512	30.2032
EPP	45	10.7731	3.3380	7.5790	24.3495

Table 2: Descriptive Statistics of Model Variables Continued

	N	mean	sd	min	max
NIT	45	8.5859	5.7663	0.1203	19.9969
NIF	45	-2.7305	1.5730	-6.0102	-0.2464
NIP	45	11.3173	6.8454	0.5519	23.6309
NWY	45	31.7543	6.2174	18.6863	50.6000
SWY	45	18.2505	3.3700	10.5921	26.3103
CY	45	15.3837	4.3755	5.1629	27.6324
EY	45	18.4917	3.4515	12.7357	26.6489
T	45	23.0000	13.1339	1.0000	45.0000
NWTP3	43	24.7842	4.9158	15.8034	34.7319
SWTP3	43	22.3116	2.1719	18.3218	27.3592
CTP3	43	21.9793	4.4219	16.4615	31.6179
ETP3	43	19.8981	3.7969	15.0265	29.3689
IPPF3	43	87.7127	10.0306	73.9152	115.2224
L_NWTP3	42	24.6211	4.8562	15.8034	34.7319
L_SWTP3	42	22.2633	2.1747	18.3218	27.3592
L_CTP3	42	21.9228	4.4598	16.4615	31.6179
L_ETP3	42	19.8982	3.8429	15.0265	29.3689
L3_NWPI	40	0.2829	0.0532	0.1940	0.4117
L3_SWPI	40	0.2605	0.0297	0.1991	0.3167
L3_CPI	40	0.2513	0.0482	0.1987	0.3826
L3_EPI	40	0.2309	0.0494	0.1847	0.3774
NWPREM	45	21.2792	6.0199	9.8429	36.2399
SWPREM	42	25.4020	6.9807	10.7890	38.8768
CPREM	45	19.5164	4.1730	13.2611	28.4837
EPREM	45	20.4755	3.9448	13.3712	29.6133
D81	45	0.7778	0.4204	0	1
D867	45	0.0444	0.2084	0	1
D879	45	0.0667	0.2523	0	1
D967	45	0.0444	0.2084	0	1
C_NWBA	44	1.8227	4.5091	-9.2000	15.0047
C_SWBA	44	-0.4409	1.9613	-5.7000	5.0719
C_CBA	44	-1.2580	2.0002	-7.5500	2.4622
C_EBA	44	-2.1266	2.9949	-8.2000	7.9000
D00	45	0.3556	0.4841	0	1
D11	45	0.0222	0.1491	0	1
D98	45	0.4000	0.4954	0	1
D8198	45	0.4000	0.4954	0	1
D12	45	0.0222	0.1491	0	1
D85	45	0.0222	0.1491	0	1
D95	45	0.4667	0.5045	0	1
L_NWPREM	44	20.9392	5.6355	9.8429	33.6556
L_SWPREM	42	25.4020	6.9807	10.7890	38.8768
L_CPREM	44	19.3637	4.0920	13.2611	28.4837
L_EPREM	44	20.4544	3.9878	13.3712	29.6133
D80	45	0.8000	0.4045	0	1

5.1.1 Specification 1: Ordinary Least Squares Estimation

In this section, Ordinary Least Squares (OLS) is used to provide baseline estimates of Specification 1, following the framework detailed in Roosen (1999). Given Roosen's foundational assumption that each sector is determined simultaneously, OLS estimation will, in theory, compute biased coefficients and invalid standard errors in equations containing the aforementioned endogenous variables. In recognition of this fact, the sections that follow provide the Two-Stage and Three-Stage Least Squares estimation results.

Table 3: Change in Bearing Acreage

	(1) C_NWBA	(2) C_SWBA	(3) C_CBA	(4) C_EBA
L3_NWPI	22.01	-	-	-
	(12.09)			
D867	12.19***	-	-	-
	(2.912)			
L3_SWPI	-	19.86	-	-
		(9.848)		
D879	-	4.776***	-	-
		(0.980)		
L3_CPI	-	-	5.141	-
			(12.29)	
D81	-	-	1.356	-
			(1.768)	
L3_EPI	-	-	-	34.45***
				(8.049)
Constant	-5.090	-5.994*	-3.682	-10.05***
	(3.507)	(2.622)	(4.458)	(1.899)
Observations	40	36	40	40
R^2	0.3336	0.4395	0.0191	0.3252

OLS Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Regional Bearing Acreage

Table 3 presents the coefficient estimates for the bearing acreage equation in each region. The goodness of fit of the Northwest bearing acreage equation is indicated by an R-squared value of 0.3336. The dummy variable, $D867$, is positive and significant at the 0.001 level, supporting evidence of an increase in tree planting for Washington State during the mid 1980's. All coefficients enter the bearing acreage equation with the expected sign. The profitability indicator variable has a positive effect on the change in bearing acreage. This indicates that an increase in the expected profitability of apple production leads to additional land area dedicated to commercial apple production. However, the coefficient is not significantly different from zero at the 0.05 level based on the OLS statistics.

The R-squared value for the Southwest region is slightly greater than that of the Northwest region with a value of 0.4395. The dummy variable *D*879 is positive and significant at the 0.001 level. This provides empirical testament to the increase in tree planting that took place in Southwestern States in the mid 1980's during the development of high value varieties such as the Fuji apple. All variables enter the bearing acreage equation for the Southwest region with the expected sign. The profitability indicator variable interacts positively with the dependent variable. This suggests the farmers respond to a more favourable apple industry outlook by planting more apple trees, which will not bear fruit until several years into the future. However, the estimated coefficient is not significantly different from zero at the 0.05 level.

The goodness of fit measure for the Central region is 0.0191, indicating that the proposed specification performs relatively poorly in explaining variation in the change in bearing acreage. Results indicate that farmers respond to an increase in the profitability of apple production by expanding the bearing area. While the coefficients on *L3_CPI* and *D*81 are of the expected sign, neither are significant at the 0.05 level. The lack of significance in the dummy variable, *D*81, representing the reversal of the downward trend in bearing acreage that persisted until 1981, is possibly due to the fact that the reversal proved to be a temporary phenomenon.

The R-squared for the bearing acreage equation in the Eastern region is 0.3252. All coefficients are of the expected sign and are significant at the 0.001 level. Thus, there is evidence with empirical backing that orchardists respond to profit incentives by increasing the future bearing area.

Regional Yields

Table 4: Regional Yield Regressions

	(1) NWY	(2) SWY	(3) CY	(4) EY
L_NWTP3	0.407**	-	-	-
	(0.118)			
T	0.329***	-0.122**	0.187***	0.268***
	(0.0466)	(0.0443)	(0.0463)	(0.0243)
L_SWTP3	-	0.340	-	-
		(0.216)		
L_CTP3	-	-	0.307*	-
			(0.130)	
D967	-	-	-1.682	-
			(2.683)	
L_ETP3	-	-	-	0.340***
				(0.0777)
Constant	14.40***	13.92**	4.447	5.441**
	(3.204)	(4.818)	(3.247)	(1.908)
Observations	42	38	42	42
R^2	0.6068	0.2072	0.3586	0.7574

OLS Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Table 4, the OLS regression results for the regional yield equations are displayed. The goodness of fit for the Northwest region is indicated by an R-squared value of 0.6068. The coefficients for the variables L_NWTP3 and T are significant at the 0.01 level based on the OLS figures. All point estimates are of the expected sign. An increase in the three-year average total payout for apples is predicated to result in an increase in yield per acre. The a priori assumption that over time, advances in technology enable farmers to improve average yields is supported by a positive and significant estimated coefficient on the linear time trend variable.

The R-squared value for the Southwest region is equal to 0.2072 which is notably smaller than that of the Northwest region. The linear time trend variable is significant at the 0.01 level. The relationship between yield and the three-year average payout variable is positive, however, it is not significant at the 0.05 level. Conversely, the linear time trend variable is significant, but the relationship is of the opposite direction than theory suggests. Given that bearing acreage is in steep recession within the Southern states, it is possible that on average, commercial apple trees are relatively old and beyond the threshold age where yields are expected to gradually decline.

The goodness of fit for the Central yield equation is characterized by an R-squared value of 0.3586. Both the variable T and L_CTP3 are significant at the 0.05 level and of the sign asserted by theory. Thus, the results presented here indicate a positive relationship between three-year average total prices and yield per acre in the Central region. Likewise, with improvements in technology and practise, as reflected by the linear time trend variables, yields are predicted to increase. The dummy variable $D967$ specified by Roosen, representing an apparent structural change in the yield-price relationship, is not significant at the 0.05 level.

Finally, the R-squared for the Eastern regression is the highest among all regions, with a value of 0.7574. Both the linear time trend and the price variables enter the yield relation positively. As with the Northwest and Central regions, producers in the Eastern region are predicted to achieve greater yields throughout time, which is possibly due to technological progress. During a period of several years when prices are elevated, the empirical evidence provided in Table 4 indicates that yields will, on average, increase as well.

Table 5: Regional Allocation Regressions

	(1) NWFU	(2) SWFU	(3) CFU	(4) EFU
NWPROD	0.715^{***}	-	-	-
	(0.0214)			
NWPREM	30.52^{***}	-	-	-
	(5.828)			
SWPROD	-	0.391^{***}	-	-
		(0.0330)		
SWPREM	-	3.649^{**}	-	-
		(1.157)		
CPROD	-	-	0.383^{***}	-
			(0.0442)	
CPREM	-	-	-3.659	-
			(2.771)	
EPROD	-	-	-	0.405^{***}
				(0.0326)
EPREM	-	-	-	11.10^{**}
				(3.156)
Constant	-495.8^{***}	-93.69^{**}	130.9	-181.5
	(136.4)	(34.06)	(96.69)	(117.1)
Observations	45	41	45	45
R^2	0.9704	0.8221	0.7658	0.7883

OLS Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Regional Allocation

The results of the OLS regression for the regional allocation sector are found in Table 5. The R-squared for the Northwest regression is 0.9704, implying that this specification performs extremely well at explaining variation in the fresh utilization variable. Total annual production and the premium paid for fresh apples are positively related to fresh utilization at the 0.001 level of significance based on the OLS results. As expected, an increase in production is predicted to result in a greater volume of apples allocated to the fresh market. The fresh premium enters the Northwest fresh allocation equation with a positive coefficient. Therefore, all else equal, an increase in the premium paid for fresh fruit will, on average, result in a greater volume of apples in fresh fruit markets.

This specification also performs well in explaining variation in the Southwest fresh utilization variable, with a goodness of fit measure equal to 0.8221. Production and fresh premiums are significantly different from zero at the 0.01 level. Once again, the coefficients are of the sign implied by theory. All else equal, higher production will on average result in a larger volume of apples allocated to fresh fruit markets. Holding production constant, an increase in the premium paid on fresh apples is predicted to increase the proportion of apples in fresh markets, relative to processed markets.

The allocation regression of the Central region has an R-Squared of 0.7658. The coefficient on total production is of the expected sign and is significantly different from zero at the 0.001 level. The fresh premium variable is estimated to interact negatively with the dependent variable, contradicting a priori theoretical assumptions. This implies that an increase in the fresh premium deters producers and packinghouses from sorting fruit for fresh use. Note, however, that the point estimate is not different from zero at the 0.05 level of significance. The results for the Central region regression provide strong testament to the strength of total production as an explanator for fresh utilization.

OLS estimation of the fresh utilization equation for the Eastern region resulted as well in a goodness of fit measure of 0.7883. The fresh premium and the total production for the region are the driving variables in this regression, each with a coefficient significantly different from zero at the 0.01 level. As well, the relationships between the dependent and independent variables are of the expected direction. All else equal, greater production is predicted to lead to a higher volume of apples in fresh fruit markets. Similarly, holding production constant, an increase in the fresh price premium will on average lead to a greater proportion of apples sent to fresh markets relative to processed markets.

National Demand

The demand for fresh and processed fruit is estimated at a national level. Regression results for each utilization are presented in Table 6. The R-squared goodness of fit measure for the fresh price equation is equal to 0.5359. Coefficient estimates for the own per capita consumption, the personal consumption expenditure on food and the linear time trend are all significant at the 0.01 level based on the OLS statistics. As expected, given the theory of demand, the relationship between price and quantity is negative. The positive coefficient for the expenditure variables suggests that fresh apples are indeed a normal good. Per capita consumption of oranges is estimated to be negatively related to the price of fresh apples. While this indicates that oranges are substitute goods for apples, the coefficient is not significant at the 0.05 level.

Table 6: Demand Regressions

	(1) FPUS	(2) PPUS
QUF	-1.629**	-
	(0.496)	
QUFO	-0.640	-
	(0.475)	
PCED1	0.0611**	0.0167
	(0.0193)	(0.0166)
T	-1.197**	-0.342
	(0.338)	(0.321)
QUP	-	-0.303
		(0.160)
QUJO	-	-0.522
		(0.841)
Constant	34.64	11.33
	(19.19)	(13.61)
Observations	45	45
R^2	0.5359	0.5167

OLS Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The R-squared for the processed demand function is 0.5167. None of the independent variables in this specification, however, have a statistically significant relationship with the national processed price at the 0.05 level. Noting this fact, the estimated coefficient for the own per capita consumption variables is of the expected negative sign. An increase in the consumption expenditure on food is predicted to result in higher processed apple prices, suggesting that processed apples are also normal goods. Finally, the per capita consumption of orange juice is negatively related to the processed apple price. Therefore, orange juice is a substitute good in consumption for processed apple products.

Price Determination

In Table 7 and Table 8 results are presented from the fresh and processed regional price determination regressions, respectively. The regional fresh price regressions the R-squared values are 0.9176, 0.2620, 0.5858 and 0.5672 for the Northwest, Southwest, Central and Eastern regions, respectively. In the Northwest, Central and Eastern regions the U.S. national price is significant at the 0.001 level. In the Southwest region the national price is significant at the 0.01 level. The Southwest, Central and Eastern region coefficient estimates are less than one, which implies that fresh prices for these regions is predicted to increase less than one-for-one with the national fresh price. A coefficient greater than one in the Northwest region suggests that fresh prices increase more than one-for-one in this region with an increase in the national fresh price. The dummy variable, $D86$, in the Southwest regression is positive and significant at the 0.01 level according to the OLS figures. The goodness of fit measure of the regional processed price regressions are 0.8125, 0.6890, 0.7595 and 0.8246 for the Northwest, Southwest, Central and Eastern regions, respectively. Furthermore, the national processed price is significant at the 0.001 level in the regional processed price determination equations for all regions. Coefficient estimates are greater than one in the Northwest and Central regions, which implies processed prices increase more than one-for-one with an increase in the national processed price. Conversely, coefficients are less than one in the Southern and Eastern regions. Therefore, processed prices in these regions increase less than one-for-one with an increase in the national processed price.

Table 7: Fresh Price Regressions

	(1) NWFP	(2) SWFP	(3) CFP	(4) EFP
FPUS	1.158***	0.511**	0.833***	0.757***
	(0.0529)	(0.169)	(0.107)	(0.101)
D86	-	5.718**	-	-
		(1.895)		
Constant	-5.811**	17.82**	5.042	7.777*
	(1.669)	(5.718)	(3.369)	(3.181)
Observations	45	41	45	45
R^2	0.9176	0.2620	0.5858	0.5672

OLS Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Processed Price Regressions

	(1) NWPP	(2) SWPP	(3) CPP	(4) EPP
PPUS	1.233***	0.824***	1.026***	0.851***
	(0.0903)	(0.0887)	(0.0881)	(0.0598)
Constant	-3.629***	3.112**	1.006	2.193**
	(0.965)	(0.952)	(0.941)	(0.639)
Observations	45	41	45	45
R^2	0.8125	0.6890	0.7595	0.8246

OLS Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.1.2 Specification 1: Two-Stage Least Squares Estimation

In this section, Specification 1 is estimated using Two-Stage Least Squares. Specification 1 contains the following right-hand-side (RHS) endogenous variables: $NWPROD$, $SWPROD$, $CPROD$, $EPROD$, $NWPREM$, $SWPREM$, $CPREM$, $EPREM$, QUF, QUP, $FPUS$,and $PPUS$. The approach implemented here is analogous to the systems estimation technique, Three-Stage Least Squares, in that the same set of predetermined variables are used as instruments for each endogenous variable within the model. The instruments are the following variables[5] $IPPF3$, $population$, T, $QUFO$, $QUJO$, $QUFB$, $QUCPEACH$, $QUCPEAR$ and $PCED1$. It follows that Two-Stage Least Squares estimation should produce identical point estimates to that of Ordinary Least Squares in equations absent of endogenous explanatory variables. The bearing acreage equations, for example, contain no right-hand-side endogenous variables. Profitability indicator variables enter the regressions with a three-year lag and are thus predetermined in this system. Therefore, the estimated coefficients in Table 9 are identical to those in Table 3.

Table 9: Bearing Acreage (2SLS)

	(1) C_NWBA	(2) C_SWBA	(3) C_CBA	(4) C_EBA
L3_NWPI	22.01	-	-	-
	(12.09)			
D867	12.19***	-	-	-
	(2.912)			
L3_SWPI	-	19.86	-	-
		(9.848)		
D879	-	4.776***	-	-
		(0.980)		
L3_CPI	-	-	5.141	-
			(12.29)	
D81			1.356	
			(1.768)	
L3_EPI	-	-	-	34.45***
				(8.049)
Constant	-5.090	-5.994*	-3.682	-10.05***
	(3.507)	(2.622)	(4.458)	(1.899)
Observations	40	36	40	40
R^2	0.3336	0.4395	0.0191	0.3252

Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Regional yield regression results are included in Table 10. As in the bearing acreage regression, the yield equations contain no right-hand-side endogenous variables and are thus identical to those in Table 4. The three-year moving average of total prices is constructed using an endogenous variable (the total price in the current year); however, the

[5]These are the same instruments used by Roosen, excluding trade variables.

relevant regressor in the yield equation is the lagged three-year moving average, which is predetermined.

In Table 11 the Two-Stage Least Squares estimates for the regional allocation equations are provided. In this case, regional production and fresh price premium variables are both endogenous. Regional production variables enter the system as an endogenous variable in the supply sector. The fresh price premium is implicitly endogenous through the demand and price determination sectors.

This specification performs relatively well at explaining variation in the fresh utilization variables with R-squared values equal to 0.9238, 0.7416, 0.7641 and 0.7675 for the Northwest, Southwest, Central and Eastern regressions, respectively. Both the production and fresh premium variables are significant at the 0.001 level in the Northwest, Southwest and Eastern regions. In the Central region, the production variable alone is significant at the 0.01 level. Coefficients agree with a priori knowledge of the allocation sector for the Northwest, Southwest and Eastern regions. In the Central region, as in the OLS estimation results, the premium paid for fresh apples is related negatively with fresh utilization. This result is not significant at the 0.05 level.

Table 10: Regional Yield Regressions (2SLS)

	(1) NWY	(2) SWY	(3) CY	(4) EY
L_NWTP3	0.407**	-	-	-
	(0.118)			
T	0.329***	-0.122**	0.187***	0.268***
	(0.0466)	(0.0443)	(0.0463)	(0.0243)
L_SWTP3	-	0.340	-	-
		(0.216)		
L_CTP3	-	-	0.307*	-
			(0.130)	
D967	-	-	-1.682	-
			(2.683)	
L_ETP3	-	-	-	0.340***
				(0.0777)
Constant	14.40***	13.92**	4.447	5.441**
	(3.204)	(4.818)	(3.247)	(1.908)
Observations	42	38	42	42
R^2	0.6068	0.2072	0.3586	0.7574

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12 illustrates the coefficients results from Two-Stage Least Squares estimation of the fresh and processed demand functions. The per capita consumption variables for fresh and processed apples are assumed to be endogenous in their respective equations. The R-squared values are 0.5160 and 0.6083 for the fresh and processed apple demand functions respectively. The personal consumption expenditure and the linear time trend variables are statistically significant at the 0.001 level in the demand regression for fresh apples. In the processed demand equation, the own per capita consumption variable is statistically significant at the 0.05 level. Surprising is the fact that the per capita consumption of fresh apples is "statically significant" when OLS is used, but is not statistically significant when the 2SLS estimation technique is selected. The opposite is true for the processed demand function. Own per capita consumption lacked "statistical significance" for OLS estimation, but is statistically significant in Table 12. Fresh apples are predicted to be a normal good that competes with fresh oranges for consumer demand. Likewise, processed apple products are a normal good, competing with orange juice for consumer demand in processed markets.

Table 11: Regional Allocation Regressions (2SLS)

	(1) NWFU	(2) SWFU	(3) CFU	(4) EFU
NWPROD	0.628***	-	-	-
	(0.0480)			
NWPREM	71.19***	-	-	-
	(15.83)			
SWPROD	-	0.405***	-	-
		(0.0425)		
SWPREM	-	7.660***	-	-
		(2.015)		
CPROD	-	-	0.327**	-
			(0.111)	
CPREM	-	-	-5.034	-
			(4.406)	
EPROD	-	-	-	0.450***
				(0.0416)
EPREM	-	-	-	17.29***
				(3.800)
Constant	-950.2***	-204.0***	227.8	-431.3**
	(247.6)	(55.70)	(211.9)	(143.8)
Observations	43	39	43	43
R^2	0.9238	0.7416	0.7641	0.7675

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12: Demand Regressions (2SLS)

	(1) FPUS	(2) PPUS
QUF	-0.897	-
	(0.749)	
QUFO	-0.614	-
	(0.473)	
PCED1	0.0760***	0.00895
	(0.0206)	(0.0158)
T	-1.461***	-0.221
	(0.357)	(0.322)
QUP	-	-0.384*
		(0.192)
QUJO	-	-1.163
		(0.754)
Constant	12.80	21.44
	(23.55)	(13.35)
Observations	43	43
R^2	0.5160	0.6083

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Two Stage Least Squares estimates for the regional price determination equations are shown in Table 13 and Table 14. The national fresh and processed prices are assumed to be endogenous in this specification and instrumented in order to rectify this issue. For the fresh price regressions the R-squares values are 0.9074, 0.2293, 0.5051 and 0.4822 for the Northwest, Southwest, Central and Eastern regions, respectively. Additionally, in the processed price regressions the R-squared values are equal to 0.8237, 0.6853, 0.7559 and 0.8211, listed in the same order as the fresh price equations. In both tables, the national price variables have a positive partial effect on regional prices. As well, national fresh price coefficients are statistically different from zero at the 0.001 level. However, there is no significance in the relationship between the national fresh price and that of the Southwest region. The dummy variable, *D*86, is positive and significant at the 0.05 level indicating that fresh apple prices were higher on average in the Southwest, subsequent to the year 1986. National processed prices have a statistically significant relationship with regional processed prices at the 0.001 level. This is true for all regions.

Table 13: Fresh Price Regressions (2SLS)

	(1) NWFP	(2) SWFP	(3) CFP	(4) EFP
FPUS	1.028***	0.397	1.164***	1.031***
	(0.0780)	(0.249)	(0.164)	(0.153)
D86	-	4.799*	-	-
		(2.080)		
Constant	-1.874	22.03**	-5.066	-0.678
	(2.433)	(8.336)	(5.107)	(4.783)
Observations	43	39	43	43
R^2	0.9074	0.2293	0.5051	0.4822

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 14: Processed Price Regressions (2SLS)

	(1) NWPP	(2) SWPP	(3) CPP	(4) EPP
PPUS	1.286***	0.894***	0.907***	0.778***
	(0.108)	(0.109)	(0.111)	(0.0754)
Constant	-4.306***	2.405*	2.296*	2.968***
	(1.125)	(1.147)	(1.160)	(0.788)
Observations	43	39	43	43
R^2	0.8237	0.6853	0.7559	0.8211

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.1.3 Specification 1: Three-Stage Least Squares Estimation

In this section, the coefficient results from Three-Stage Least Squares estimation of Specification 1 of the model are reviewed. More precise standard errors are the primary motivation behind the Three-Stage Least Squares estimation technique. Only the observations over which the entire data set is complete are used in computing these point estimates. If there were no missing values or lagged regressors, the full 45 observations would be available for estimation. Given data limitation for the Southwest region during the period of 2012-2015, these four observations are omitted from estimation, not just for the Southwest region but for all variables. Including the profitability indicators results in a loss of five observations for the years 1971-1975. Consequently, the estimation period for the entire system is 1976-2011, resulting in only 36 observations. The endogenous variables for each sector throughout the system were identified above in Section 5.1.2. The set of instruments used in the previous Two-Stage Least Squares estimation were those provided by Roosen. In Zellner and Theil (1962), endogenous variables are instrumented by all pre-determined variables within the entire system, not a subset of these variables. The results that follow are those produced by Three-Stage Least Squares estimation of Specification 1, where endogenous regressors are instrumented with the full set of predetermined variables in the system, plus any additional

Table 15: Bearing Acreage (3SLS)

	(1)	(2)	(3)	(4)
	C_NWBA	C_SWBA	C_CBA	C_EBA
L3_NWPI	19.52***	-	-	-
	(6.967)			
D867	12.65***	-	-	-
	(1.408)			
L3_SWPI	-	15.50***	-	-
		(5.345)		
D879	-	4.768***	-	-
		(0.508)		
L3_CPI	-	-	-0.663	-
			(5.560)	
D81	-	-	0.824	-
			(0.656)	
L3_EPI	-	-	-	33.00***
				(6.457)
Constant	-4.362**	-4.843***	-1.786	-9.803***
	(2.096)	(1.438)	(1.852)	(1.563)
Observations	36	36	36	36
R-squared	0.331	0.436	0.013	0.367

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

instruments suggested by Roosen that were not included in the model [6].

The Three-Stage Least Squares point estimates and summary statistics for the regional bearing acreage sectors are shown in Table 15. The R-squared values for the Northwest, Southwest and Eastern regions are 0.331, 0.436 and 0.367 respectively. Specification 1 performs poorly at explaining variation in bearing acreage for the Central region, with an R-squared of 0.013. The profitability indicator is of the anticipated sign, and is statistically significant at the 0.01 level, in the Northwest, Southwest and Eastern regions. The dummy variables $D867$ and $D879$ are also statistically significant at the 0.01 level in their relevant relationships. Statistically significant interactions between bearing acreage and profitability indicators suggest that farmers in the Northwest, Southwest and Eastern regions respond to profit incentives by expanding the existing orchard. This is not evident in the Central region, where the null hypothesis that the $L3\_CPI$ coefficient is equal to zero cannot be rejected at even the 0.1 level. Positive coefficients on $D867$ and $D879$ corroborate the supposition that the development of high value varieties led to a sharp increase in orchard planting for Washington and California during the mid 1980's. As in the 2SLS and OLS estimation of Specification 1, there is no empirical evidence that producers in the Central U.S. were able to reverse the downward trend in bearing acreage that persisted prior to the 1980's.

[6]The additional instruments include: $IPPF3$, $POPULATION$, $QUCPEACH$, $QUCPEAR$ and $QUFB$

Results for the regional yield relationships are summarized in Table 16. The goodness of fit is signalled by R-squared values of 0.395, 0.319, 0.275 and 0.702 for the Northwest, Southwest, Central and Eastern regions respectively. The linear time trend variable is statistically significant at the 0.01 level for all regions. Likewise, the three-year average price variable is significant at the 0.01 level in the Northwest, Southwest and Eastern regions, and significant at the 0.05 level in the Central region. The price variable enters the yield relationship as anticipated in all regions, demonstrating that yields increase, on average, with higher apples returns. The ephemeralization of agricultural lands in the Northwest, Central and Eastern is supported by positive and statistically significant coefficients on the time variable. The opposite is concluded from results for the Southwest region. Roosen cites a change in the yield-price relationship during the years 1996 and 1997 for the Central United States. Estimation results submit that yields are indeed lower during this period.

Table 16: Regional Yield Regressions (3SLS)

	(1)	(2)	(3)	(4)
	NWY	SWY	CY	EY
L_NWTP3	0.331***	-	-	-
	(0.0911)			
T	0.281***	-0.159***	0.203***	0.302***
	(0.0400)	(0.0307)	(0.0325)	(0.0207)
L_SWTP3	-	0.324***	-	-
		(0.0878)		
L_CTP3	-	-	0.179**	-
			(0.0884)	
D967	-	-	-1.864**	-
			(0.826)	
L_ETP3	-	-	-	0.364***
				(0.0654)
Constant	17.28***	15.40***	6.947***	4.228***
	(2.593)	(2.057)	(2.240)	(1.585)
Observations	36	36	36	36
R-squared	0.395	0.319	0.275	0.702

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 17 describes the Three-Stage Least Squares estimation results for the regional allocation sectors. R-squared values for the Northwest, Southwest, Central and Eastern regions are 0.945, 0.847, 0.719 and 0.803 respectively. In all regions, both the fresh price premium and the total production variables are statistically significant at the 0.01 level. Production has a positive partial effect on the total fresh utilization. Therefore, empirical evidence supports the a priori assumption that larger harvests result in a greater supply of apples to fresh fruit markets. Higher fresh premiums in the Northwest, Southwest and Eastern regions are predicted to stimulate farmers and packinghouses to allocate a relatively larger portion of apples to fresh rather than processed markets. In the Central region, fresh premiums are predicted to have an opposing effect. Contracting a priori assumptions, results show that an increase in the relative price of fresh apples deters allocation to fresh utilization.

Table 17: Regional Allocation Regressions (3SLS)

	(1)	(2)	(3)	(4)
	NWFU	SWFU	CFU	EFU
NWPREM	35.12***	-	-	-
	(4.716)			
NWPROD	0.704***	-	-	-
	(0.0173)			
SWPREM	-	3.183***	-	-
		(0.651)		
SWPROD	-	0.373***	-	-
		(0.0178)		
CPREM	-	-	-8.872***	-
			(2.070)	
CPROD	-	-	0.314***	-
			(0.0288)	
EPREM	-	-	-	10.16***
				(2.086)
EPROD	-	-	-	0.397***
				(0.0195)
Constant	-551.6***	-59.54***	310.3***	-159.9**
	(124.8)	(20.94)	(69.94)	(69.64)
Observations	36	36	36	36
R-squared	0.945	0.847	0.719	0.803

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 18 communicates the estimated national demand functions for fresh and processed apples. In both cases, R-squared values of 0.520 and 0.632, signify that Specification 1 provides a good fit of the national price variables. The per capita consumption of alternative goods have a statistically significant impact on the price of apples at the 0.05 level. The remaining coefficients are significantly different from zero at the 0.01 level. The own price-quantity relationships are consistent with the direction asserted by the theory of demand. Apples are predicted to be normal goods, as an increase in the personal consumption expenditure stimulates higher prices for fresh and processed apples at the national level. Fresh oranges and orange juice enter negatively in their respective equations, indicating that these items are substitute goods in the consumption of apples.

Point estimates and summary statistics for the regional price determination sector are provided in Tables 19 and 20. The R-squared statistic for the Northwest, Southwest, Central and Eastern fresh price equations are 0.927, 0.207, 0.466 and 0.511. The R-squared, listed in the preceding order, are 0.909, 0.595, 0.799 and 0.781, indicating that Specification 1 is a good fit for this sector. The national price is statistically significant in explaining regional prices at the 0.01 level. This is true for both the fresh and processed pricing equations. Finally, the *D*86 dummy variable is also statistically significant at the 0.01 level, and indicates a larger intercept for the Southwest fresh price equation subsequent to the year 1986.

Table 18: Demand Regressions (3SLS)

	(1) FPUS	(2) PPUS
T	-1.082***	-0.258***
	(0.185)	(0.0986)
QUF	-1.471***	-
	(0.284)	
QUFO	-0.406**	-
	(0.188)	
PCED1	0.0503***	0.0131***
	(0.0104)	(0.00507)
QUP	-	-0.450***
		(0.0613)
QUJO	-	-0.465**
		(0.231)
Constant	36.52***	16.59***
	(9.882)	(3.946)
Observations	36	36
R-squared	0.520	0.632

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 19: Fresh Price Regressions (3SLS)

	(1) NWFP	(2) SWFP	(3) CFP	(4) EFP
FPUS	1.202***	0.360***	0.761***	0.788***
	(0.0369)	(0.118)	(0.0567)	(0.0562)
D86	-	4.786***	-	-
		(1.299)		
Constant	-6.945***	23.11***	6.692***	6.580***
	(1.136)	(3.867)	(1.796)	(1.757)
Observations	36	36	36	36
R-squared	0.927	0.207	0.466	0.511

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 20: Processed Price Regressions (3SLS)

	(1) NWPP	(2) SWPP	(3) CPP	(4) EPP
PPUS	1.618***	0.983***	0.754***	0.660***
	(0.0551)	(0.0890)	(0.0337)	(0.0317)
Constant	-7.153***	1.546*	3.424***	3.926***
	(0.576)	(0.913)	(0.371)	(0.344)
Observations	36	36	36	36
R-squared	0.909	0.595	0.799	0.781

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.2 Specification 2: Reformulated Model

To re-iterate, the change in bearing acreage is a function of the profitability of apple production relative to other land uses within each region. Properly specified profitability indicators must reflect the following features: 1) Orchardists are unlikely to incur the significant investment necessary to increase bearing acreage after a single year of elevated profits. It is more likely that farmers require a favourable mid to long term outlook before deciding to expand the bearing area. 2) There is a gestation period between tree planting and apple production; thus the change in bearing acreage in the current year is reflective of the planting decision several years prior. The variables $L3\_NWPI$, $L3\_SWPI$, $L3\_CPI$ and $L3\_EPI$ serve as the profitability indicators for each region and are constructed as the ratio of the three-year moving average of the regional total price of apples to the three-year moving average of the index of prices paid by farmers. The profitability variables are lagged three years in the bearing acreage equation to reflect the previously mentioned gestation period for apple trees. These measures are identical to those used in Specification 1.

All regions have experienced declining bearing acreage, particularly towards the end of the twentieth century. Bearing acreage is also a function of the value from alternative land uses. With an increasing population and urban expansion it stands to reason that the opportunity cost of agricultural land in the United States has increased over time. The implications of urban expansion would be particularly prevalent in smaller states with less land availability. A linear time trend is included in the bearing acreage equations to reflect the gradual decline in land area that is dedicated to apple production throughout the United States.

The Northwest, unlike the Central and Eastern regions, was characterised by increasing bearing acreage of apples prior to the year 2000, after which acreage began to decline. This event is captured by the dummy variable $D00$. Within the years 1986-1987 there was a substantial increase in acreage for Washington State, followed by an equivalent decrease in 2011. These events are captured by the dummy variables $D867$ and $D11$, respectively. A possible explanation, that provides testament to the general theory of perennial crop supply, is that the trees planted in the 1986-1987 event were simply removed during the year 2011 due to the characteristic declining productivity of old plants. Thus, the inclusion of these dummy variables is backed by the foundational theoretical framework governing models of perennial crop supply set forth by French and Matthews (1971).

Similarly, the bearing acreage of apples increased in the Southwest region until the year 1998, after which it has been in steep decline. Futher, there was a noteworthy increase in acreage during the late 1980's. These developments are accounted for in the Southwest bearing acreage regression by the dummy variables $D98$ and $D879$, respectively. The $D879$ variable would ideally have been complemented by the inclusion of a dummy variable similar to the $D11$ variable for the Northwest region. However, due to data availability for Southwestern States, the estimation period ends in 2011.

The decline in bearing acreage has been far more linear since 1971 in the Central and Eastern regions. The variable $D8198$ represents the time period of 1981-1998 when the Central region was able to curb the downward trend; however, apple orchard removal accelerated in the years that follow. The inclusion of the $D11$ variable in the acreage equation for the Central region is motivated by the same rationale as was described for the Northwest Region.

The general specification of the regional yield equations is analogous to Specification 1. The effect of technological progression is captured through the inclusion of a linear time trend. Once again, the adoption of technology depends on the profitability of apples. All else equal, regions obtaining higher prices are more likely to realize higher yields, either through short-run harvest incentives or an increased propensity to invest. This is represented in the yield equation through the inclusion of a three-year moving average of apple prices.

Seasonal fluctuations in yield per acre are likely to be weather driven, which, while being unavoidable, may offer valuable information pertaining to the supply response of producers in unaffected regions. For example, producers in New York and Michigan may respond to crop damage in Washington by lowering quality standards. Therefore, more fruit per acre may be harvested in unaffected regions due to the anticipation of the inevitable shortage. In 1985, the Washington crop was devastated by a frost in the Yakima Valley. Likewise, a frost is also to blame for the destruction of the New York and Michigan crops in 2012 (U.S. Apple, 2013). The dummy variables $D12$ and $D85$ representing these events are included in the yield equation for each region[7].

The allocation sector in Specification 2 contains a minor deviation from that of Specification 1; however, the theoretical implications are substantial. In Specification 1, the price premium enters the allocation equation absent of a lag. This implies that the fresh premium in the current period is known at the time of allocation. It is more likely, however, that prices within the current year are for the most part unknown to producers and packinghouses at the time of allocation. Therefore, implementing adaptive expectations theory, the expected fresh price premium for the current year is equal to the value that was realized in the previous year. The formulation of the fresh premium is unchanged; however, the variables enters the allocation equation with a one-year lag. As a prior, one would of course expect that a higher fresh price premium in the previous year would result in more

[7] The D12 variable is not included in the Southwest region as it is only estimated until the year 2011.

apples supplied to fresh fruit markets in the current year. By identity, the volume of apples allocated to processed fruit markets is equal to the total utilized production, less the volume allocated for fresh utilization.

The Central, Eastern and Southwest regions each experience declining fresh utilization, beginning in the 1990's. For the Eastern and Southwest regions this is explained by declining production, which is included as a explanatory variable in the allocation regressions. Fresh utilization falls in the Central region after the year 1995, with production remaining relatively constant. This is accounted for by the dummy variable, $D95$ in the Central Allocation Equation.

Inverse demand functions are specified for both the fresh and processed utilizations. In both cases, explanatory variables are justified by the well-known determinants of demand. Per capita consumption of fresh and processed apples is included as an explanatory variable in their respective demand functions. The personal consumption expenditure on food captures income effects in the demand for apples. In fresh fruit markets, consumers may also choose to consume oranges and bananas. Orange juice and canned pears are examples of goods existing within the same market definition as processed apple product. The per capita consumption of these goods augments the demand functions to which they pertain.

The regional price determination equations are in most respects identical to those enumerated in Specification 1. Namely, regional prices are a function of the national prices determined in the demand sector. In all cases, the regional prices are strongly explained by the U.S. average price until 1980. This observation continues for the Northwest, Central and Eastern regions for the entire period of estimation. The dummy variable $D80$ is included in the price determination equation for fresh fruit in the Southwest region as prices exceed the U.S. average thereafter.

5.2.1 Structural Ordering

Traditionally, researchers assume that the sectors defining apple industry models are determined independently. Roosen (1999) relaxes this assumption by specifying a simultaneous equations model, which is estimated using Three-Stage Least Squares. While the simultaneity assumption is likely appropriate when modelling most industries, the particular nature of the apple industry provides a strong argument for sector independence. Namely, a block recursive structure is assumed for Specification 2. In the remainder of this discussion, leading up to the estimation results, justification for this recursive ordering is provided.

The sequence of the recursive ordering is as follows: First, supply is determined by the product of current yields and bearing acreage. Second, the total production for the year is allocated for either fresh or processed utilization. Thus, production is predetermined at the time of allocation. Finally, the national price of fresh and processed apples is determined by the quantity available to consumers in the respective markets. Regional prices are determined independently, as a function of the national price.

The supply sector in this model is based on the theory of perennial crop supply from French and Matthews (1971). A key aspect of this theory is that producers, using current and previous profitability indicators, form expectations of future profitability and then adjust production to an optimal level. Given that orchardists maintain relatively little control over yields from year to year, production is altered by adjusting the farm's bearing acreage. As previously discussed, there is a gestation period between planting and the first harvest. This implies that farmers implement their current information set when choosing the level production, and that the adjustment processes takes place with a lag equal to the gestation period. This, when coupled with the fact that yields remain relatively rigid from year to year, leads to the conclusion that farmers are constrained in responding simultaneously to changes in price by altering current production. Note, however, that should a significant crop failure occur in a major producing area, farmers may respond by harvesting more intensively or lowering quality standard in anticipation of higher prices. Furthermore, producers have little knowledge of the supply provided by all other growers and therefore, can only use previous prices as an indication of current period returns. The volume of the current harvest can significantly impact grower prices. However, once prices are determined in the demand sector for the current period, producers can do little to alter production in response.

A similar argument follows for the allocation sector. The price premium for fresh fruit in the current year is unknown at the time of allocation. Therefore, producers and packinghouses base their expectation of the fresh premium on that which was realized in the previous period. Total production is also likely an important variable in explaining the volume of fruit allocated to the fresh market. At the time when apples are sorted to fresh and processed markets, the crop for the year has been set and grown, which implies that production may be treated as predetermined in the allocation equation. As a further note, certain apple varieties are better suited for fresh consumption, while other are preferred for processing. Even if current prices were known, the fact that a region's varietal mix cannot adjust in the short-run suggests that producers, and therefore packinghouse, are somewhat constrained in responding to changes in the fresh premium.

In the remainder of this section, the behavioural equations and identities for Specification 2 are defined. As in Section 5.1, behaviour equations are those which are to be estimated and are indicated as such by the presence of regression coefficients and error terms. The remaining equations are identities. Finally, the model is estimated consistently using Ordinary Least Squares under the aforementioned block recursive ordering.

Sector One: Supply

Bearing Acreage

Northwest Region

$$\Delta NWBA_t = \beta_0 + \beta_1 (NWTP3_{t-3}/IPP3_{t-3}) + \beta_2 D867 + \beta_3 D00 + \beta_4 D11 + \beta_5 T + u_{1t}$$
$$NWBA_t = NWBA_{t-1} + \Delta NWBA_t \quad (1)$$

Southwest Region

$$\Delta SWBA_t = \beta_0 + \beta_1 (SWTP3_{t-3}/IPP3_{t-3}) + \beta_3 D879 + \beta_4 D98 + \beta_5 T + u_{2t} \quad (2)$$
$$SWBA_t = SWBA_{t-1} + \Delta SWBA_t$$

Central Region

$$\Delta CBA_t = \beta_0 + \beta_1 (CTP3_{t-3}/IPP3_{t-3}) + \beta_2 D8198 + \beta_3 D11 + \beta_4 T + u_{3t} \quad (3)$$
$$CBA_t = CBA_{t-1} + \Delta CBA_t$$

Eastern Region

$$\Delta EBA_t = \beta_0 + \beta_1 (ETP3_{t-3}/IPP3_{t-3}) + \beta_2 T + u_{4t} \quad (4)$$
$$EBA_t = EBA_{t-1} + \Delta EBA_t$$

Yield

Northwest Region

$$NWY_t = \beta_0 + \beta_1 NWTP3_{t-1} + \beta_2 D12 + \beta_3 D85 + \beta_4 T + u_{5t} \quad (5)$$

Southwest Region

$$SWY_t = \beta_0 + \beta_1 SWTP3_{t-1} + \beta_2 D85 + \beta_3 T + u_{6t} \quad (6)$$

Central Region

$$CY_t = \beta_0 + \beta_1 CTP3_{t-1} + \beta_2 D12 + \beta_3 D85 + \beta_4 T + u_{7t} \quad (7)$$

Eastern Region

$$EY_t = \beta_0 + \beta_1 ETP3_{t-1} + \beta_2 D12 + \beta_3 D85 + \beta_4 T + u_{8t} \quad (8)$$

Total Production

Northwest Region

$NWPROD_t = NWBA_t \times NWY_t$

Southwest Region

$SWPROD_t = SWBA_t \times SWY_t$

Central Region

$CPROD_t = CBA_t \times CY_t$

Eastern Region

$EPROD_t = EBA_t \times EY_t$

Sector Two: Allocation

Fresh Utilization

Northwest Region

$$NWFU_t = \beta_0 + \beta_1(NWFP_{t-1} - NWPP_{t-1}) + \beta_2 NWPROD_t + u_{9t} \quad (9)$$

Southwest Region

$$SWFU_t = \beta_0 + \beta_1(SWFP_{t-1} - SWPP_{t-1}) + \beta_2 SWPROD_t + u_{10t} \quad (10)$$

Central Region

$$CFU_t = \beta_0 + \beta_1(CFP_{t-1} - CPP_{t-1}) + \beta_2 CPROD_t + \beta_3 D95 + u_{11t} \quad (11)$$

Eastern Region

$$EFU_t = \beta_0 + \beta_1(EFP_{t-1} - EPP_{t-1}) + \beta_2 EPROD_t + u_{12t} \quad (12)$$

Processed Utilization

Northwest Region

$NWPU_t = NWPROD_t - NWFU_t$

Southwest Region

$SWPU_t = SWPROD_t - SWFU_t$

Central Region

$CPU_t = CPROD_t - CFU_t$

Eastern Region

$EPU_t = EPROD_t - EFU_t$

Aggregate to U.S. Total Utilization

$USFU_t = NWFU_t + SWFU_t + CFU_t + EFU_t$
$USPU_t = NWPU_t + SWPU_t + CPU_t + EPU_t$

Per Capita Consumption

$QUF_t = USFU_t / population_t + NIF_t$
$QUP_t = USPU_t / population_t + NIP_t$

where the NIF and NIP variables are already denominated as per capita values.

Sector Three: Demand

Fresh Demand

$$FPUS_t = \beta_0 + \beta_1 QUF_t + \beta_2 QUFO_t + \beta_3 QUFB_t + \beta_4 PCED1_t + \beta_5 T + u_{13t} \quad (13)$$

Processed Demand

$$PPUS_t = \beta_0 + \beta_1 QUP_t + \beta_2 QUJO_t + \beta_3 QUCPEAR_t + \beta_4 PCED1_t + \beta_5 T + u_{14t} \quad (14)$$

Sector Four: Regional Price Determination

Fresh Price

Northwest Region

$$NWFP_t = \beta_0 + \beta_1 FPUS_t + u_{15t} \quad (15)$$

Southwest Region

$$SWFP_t = \beta_0 + \beta_1 FPUS_t + \beta_2 D80 + u_{16t} \quad (16)$$

Central Region

$$CFP_t = \beta_0 + \beta_1 FPUS_t + u_{17t} \quad (17)$$

Eastern Region

$$EFP_t = \beta_0 + \beta_1 FPUS_t + u_{18t} \tag{18}$$

Processed Price

Northwest Region

$$NWPP_t = \beta_0 + \beta_1 PPUS_t + u_{19t} \tag{19}$$

Southwest Region

$$SWPP_t = \beta_0 + \beta_1 PPUS_t + u_{20t} \tag{20}$$

Central Region

$$CPP_t = \beta_0 + \beta_1 PPUS_t + u_{21t} \tag{21}$$

Eastern Region

$$EPP_t = \beta_0 + \beta_1 PPUS_t + u_{22t} \tag{22}$$

Total Price

Northwest Region

$$NWTP_t = (NWFU_t \times NWFP_t + NWPU_t \times NWPP_t)/NWPROD_t$$

Southwest Region

$$SWTP_t = (SWFU_t \times SWFP_t + SWPU_t \times SWPP_t)/SWPROD_t$$

Central Region

$$CTP_t = (CFU_t \times CFP_t + CPU_t \times CPP_t)/CPROD_t$$

Eastern Region

$$ETP_t = (EFU_t \times EFP_t + EPU_t \times EPP_t)/EPROD_t$$

5.2.2 Specification 2: Ordinary Least Squares Estimation

In this section, OLS estimation results for Specification 2 are provided and discussed. The sectors are assumed to abide by a block recursive structural ordering. First, regional total production is determined in the supply sector. The harvest is then allocated into either fresh or processed fruit markets. The total volume of apples available to U.S. consumers in each market is the sum of the volume provided by each each of the four regions. National prices are determined through inverse demand functions which are then used to compute regional prices in the price determination sector.

Table 21: Change in Bearing Acreage

	(1) C_NWBA	(2) C_SWBA	(3) C_CBA	(4) C_EBA
L3_NWPI	14.84	-	-	-
	(11.22)			
T	0.161	0.0711	0.0390	0.102
	(0.0870)	(0.0387)	(0.0394)	(0.0511)
D00	-7.498***	-	-	-
	(1.839)			
D867	10.03***	-	-	-
	(2.328)			
D11	-6.690*	-	-5.886***	-
	(3.126)		(1.599)	
L3_SWPI	-	3.480	-	-
		(8.381)		
D879	-	3.533***	-	-
		(0.804)		
D98	-	-3.493***	-	-
		(0.880)		
L3_CPI	-	-	9.112	-
			(8.486)	
D8198	-	-	2.763***	-
			(0.737)	
L3_EPI	-	-	-	53.03***
				(12.09)
Constant	-3.895	-1.883	-5.585	-16.95***
	(4.367)	(2.260)	(3.243)	(3.899)
Observations	40	36	40	40
R^2	0.6516	0.6820	0.5291	0.3912

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Regional Bearing Acreage

Table 21 presents regression results for the regional bearing acreage behavioural equations. The R-squared value for the Northwest region is 0.6516. The variables appearing to drive change in bearing acreage in the Northwest are $D00$, $D867$ and $D11$. $D00$ and $D867$ are significant at the 0.001 level, while $D11$ is significant at the 0.05 level. All coefficients carry the expected sign. Once the decline in bearing acreage, that has persisted since the year 2000, has been controlled for by the $D00$ dummy variable, a general increase in bearing acreage is indicated by a positive coefficient on the linear time trend. This relation, however, is not significant at the 0.05 level. The dummy variable $D867$ indicates that there is a statistically significant increase in bearing acreage during the mid 1980's. Given the foundational assumptions upon which the supply sector is formulated, one should expect a substantial decrease in bearing acreage as the trees planted in the mid 1980's are removed due to old age. The negative and significant coefficient on the $D11$ variables potentially provides evidence of this theory, although this does not rule out alternative explanations. For example, there may have been a severe weather event in 2011 that served as a catalyst for the removal of these plants. A positive coefficient for the $L3\_NWPI$ suggests that farmers respond to a profitable mid-to-long term outlook by planting additional acreage. However, this relationship is not significant at the 0.05 level. The consolidation of apple farms in the Northwest is a possible explanation for the lack of significance in this relationship. Urban sprawl and an increasing opportunity cost of agricultural land may have led some farms to cease operation. More competitive farms, with a favourable long-term outlook, may then absorb some of the less competitive farms, increasing there own bearing acreage. A net decrease in bearing acreage within a state may yet be recorded if some farms are not purchased by existing orchardists.

Specification 2 appears to explain variation in the change in bearing acreage for the Southwest region relatively will, with an R-squared of 0.6820. The variables $D879$ and $D98$ are significant at the 0.001 level. The positive coefficient on the $D879$ dummy provides empirical evidence of an increase tree planting during the mid 1980's when new, high value, apple varieties were developed. The $D98$ variable enters negatively, as expected, given the decline in bearing that has occurred in the Southern states since 1998. As for the Northwest region, the profitability indicator variable for the Southwest interacts positively with the dependent variable, although is lacking statistical significance at the 0.05 level. A potential explanation was discussed for the Northwest region which applies to the Southwest and Central regions. A positive coefficient is estimated for the linear time trend; however, it is not statistically different from zero at the 0.05 level.

The R-squared for the Central region is equal to 0.5291. Variables significant at the 0.001 level are $D8198$ and $D11$. In Specification 1, the variable $D81$ was included to represent the period when the Central region reversed the downward trend in bearing acreage by focusing on the planting and production of processed apples. Declining bearing acreage was re-established in the late 1990's, which is a possible explanation for the lack of significance for the $D81$ variable in the previous estimation. Here the dummy variable, $D8198$ indicates that for a period of about twenty years, between 1981 and 1998, the Central region was able to curb the decline in bearing area by focusing on the production of processed apples. With the onset of the twentieth century, net acreage removal continued. The negative effect of the $D11$ variable provides support to the theory that annual removals are a function of the portion of trees beyond the threshold age when productivity is expected to fall. Namely, it is possible that trees removed in 2011 are those which were planted during the previously discussed trend reversal in the 1980's. Once again, alternative arguments exist. The relationship between the profitability variable and the change in bearing acreage is as expected. All else equal, as apple production becomes more profitable, orchard planting in predicted to increase on average. There is no statistically significant evidence of this for the Central region at the 0.05 level.

The goodness of fit for the Eastern region is given by an R-squared of 0.3912. The apple production profitability variable, $L3\_EPI$, is statistically significant at the 0.001 level. Thus, there is empirical evidence that orchardists in the Eastern region respond to several years of elevated profits by planting additional acreage of apple trees. Bearing acreage declines linearly in the Eastern Region, with no noteworthy deviation from this tendency, distinguishing it from the other three regions. The lack of significance in the linear time trend may then signify that orchard removal is a consequence of declining profits accruing to apple farmers in the Central states.

Regional Yield

Table 22: Regional Yield Regression

	(1) NWY	(2) SWY	(3) CY	(4) EY
L_NWTP3	0.349**	-	-	-
	(0.112)			
T	0.305***	-0.116*	0.242***	0.291***
	(0.0449)	(0.0442)	(0.0344)	(0.0222)
D12	3.094	-	-15.59***	-5.636***
	(3.582)		(2.700)	(1.560)
D85	-9.638**	3.815	5.895*	1.557
	(3.499)	(3.004)	(2.659)	(1.536)
L_SWTP3	-	0.341	-	-
		(0.214)		
L_CTP3	-	-	0.389***	-
			(0.0921)	
L_ETP3	-	-	-	0.368***
				(0.0686)
Constant	16.60***	13.66**	1.453	4.424*
	(3.106)	(4.781)	(2.322)	(1.704)
Observations	42	38	42	42
R^2	0.6782	0.2431	0.6801	0.8240

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 22 provides point estimates resulting from the OLS estimation of the respecified regional yield regressions. An R-squared of 0.6782 in the Northwest regression suggests that this specification is a relatively good fit of the yield data. The coefficient on the linear time trend is significant at the 0.001 level. The independent variables, L_NWTP3 and $D85$, are statistically significant in explaining variation in yields at the 0.01 level. The positive effect of the linear time trend hints that producers may have benefited, in terms of yields, from technological progress. Farmers are predicted to obtain greater yields when apple prices have been high on average for the past several years. It is admissible that this is due to an increased propensity to invest or harvest more intensively. Results indicate a significant drop in yields during the 1985 production year, when the Washington crop was severally damaged by a spring frost. Likewise, as is indicated by the $D12$ variable, yields were higher in 2012. This finding, however, is not empirically backed at the 0.05 level of significance.

The R-squared for the Southwest region indicates a relatively poor fit of the yield data, with a value of 0.2431. While the time trend variable is significant at the 0.05 level, its negative sign contradicts the expectation that yields should increase with technological progress. The remaining coefficients are estimated to have the anticipated relationship with yields. The three-year average price variable has a positive partial effect on yields. Thus, it would appear that increasing prices provide both incentives and the ability for growers in the Southwest region to obtain higher production per unit of bearing area. However, this relationship is not significant at the 0.05 level. The dummy variable, *D*85, serves to increase the intercept of the Southwest yield equation for the year 1985. This signifies that higher yields were realized in the Southwest region in 1985, when the majority of the Washington crop was destroyed. This finding also lacks significance at the 0.05 level.

The goodness of fit measure for the Central region in comparable to that of the Northwest, with a value of 0.6801. Point estimates for the linear time trend, the D12 dummy and the three-year average price variable are significant at the 0.001 level. Further, the D85 variable has a significant effect on yields at the 0.05 level. All estimated coefficients are of the expected sign. Thus, findings indicate that orchardists in the Central region respond positively to price incentives by making efforts to improve yields. As in the Northwest region, the positive partial effect of the time variable signifies that technological progress may have enabled farmers to achieve greater production per acre through time. Additionally, there is statistically significant evidence that yields suffered in 2012 when the Michigan crop was severely damaged by an early spring frost. A positive and significant coefficient for the D85 dummy variable supports the hypothesis that apple producers reacted to the 1985 frost event in Washington by harvesting more apples per acre.

The R-squared for the Eastern region is 0.8240, indicating the best fit among all four regions. The linear time trend, *D*12 dummy variable and the three-year average price variables are each of statistically significant relationships with yields at the 0.001 level. The positive time trend suggests progress in technology and practice has led to higher yields per acre in the Eastern states. The three-year average price variable has a positive partial effect on yields. Thus, there is evidence to support the hypothesis that higher prices lead to improved yields, either through more intensive harvest or enhanced propensity to adopt novel technologies/practices. The *D*12 dummy variable decreases the intercept for the year 2012, when there was an early spring frost in New York state. Alternatively, the D85 variable, results in higher predicted yields during the year 1985, when the Washington crop was destroyed.

Estimated coefficients for the D12 and D85 variables have the hypothesized effect on yields in all regions where they are present. This finding provides testament to the a priori assumption that farmers in unaffected regions respond to severe crop loss in major production areas by harvesting more apples per acre. As discussed, once a crop is set, there is little action that producers can take to improve yields and to do so may constrain yields in the subsequent year. If, however, producers anticipate a below-average total U.S. crop, they may have incentive to sacrifice future yields in order to take advantage of the inevitably higher prices in the current year. Additionally, quality standards may drop in order to meet consumer demand, which would also result in a larger yield per acre.

Table 23: Fresh Allocation Regression

	(1) NWFU	(2) SWFU	(3) CFU	(4) EFU
L_NWPREM	24.82**	-	-	-
	(8.006)			
NWPROD	0.709***	-	-	-
	(0.0285)			
L_SWPREM	-	3.250*	-	-
		(1.206)		
SWPROD	-	0.380***	-	-
		(0.0343)		
L_CPREM	-	-	4.265*	-
			(1.652)	
D95	-	-	-107.1***	-
			(13.41)	
CPROD	-	-	0.387***	-
			(0.0240)	
L_EPREM	-	-	-	10.23**
				(3.215)
EPROD	-	-	-	0.381***
				(0.0338)
Constant	-333.4*	-74.11*	23.39	-100.7
	(160.5)	(33.99)	(46.00)	(110.2)
Observations	44	40	44	44
R^2	0.9571	0.8147	0.9066	0.7733

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Regional Allocation

Table 23 enumerates the empirical results for the OLS estimation of the reformulated regional allocation equations. Total production and the lagged fresh price premium variables explain a large portion of the variation in the Northwest fresh allocation variables, as indicated by an R-squared of 0.9571. Both of the aforementioned regressors have a statistically significant impact on the dependent variable in the expected direction. The lagged fresh premium coefficient is positive and significant at the 0.01 level. This finding agrees with the a priori assumption that farmers use the previous price premium to form an expectation of the premium that will be paid for apples allocated for fresh use from the current crop. Holding production constant, a higher expected fresh price premium is predicated to increase the ratio of the fresh utilization to the processed utilization. Naturally, a larger crop in the Northwest U.S., as indicated by a higher values of *NWPROD*, is predicted to result in more apple in fresh fruit markets.

The R-squared measure for the Southwest Region is equal to 0.8147. As in the Northwest region, both the lagged fresh price premium and production variables are significant. Production is significant in explaining fresh utilization at the 0.001 level. The point estimate for the lagged Southwest price premium is statistically different from zero at the 0.05 level. The partial effects of the explanatory variables on the dependent variable are of the anticipated direction. Thus, higher fresh price premiums paid during the previous year are predicted to stimulate a larger total supply of fresh apples in the current year. A larger harvest is also predicted to result in more apples in fresh markets on average.

The OLS estimation of Specification 2 produces a good fit of the Central fresh utilization data, as is conveyed by an R-squared of 0.9066. All regressors have a statistically significant impact on the dependent variable. Total regional production and the $D95$ dummy variable coefficients are significantly different from zero at the 0.001 level, while the lagged fresh premium is significant at the 0.05 level. Once again, all independent variables interact with fresh utilization as suggested by theory. Higher expected premiums on fresh fruit are predicted to result in a greater proportion of the current crop being sorted for fresh utilization. Holding premiums constant, increases in production will on average cause more apples to appear in fresh fruit markets. The $D95$ variable is estimated to lower the intercept in the Central fresh utilization equation for years subsequent to 1995. Thus, there is empirical evidence to support the claim that the volume of fresh apples coming from the Central states fell after 1995, even though production remained relatively unchanged.

The goodness of fit measure for the Eastern region is equal to 0.7733, the lowest among all regions. However, each estimated coefficient is statistically significant and of the previously assumed sign. In agreement with empirical findings for the other three regions, a more favourable fresh premium in the previous year is predicted to result in a higher volume of fresh apples from the Eastern region during the current period. Similarly, the partial effect of the production variable is to increase the total volume of fresh apple supply provided by producers in the Eastern states.

Table 24: Demand Regressions

	(1)	(2)
	FPUS	PPUS
QUF	-1.838**	-
	(0.534)	
QUFO	-0.523	-
	(0.487)	
QUFB	0.548	-
	(0.523)	
PCED1	0.0821**	0.0168
	(0.0278)	(0.0168)
T	-1.677**	-0.348
	(0.569)	(0.336)
QUP	-	-0.302
		(0.163)
QUJO	-	-0.509
		(0.873)
QUCPEAR	-	-0.0849
		(1.232)
Constant	13.86	11.59
	(27.57)	(14.28)
Observations	45	45
R^2	0.5486	0.5168

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

National Demand

Inverse demand functions are estimated at the national level. Regression results are presented in Table 24. The explanatory variables included in Specification 2 are identical to those found in Specification 1, with the exception of additional per capita consumption variables for fresh bananas and canned pears. The national average fresh apple price is a function of the own per capita utilization, per capita consumption of fresh oranges and bananas, the personal consumption expenditure on food and a linear time trend. OLS estimation brought about an R-squared value of 0.5486, indicating a reasonably good fit of the data. Per capita consumption of fresh apples, the food expenditure and the linear time trend variables have statistically significant partial effects on the fresh price at the 0.01 level. A negative relationship between the per capita consumption and the price of fresh apples is in agreement with the well-known theory of demand. Fresh oranges are predicted to serve as a substitute good in the consumption of fresh apples. This finding is not supported at the 0.05 level of statical significance. Conversely, fresh bananas are complementary goods in the consumption of apples. The p-value for this coefficient does not signify a statistically significant relationship between the consumption of bananas and the price of apples at the 0.05 level. The price of fresh apples is predicated to increase, on average, with an in increase in the personal consumption expenditure on food. This finding agrees with those of previous studies, where apples are determined to be normal goods. Perhaps surprising is the partial effect of the linear time trend variable, T. Holding all other factors constant, the real price of fresh apples is predicted to decrease over time.

The R-squared for the processed apple demand function is equal to 0.5168. As in Specification 1, none of the regressors have sufficiently low p-values to indicate significant relationships with the national average processed price at the 0.05 level. Nonetheless, the own price-quantity relation is estimated to be negative and thus complies with the theory of demand. An increase in the per capita consumption of orange juice and canned pears is estimated to interact negatively with the average price of processed apples. If this was coupled with statistical significance, there would then be sufficient evidence to asserted that these goods are substitutes in consumption to processed apple products. However, this is not the case. Results hint that processed apples are also normal goods, as demonstrated by a positive coefficient on the expenditure variable. As with fresh apples, the real price of processed apple products is predicted to decrease with time.

Regional Price Determination

Results of the regional price determination regressions for fresh and processed apples are illustrated in Table 25 and Table 26 respectively. Barring the inclusion of the $D80$ variable, this specification is identical to that presented in Section 5.1.1. The R-squared of the regional fresh price regressions for the Northwest, Southwest, Central and Easter regions are 0.9176, 0.2721, 0.5858 and 0.5672 respectively. The positive relationship between the national fresh price and the regional fresh price is statistically significant at the 0.001 level for the Northwest, Central and Eastern regions, and significant at the 0.01 level for the Southwest regions. As would be expected, these results differ little from those in Specification 1. The D80 variable raises the intercept of the Southwest equation in years subsequent 1980. This illustrates the observed departure of Southwest fresh apple prices from the national average during this time period. Specification 2 is identical to Specification 1 in all respects, for the regional processed price regressions. Thus further discussion here would be redundant.

Table 25: Fresh Price Regressions

	(1) NWFP	(2) SWFP	(3) CFP	(4) EFP
FPUS	1.158***	0.640**	0.833***	0.757***
	(0.0529)	(0.185)	(0.107)	(0.101)
D80	-	7.570**	-	-
		(2.423)		
Constant	-5.811**	11.62	5.042	7.777*
	(1.669)	(6.875)	(3.369)	(3.181)
Observations	45	41	45	45
R^2	0.9176	0.2721	0.5858	0.5672

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 26: Processed Price Regressions

	(1) NWPP	(2) SWPP	(3) CPP	(4) EPP
PPUS	1.233***	0.824***	1.026***	0.851***
	(0.0903)	(0.0887)	(0.0881)	(0.0598)
Constant	-3.629***	3.112**	1.006	2.193**
	(0.965)	(0.952)	(0.941)	(0.639)
Observations	45	41	45	45
R^2	0.8125	0.6890	0.7595	0.8246

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6 Conclusion

The mid to late twentieth century was host to a number of economic studies pertaining to the United States apple industry. Since then, few such research initiative have been undertaken. This study addresses the gap in the literature by formulating a regional structural model of the U.S. apple industry using data for the time period of 1971-2015. In general, the existing literature can be divided into two categories: structural models treating the apple industry as a whole, and sector-specific models focusing on a particular aspect of the apple industry. The industry model proposed in this study is comprised of four sectors that jointly describe the production, allocation, demand and pricing of apples.

Two separate model specifications are provided. The first specification is analogous to that of Roosen (1999), where each sector in the model is assumed to be determined simultaneously. Thus, several estimation procedures are employed, including Two-Stage and Three-Stage Least Squares, in recognition of the presence of endogenous regressors. An alternative formulation is provided in the second specification, where regional supply responses to crop failure in a major producing area is examined. The specific nature of apple production corroborates the assumption of a block recursive model structure. Thus, the second specification is estimated using Ordinary Least Squares.

Findings suggest that technological progress is a critical factor contributing to higher yields per acre in U.S. apple farms. Improved yields have enabled orchardist to maintain a high level of production despite a declining bearing area. As well, in the presence of crop loss in a major producing area, unaffected regions may respond by harvesting more intensely. Annual apple production is allocated into either fresh or processed fruit markets. Empirical results indicate total production has a positive partial effect on the volume of apples allocated to fresh fruit markets. Furthermore, holding production constant, a higher premium paid for fresh apples results in a relatively larger volume of apples sorted for fresh utilization than for processed utilization. Estimated demand functions concur with the theory of demand, predicting a negative price-quantity relationship for apples. In agreement with previous studies, coefficient estimates signify that apples are a normal good. Finally, national apple prices are found to be a strong explanator for regional prices.

Several avenues exist to expand this study. First, the explicit inclusion of a trade sector would facilitate a more thorough understanding of apple consumption, as well as import responses to crop loss. Second, with access to sufficient tree planting and removal data, a truly novel representation of apple supply could be achieved. An analysis of the variables driving yields and the total bearing area would enable researchers to more accurately predict production volumes and explain critical trends in the industry.

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Appendices

Appendix A

Table 1: U.S. Aggregate Data

YEAR	DEF	IPPF	PCED1	QUT	QUF	QUC	QUR	QUJ	QUD	QUO	QUP	POPULATION	QUFB	QUFO	QUCPEACH	QUCPEAR	QUJO
1971	23.897	399	147.8	30.73	16.42	5.27	0.91	7.02	0.48	0.63	14.31	208.917	18.1	15.7	8.11	3.98	4.18
1972	24.929	425	159.5	28.03	15.53	4.67	1.12	5.44	0.64	0.65	12.52	210.985	17.9	14.5	7.29	3.63	4.19
1973	26.291	491	177.2	29.66	16.13	5.97	1.22	4.63	1.12	0.6	13.54	212.932	18.2	14.4	6.92	4.01	4.32
1974	28.656	558	198.9	30.77	16.4	5.75	0.85	5.91	0.91	0.95	14.37	214.931	18.5	14.4	8	3.72	4.66
1975	31.299	613	220.1	33.52	19.49	4.75	0.95	6.87	1.04	0.42	14.03	217.095	17.6	15.9	7.03	3.86	5.18
1976	33.028	653	238.9	30.05	17.08	4.26	1.01	6.3	1.07	0.33	12.97	219.179	19.3	14.7	7.06	4.32	5.01
1977	35.074	689	258.6	31.54	16.52	4.88	0.73	7.87	0.99	0.55	15.02	221.477	19.2	13.4	7.29	4.46	4.31
1978	37.531	745	285.3	35.77	17.95	5.51	0.93	9.57	0.99	0.83	17.83	223.865	20.2	13.4	6.58	3.79	4.46
1979	40.642	848	320.1	35.97	17.14	5.92	0.6	10.63	1.11	0.57	18.83	226.451	21	11.5	6.72	4.64	4.95
1980	44.312	949	350.7	39.80	19.20	5.27	0.78	13.01	0.82	0.72	20.60	228.937	20.77	14.28	6.82	4.58	4.72
1981	48.453	1035	377.3	34.59	16.85	4.35	0.67	11.52	0.82	0.38	17.74	231.157	21.48	12.36	5.54	4.37	4.3
1982	51.456	1090	396.9	39.67	17.54	5.37	0.84	14.58	0.85	0.50	22.13	233.322	22.54	11.69	5.23	4.05	5.78
1983	53.481	1104	416.7	41.59	18.27	5.13	0.74	15.83	1.21	0.41	23.32	235.385	21.25	15.04	4.34	3.64	4.82
1984	55.386	1129	439.9	44.33	18.35	5.01	0.87	18.41	1.26	0.43	25.98	237.468	22.18	11.87	4.77	3.17	4.81
1985	57.16	1114	459.2	43.18	17.26	5.26	0.79	18.41	1.15	0.31	25.92	239.638	23.48	11.6	4.73	3.21	5
1986	58.321	1109	483.9	43.14	17.84	4.91	1.02	18.16	0.83	0.38	25.29	241.784	25.82	13.43	5.04	3.44	4.57
1987	59.821	1139	506.6	48.18	20.83	5.38	1.02	19.44	1.21	0.30	27.35	243.981	25.02	12.81	4.74	3.88	4.52
1988	61.917	1191	544.4	47.30	19.84	5.71	1.12	19.15	1.21	0.27	27.46	246.224	24.29	13.9	4.91	3.52	4.66
1989	64.335	1255	582.1	46.61	21.22	5.34	1.28	17.44	1.11	0.23	25.39	248.659	24.71	12.17	4.65	3.71	3.7
1990	66.732	1310	626.3	47.92	19.58	5.50	1.11	20.68	0.76	0.29	28.34	251.659	24.36	12.37	4.54	3.92	4.65
1991	68.963	1334	647.2	43.59	18.11	5.15	1.02	18.13	0.79	0.39	25.48	255.007	25.05	8.43	4.77	3.41	4.3
1992	70.532	1348	658.6	46.51	19.14	5.80	1.04	18.73	1.20	0.60	27.37	258.357	27.12	12.84	5.11	3.68	5.06
1993	72.209	1381	679.2	48.30	19.01	5.12	1.07	21.33	1.45	0.32	29.29	261.632	26.6	14.15	4.81	3.35	5.13
1994	73.742	1416	705.5	49.10	19.37	5.34	1.07	21.27	1.53	0.50	29.73	264.795	27.78	12.94	4.75	3.71	4.93
1995	75.29	1454	723.3	45.16	18.69	4.89	1.19	18.89	1.21	0.29	26.47	267.925	27.08	11.83	3.58	2.95	5.16
1996	76.665	1531	748.6	46.41	18.67	4.91	1.04	20.33	1.24	0.23	27.74	271.121	27.6	12.58	4.5	2.81	5.23
1997	77.978	1574	773.3	45.11	18.09	5.60	1.35	18.47	0.95	0.66	27.03	274.356	27.16	13.91	4.87	3.43	5.82
1998	78.827	1532	802	47.34	18.98	4.37	0.94	21.52	1.18	0.34	28.35	277.55	28.01	14.61	4.15	3.28	5.53
1999	80.037	1531	846	47.07	18.50	4.84	0.93	21.36	0.99	0.45	28.57	280.976	30.7	8.38	4.3	3.37	5.57
2000	81.857	1588	894.4	45.06	17.46	4.36	0.77	21.37	0.77	0.33	27.60	283.92	28.45	11.74	4.6	2.82	5.18
2001	83.727	1637	931.6	43.45	15.61	4.57	0.91	21.29	0.83	0.25	27.84	286.788	26.63	11.88	4.21	2.98	5.06
2002	85.012	1642	958.2	43.13	16.00	4.01	0.69	21.45	0.80	0.17	27.13	289.518	26.78	11.74	4.61	2.59	4.9
2003	86.704	1696	1004.2	46.57	16.91	4.50	1.03	23.13	0.64	0.36	29.66	292.192	26.17	11.9	4.01	2.65	4.96
2004	89.089	1788	1064.7	50.45	18.79	4.53	0.69	25.28	0.70	0.45	31.65	294.914	25.78	10.8	4.28	2.5	4.77
2005	91.96	1891	1126.3	45.22	16.66	4.19	0.85	22.26	0.73	0.54	28.57	297.647	25.18	11.42	4.01	2.28	4.41
2006	94.789	1999	1186.6	50.72	17.73	4.21	0.85	26.37	0.97	0.60	32.99	300.574	25.11	10.25	3.47	2.38	4.15
2007	97.313	2138	1246.9	49.80	16.39	3.96	0.89	27.14	0.90	0.52	33.41	303.506	25.95	7.46	4.24	2.29	3.8
2008	99.243	2434	1296.6	47.90	15.88	4.61	0.71	25.05	0.88	0.78	32.02	306.208	25.04	9.93	3.57	2.24	3.99
2009	100	2364	1287.9	47.28	16.20	4.18	0.75	24.92	0.61	0.63	31.08	308.833	22.01	9.06	3.94	2.44	3.7
2010	101.329	2434	1321.1	47.56	15.29	3.98	0.57	26.37	0.65	0.71	32.27	311.041	25.61	9.68	3.63	1.94	3.67
2011	103.431	2706	1387.8	42.49	15.44	4.17	0.69	20.61	0.60	0.99	27.05	313.367	25.53	9.97	3.14	2.15	3.1
2012	105.337	2824	1436.1	43.40	16.02	3.15	0.30	22.48	0.87	0.57	27.38	315.689	26.97	10.54	3.14	2.03	3.25
2013	107.035	2876	1465.6	45.46	17.31	4.66	0.79	21.24	0.64	0.82	28.15	318.056	28.06	10.45	3.28	2.01	3.07
2014	108.942	3031	1533.9	45.48	18.58	4.23	0.75	20.42	0.70	0.79	26.89	320.526	27.92	9.43	3.07	1.96	2.88
2015	110.088	.	1591.1	46.09	17.20	4.17	0.81	22.30	0.68	0.92	28.90	322.953	27.99	8.55	3.24	1.93	2.85

Table 2: Bearing Acreage

YEAR	Arizona	Arkansas	California	Colorado	Connecticut	Delaware	Georgia	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Maine	Maryland	Massachusetts	Michigan	Minnesota	Missouri	New Hampshire
1971	.	1700.00	21200.00	5600.00	4000.00	800.00	.	5300.00	8700.00	6400.00	1700.00	1700.00	1900.00	5200.00	5800.00	7200.00	55500.00	2200.00	4600.00	3700.00
1972	.	2000.00	21600.00	5700.00	3900.00	800.00	.	5300.00	8500.00	6300.00	1600.00	1700.00	1800.00	5300.00	5700.00	6800.00	54500.00	2200.00	4800.00	3500.00
1973	.	2000.00	21700.00	5700.00	3700.00	800.00	.	5200.00	8300.00	6100.00	1800.00	1700.00	1800.00	5500.00	5400.00	6600.00	53500.00	2200.00	5000.00	3600.00
1974	.	2000.00	22000.00	6000.00	3600.00	800.00	.	5000.00	8100.00	5200.00	1700.00	1700.00	1800.00	5500.00	5600.00	6600.00	52500.00	2200.00	5100.00	3700.00
1975	.	2000.00	21300.00	5800.00	3600.00	800.00	.	4900.00	7900.00	5200.00	1700.00	1800.00	1700.00	5500.00	5700.00	7000.00	51700.00	2300.00	4900.00	3700.00
1976	.	2000.00	21700.00	5900.00	3600.00	800.00	2900.00	4900.00	7900.00	5100.00	1600.00	1800.00	1700.00	5500.00	5800.00	6800.00	48900.00	2500.00	4700.00	3700.00
1977	.	2000.00	21300.00	5600.00	3600.00	800.00	3200.00	5100.00	7500.00	4900.00	1500.00	1800.00	1600.00	5500.00	5800.00	6800.00	46100.00	2600.00	4600.00	3700.00
1978	500.00	1900.00	21000.00	5400.00	3600.00	800.00	3600.00	5200.00	8200.00	4800.00	1500.00	1800.00	1600.00	5100.00	5800.00	6800.00	43300.00	2800.00	4400.00	3700.00
1979	600.00	1900.00	21800.00	5200.00	3600.00	800.00	4000.00	5200.00	7900.00	4800.00	1500.00	1800.00	1800.00	5100.00	5800.00	6900.00	42500.00	2600.00	4700.00	3700.00
1980	.	1800.00	22400.00	5200.00	3600.00	900.00	4200.00	5200.00	7600.00	5000.00	1400.00	1800.00	1900.00	5100.00	5800.00	7100.00	43000.00	2400.00	4800.00	3700.00
1981	.	1500.00	23100.00	5200.00	3600.00	900.00	4400.00	5200.00	7300.00	5200.00	1300.00	1900.00	2000.00	5200.00	5900.00	7300.00	44000.00	2400.00	5000.00	3700.00
1982	.	1000.00	22300.00	.	.	.	4500.00	.	.	.	.	.	2200.00	.	.	.	44500.00	.	.	.
1983	.	1000.00	23800.00	.	.	.	4500.00	.	.	.	.	.	2400.00	.	.	.	44600.00	.	.	.
1984	.	1000.00	21300.00	.	.	.	4500.00	.	.	.	.	.	.	.	.	.	44800.00	.	.	.
1985	.	1000.00	21800.00	.	.	.	4000.00	.	.	.	.	.	.	.	.	.	46200.00	.	.	.
1986	.	1000.00	21200.00	.	.	.	4000.00	.	.	.	.	.	.	.	.	.	47300.00	.	.	.
1987	.	1000.00	22700.00	4800.00	3200.00	850.00	4000.00	5500.00	6500.00	5500.00	1300.00	1200.00	2500.00	5800.00	3000.00	7000.00	49500.00	2300.00	4800.00	3400.00
1988	.	1000.00	27600.00	4800.00	2900.00	850.00	4000.00	5500.00	6500.00	5500.00	1400.00	970.00	2400.00	5600.00	2800.00	6400.00	51000.00	2300.00	4700.00	3800.00
1989	4400.00	1000.00	29900.00	4600.00	2700.00	850.00	3500.00	5500.00	6000.00	5500.00	1500.00	840.00	2400.00	5200.00	2800.00	5800.00	51900.00	2300.00	4600.00	3600.00
1990	4000.00	1000.00	31400.00	4200.00	2700.00	850.00	3000.00	5500.00	6000.00	5500.00	1600.00	750.00	2400.00	5000.00	2800.00	5300.00	52100.00	2300.00	4500.00	3400.00
1991	4000.00	1000.00	31800.00	4000.00	2800.00	850.00	2800.00	5500.00	6000.00	4000.00	1700.00	620.00	2400.00	4700.00	2800.00	4900.00	53000.00	2300.00	4300.00	3400.00
1992	4500.00	1000.00	33800.00	4000.00	2900.00	800.00	2700.00	5900.00	6000.00	4000.00	1800.00	500.00	2400.00	4800.00	2800.00	5000.00	54000.00	2600.00	4000.00	3500.00
1993	4400.00	1000.00	34700.00	3600.00	2500.00	800.00	2400.00	6600.00	6000.00	4000.00	1800.00	480.00	2400.00	4700.00	2800.00	5150.00	55000.00	2800.00	4000.00	3300.00
1994	4400.00	1000.00	34900.00	3400.00	2500.00	800.00	2200.00	6600.00	5500.00	4000.00	1800.00	500.00	2400.00	4700.00	2800.00	5250.00	54000.00	2800.00	3900.00	3200.00
1995	4200.00	1000.00	35000.00	3400.00	2400.00	800.00	1900.00	6600.00	5500.00	4000.00	1800.00	500.00	1950.00	4700.00	2800.00	5250.00	54000.00	2800.00	4000.00	3100.00
1996	4000.00	900.00	38000.00	3400.00	2400.00	750.00	1700.00	6600.00	5500.00	4000.00	1800.00	450.00	1700.00	4700.00	2800.00	5250.00	54000.00	2800.00	3900.00	3000.00
1997	3700.00	900.00	38500.00	3200.00	2400.00	.	1400.00	6600.00	5000.00	4000.00	1800.00	650.00	1500.00	4700.00	2800.00	5250.00	54000.00	2800.00	3800.00	2950.00
1998	3800.00	900.00	37000.00	3000.00	2400.00	.	1400.00	6000.00	5000.00	4000.00	1700.00	550.00	1400.00	4700.00	2600.00	4900.00	54000.00	2800.00	3800.00	2800.00
1999	3900.00	800.00	36000.00	2800.00	2400.00	.	1300.00	5400.00	5000.00	4000.00	1700.00	450.00	1300.00	4700.00	2700.00	4900.00	52000.00	2750.00	3800.00	2600.00
2000	3900.00	800.00	33000.00	2700.00	2300.00	.	1200.00	4700.00	5000.00	4000.00	1650.00	450.00	1100.00	4000.00	2400.00	4400.00	48500.00	2750.00	3800.00	2300.00
2001	2000.00	700.00	30000.00	2200.00	2200.00	.	1200.00	4000.00	4000.00	4000.00	1600.00	400.00	950.00	3500.00	2400.00	4100.00	46000.00	2750.00	3800.00	2200.00
2002	1500.00	650.00	28000.00	1800.00	2200.00	.	1200.00	3400.00	4000.00	4000.00	1600.00	350.00	950.00	3500.00	2400.00	4100.00	43500.00	2650.00	3900.00	2100.00
2003	1200.00	600.00	28000.00	1700.00	2200.00	.	1200.00	3400.00	4000.00	3200.00	1600.00	300.00	950.00	3500.00	2400.00	4100.00	41500.00	2600.00	3400.00	2100.00
2004	1200.00	550.00	26000.00	1600.00	2200.00	.	1200.00	3400.00	4000.00	2900.00	1500.00	290.00	920.00	3500.00	2400.00	4100.00	40500.00	2500.00	3200.00	2100.00
2005	1100.00	.	24000.00	1500.00	2200.00	.	1300.00	3100.00	3500.00	2600.00	1400.00	.	860.00	3300.00	2400.00	4100.00	40000.00	2400.00	3000.00	2100.00
2006	1100.00	.	21000.00	1500.00	2200.00	.	1300.00	2800.00	3000.00	2300.00	1300.00	.	790.00	3200.00	2300.00	4000.00	38500.00	2700.00	2400.00	2100.00
2007	1200.00	.	20500.00	1600.00	2200.00	.	600.00	2800.00	2500.00	2100.00	1100.00	.	790.00	3100.00	2100.00	4000.00	36000.00	3000.00	2000.00	2100.00
2008	1200.00	.	19500.00	1400.00	2200.00	.	600.00	2600.00	2500.00	2100.00	1100.00	.	790.00	3100.00	1900.00	4000.00	37000.00	3000.00	1900.00	2100.00
2009	1200.00	.	19000.00	1500.00	2200.00	.	.	2600.00	2500.00	2000.00	1100.00	.	.	3100.00	1900.00	4000.00	38000.00	3000.00	1800.00	1900.00
2010	1200.00	.	18000.00	1400.00	2100.00	.	.	2600.00	2200.00	1800.00	1000.00	.	.	3100.00	1850.00	4000.00	39000.00	2600.00	1800.00	1900.00
2011	1200.00	.	17500.00	1300.00	2100.00	.	.	2600.00	2200.00	1700.00	1000.00	.	.	3100.00	1750.00	4000.00	34000.00	2450.00	1800.00	1900.00
2012	1000.00	.	16000.00	1200.00	1900.00	.	.	2600.00	2100.00	1500.00	1000.00	.	.	2900.00	1900.00	3000.00	35000.00	2900.00	1200.00	1400.00
2013	1000.00	.	15200.00	1200.00	2000.00	.	.	2700.00	1800.00	1400.00	1000.00	.	.	2900.00	1700.00	3000.00	36500.00	2600.00	1200.00	1400.00
2014	1000.00	.	15000.00	1200.00	1800.00	.	.	2400.00	1800.00	1300.00	900.00	.	.	2700.00	1800.00	3100.00	33000.00	2600.00	1200.00	1300.00
2015	.	.	14000.00	.	1800.00	.	.	2300.00	1700.00	1300.00	900.00	.	.	2700.00	1800.00	3000.00	33000.00	2600.00	1100.00	1300.00

YEAR	New Jersey	New Mexico	New York	North Carolina	Ohio	Oregon	Pennsylvania	Rhode Island	South Carolina	Tennessee	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	United States	Other States
1971	8700.00	4900.00	63000.00	12600.00	12000.00	6200.00	30000.00	500.00	1900.00	1100.00	2900.00	3400.00	25400.00	63600.00	16300.00	6500.00	402200.00	.
1972	8200.00	4700.00	62800.00	13500.00	11600.00	6200.00	30000.00	500.00	2000.00	1100.00	2700.00	3400.00	25600.00	68200.00	16300.00	6400.00	405200.00	.
1973	8100.00	4400.00	62000.00	13500.00	11200.00	6100.00	28400.00	500.00	2200.00	900.00	2700.00	3500.00	21500.00	72200.00	15300.00	6000.00	399100.00	.
1974	8000.00	4000.00	62000.00	13600.00	10900.00	6100.00	28300.00	500.00	2400.00	900.00	3000.00	3500.00	20700.00	72200.00	14800.00	6000.00	396000.00	.
1975	7500.00	4000.00	62000.00	13700.00	10800.00	6200.00	28200.00	500.00	2400.00	800.00	3200.00	3500.00	20700.00	74400.00	14200.00	6000.00	395600.00	.
1976	7200.00	3200.00	62400.00	14400.00	10800.00	6300.00	28000.00	500.00	2400.00	1000.00	3200.00	3500.00	24900.00	76600.00	14500.00	6500.00	403200.00	.
1977	7100.00	2800.00	62800.00	14800.00	10800.00	6400.00	27900.00	500.00	3100.00	1200.00	3200.00	3500.00	25000.00	78800.00	15000.00	6500.00	403400.00	.
1978	7100.00	2500.00	63200.00	15500.00	10600.00	6500.00	27800.00	500.00	2900.00	1000.00	3200.00	3500.00	24500.00	81000.00	15700.00	7000.00	404300.00	.
1979	7100.00	2400.00	64000.00	15800.00	10300.00	6500.00	27600.00	500.00	2800.00	1000.00	3200.00	3600.00	25000.00	83000.00	15700.00	6900.00	407600.00	.
1980	7300.00	2300.00	64400.00	15800.00	10000.00	6700.00	27400.00	500.00	2900.00	1100.00	3200.00	3700.00	25000.00	86000.00	15800.00	6700.00	412200.00	.
1981	7300.00	2200.00	64000.00	15000.00	9800.00	6900.00	27200.00	500.00	3100.00	1200.00	3200.00	3800.00	22700.00	90000.00	15900.00	6500.00	414900.00	.
1982	7200.00	.	63500.00	14800.00	9500.00	7000.00	27000.00	.	3300.00	1300.00	.	.	22400.00	95000.00	16000.00	6300.00	418255.00	.
1983	6800.00	.	63000.00	14800.00	9600.00	7000.00	27000.00	.	3500.00	1400.00	.	.	21600.00	102000.00	15700.00	6300.00	424460.00	.
1984	6500.00	.	62800.00	14800.00	9800.00	7100.00	27000.00	.	3600.00	1500.00	.	.	21000.00	105000.00	15500.00	6100.00	422880.00	.
1985	6300.00	.	63800.00	15000.00	9900.00	7500.00	27000.00	.	3700.00	1500.00	.	.	20400.00	112000.00	14500.00	6200.00	430680.00	.
1986	5900.00	.	63000.00	15200.00	10000.00	8500.00	26000.00	.	3700.00	1600.00	.	.	19800.00	126000.00	14000.00	6300.00	442390.00	.
1987	5300.00	2000.00	62000.00	15400.00	10100.00	9400.00	26000.00	540.00	3700.00	1600.00	3800.00	3900.00	18900.00	135000.00	13300.00	6500.00	452290.00	.
1988	5100.00	2000.00	61000.00	14000.00	9600.00	10500.00	25000.00	480.00	3800.00	1700.00	3800.00	3800.00	19300.00	128000.00	13100.00	6700.00	447900.00	.
1989	5000.00	2500.00	58000.00	13000.00	9200.00	10000.00	25000.00	420.00	3800.00	1700.00	3700.00	3700.00	19400.00	130000.00	13100.00	7000.00	450410.00	.
1990	5000.00	2000.00	56000.00	12000.00	8900.00	9500.00	25000.00	360.00	3800.00	1800.00	3500.00	3700.00	19600.00	136000.00	13100.00	6900.00	451460.00	.
1991	4800.00	2000.00	55000.00	11000.00	8600.00	9500.00	24000.00	330.00	3600.00	1800.00	3300.00	3600.00	19700.00	139000.00	13100.00	7000.00	449200.00	.
1992	4400.00	2000.00	56000.00	10900.00	8300.00	8000.00	24000.00	350.00	3700.00	1700.00	3100.00	3600.00	19800.00	142000.00	13100.00	7100.00	455050.00	.
1993	4200.00	2000.00	56000.00	10900.00	8000.00	8300.00	23000.00	300.00	3800.00	1700.00	3000.00	3600.00	19200.00	147000.00	13100.00	7200.00	459730.00	.
1994	4000.00	2000.00	57000.00	10000.00	7900.00	8500.00	23000.00	300.00	3500.00	1700.00	3000.00	3600.00	19000.00	152000.00	10000.00	7300.00	459450.00	.
1995	3800.00	2000.00	57500.00	10000.00	7800.00	8600.00	23000.00	300.00	3300.00	1600.00	3000.00	3700.00	18100.00	158000.00	10000.00	6200.00	462600.00	.
1996	3700.00	2000.00	57500.00	9500.00	7800.00	8700.00	23000.00	300.00	2900.00	1500.00	2800.00	3700.00	17300.00	164000.00	9000.00	6200.00	467550.00	.
1997	3500.00	1800.00	55000.00	9500.00	7900.00	8700.00	23000.00	300.00	2900.00	1400.00	2800.00	3700.00	17000.00	170000.00	8000.00	6500.00	467950.00	.
1998	3500.00	1800.00	55000.00	9500.00	7900.00	8500.00	23000.00	300.00	2700.00	1400.00	2800.00	3700.00	17000.00	172000.00	8000.00	6400.00	466250.00	.
1999	3300.00	1800.00	50000.00	9000.00	7700.00	8200.00	23000.00	300.00	2400.00	1300.00	2600.00	3600.00	16000.00	172000.00	8000.00	6500.00	454200.00	.
2000	3000.00	1800.00	47000.00	9000.00	7500.00	7900.00	23000.00	300.00	1700.00	1200.00	2600.00	3400.00	15000.00	168000.00	7000.00	6300.00	433650.00	.
2001	2800.00	1800.00	45000.00	8000.00	7400.00	7400.00	23000.00	300.00	1600.00	1200.00	2300.00	2800.00	15000.00	160000.00	6500.00	6200.00	409300.00	.
2002	2600.00	1800.00	45000.00	7000.00	7500.00	7000.00	22000.00	300.00	1500.00	1100.00	2000.00	2700.00	15000.00	155000.00	6500.00	6000.00	394800.00	.
2003	2400.00	1500.00	45000.00	7000.00	7300.00	6500.00	22000.00	300.00	1200.00	1000.00	2000.00	2700.00	15000.00	155000.00	6000.00	5800.00	388650.00	.
2004	2300.00	1500.00	45000.00	7000.00	7000.00	5400.00	22100.00	300.00	1000.00	1000.00	2000.00	2700.00	15000.00	155000.00	5000.00	5500.00	381860.00	.
2005	2200.00	.	45000.00	6800.00	6700.00	4200.00	21800.00	300.00	700.00	1000.00	1600.00	2700.00	13000.00	154000.00	5000.00	5200.00	369060.00	.
2006	2100.00	.	45000.00	6800.00	6400.00	4200.00	21000.00	300.00	600.00	1000.00	1400.00	2700.00	12000.00	154000.00	5000.00	5000.00	359990.00	.
2007	2000.00	.	42000.00	6800.00	6000.00	4800.00	20800.00	300.00	500.00	1000.00	1400.00	2800.00	12000.00	153000.00	5000.00	4800.00	350890.00	.
2008	2000.00	.	42000.00	6800.00	7000.00	4200.00	21000.00	300.00	500.00	900.00	1400.00	2800.00	12000.00	153000.00	5000.00	4700.00	350590.00	.
2009	2000.00	.	42000.00	6800.00	6800.00	4200.00	21000.00	300.00	.	800.00	1400.00	2800.00	11800.00	153000.00	4900.00	4200.00	347800.00	.
2010	2000.00	.	42000.00	6800.00	6300.00	4200.00	21000.00	300.00	.	800.00	1400.00	2800.00	11800.00	153000.00	4900.00	4100.00	345950.00	.
2011	1900.00	.	42000.00	6900.00	4300.00	4100.00	21000.00	300.00	.	800.00	1400.00	2800.00	11800.00	146000.00	4900.00	3800.00	330600.00	.
2012	1600.00	.	40000.00	6200.00	4000.00	5000.00	21000.00	300.00	.	700.00	1400.00	1700.00	11000.00	148000.00	4300.00	4400.00	325200.00	.
2013	1700.00	.	40000.00	6000.00	3900.00	4900.00	20000.00	220.00	.	650.00	1300.00	1600.00	10700.00	148000.00	4300.00	4000.00	322870.00	.
2014	1700.00	.	40000.00	6000.00	3600.00	5100.00	20000.00	230.00	.	650.00	1300.00	1700.00	10400.00	148000.00	4400.00	4000.00	318180.00	.
2015	1800.00	.	40000.00	6000.00	3400.00	5000.00	20000.00	230.00	.	650.00	1200.00	1700.00	10200.00	148000.00	4400.00	4000.00	315880.00	1800.00

Table 3: Fresh Price

YEAR	Arizona	Arkansas	California	Colorado	Connecticut	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Maine	Maryland	Massachusetts	Michigan	Minnesoda	Missouri	New Hampshire	New Jersey	New Mexico
1971	.	0.07	0.07	.	0.08	0.08	.	0.06	.	.	.	.	0.08	0.08	0.06	.	.	0.08	0.07	.
1972	.	0.08	0.09	.	0.11	0.11	.	0.08	.	.	.	0.11	0.10	0.10	0.07	.	.	0.11	0.10	.
1973	.	.	0.11	.	0.14	0.13	0.10	0.12	.	0.08	.	0.14	0.12	0.14	0.11	.	0.12	0.14	0.12	.
1974	.	.	0.11	.	0.12	0.15	0.12	0.12	.	0.11	.	0.12	0.13	0.12	0.10	.	0.14	0.12	0.12	.
1975	.	.	0.10	.	0.12	0.14	.	0.10	.	.	.	0.12	0.10	0.12	0.08	.	0.14	0.12	0.10	.
1976	.	.	0.12	.	0.14	0.16	0.11	0.14	.	.	.	0.14	0.14	0.16	0.12	0.14	0.17	0.15	0.13	0.12
1977	.	0.11	0.10	0.11	0.14	0.18	0.12	0.12	0.14	0.11	0.11	0.14	0.16	0.14	0.11	.	0.14	0.14	0.14	0.12
1978	.	.	0.13	0.13	0.15	0.19	0.15	0.15	.	0.14	0.13	0.15	0.16	0.16	0.11	0.18	0.16	0.15	0.16	0.10
1979	.	.	0.17	0.11	0.16	0.21	0.15	0.17	.	0.11	0.12	0.16	0.17	0.17	0.12	.	0.14	0.14	0.16	0.14
1980	.	.	0.14	0.10	0.17	0.18	0.15	0.15	.	.	0.15	0.16	0.16	0.18	0.10	.	0.14	0.16	0.15	.
1981	.	.	0.19	0.14	0.20	0.23	0.16	0.16	.	0.12	0.14	0.19	0.19	0.22	0.13	.	0.19	0.23	0.18	.
1982	.	.	0.21	0.14	0.18	0.20	0.16	0.17	.	0.15	0.16	0.16	0.19	0.20	0.10	.	0.18	0.18	0.17	.
1983	.	.	0.22	0.12	0.19	0.24	0.17	0.18	.	0.15	0.16	0.18	0.15	0.20	0.11	.	0.19	0.21	0.16	.
1984	.	.	0.26	0.15	0.20	0.26	0.19	0.16	.	0.18	0.14	0.21	0.15	0.23	0.12	.	0.20	0.23	0.18	.
1985	.	.	0.23	0.13	0.20	0.28	0.16	0.16	.	0.13	0.16	0.19	0.14	0.23	0.11	.	0.19	0.22	0.16	.
1986	.	.	0.31	0.13	0.23	0.30	0.20	0.24	.	0.24	0.22	0.22	0.16	0.24	0.15	.	0.23	0.25	0.23	.
1987	.	.	0.23	0.10	0.24	0.17	0.16	0.19	.	0.16	0.16	0.22	0.15	0.25	0.11	.	0.15	0.26	0.20	0.16
1988	.	.	0.32	0.14	0.28	0.20	0.20	0.20	.	0.18	0.17	0.23	0.17	0.27	0.13	.	0.23	0.27	0.23	0.20
1989	0.16	.	0.26	0.13	0.28	0.11	0.16	0.20	.	.	0.20	0.25	0.17	0.27	0.12	.	0.17	0.27	0.24	0.20
1990	0.22	.	0.29	0.19	0.29	0.22	0.19	0.22	.	.	0.22	0.27	0.17	0.28	0.15	.	0.21	0.30	0.24	0.18
1991	0.33	.	0.38	0.18	0.30	0.24	0.22	0.25	.	.	0.23	0.27	0.21	0.29	0.16	.	0.25	0.30	0.25	0.23
1992	0.35	.	0.36	0.20	0.25	0.24	0.24	0.22	.	.	0.23	0.19	0.15	0.20	0.11	.	0.23	0.24	0.21	0.17
1993	0.23	.	0.29	0.20	0.25	0.19	0.20	0.20	.	.	0.21	0.23	0.19	0.23	0.12	.	0.22	0.28	0.25	0.25
1994	0.13	.	0.28	0.20	0.30	0.16	0.24	0.24	.	.	0.23	0.19	0.24	0.26	0.13	.	0.23	0.29	0.25	0.22
1995	0.40	.	0.37	0.19	0.30	0.26	0.27	0.24	.	.	0.28	0.23	0.20	0.25	0.15	.	0.22	0.29	0.24	0.30
1996	0.44	.	0.32	0.25	0.35	0.21	0.35	0.33	.	.	0.32	0.26	0.24	0.31	0.17	.	0.26	0.29	0.22	0.31
1997	0.55	.	0.33	0.19	0.36	0.25	0.22	0.28	.	.	0.27	0.24	0.25	0.32	0.15	.	0.23	0.27	0.20	0.34
1998	0.40	.	0.27	0.13	0.40	0.13	0.23	0.32	.	.	0.28	0.27	0.25	0.40	0.14	.	0.22	0.35	0.20	0.21
1999	0.41	.	0.25	0.30	0.36	0.22	.	0.30	.	.	0.31	0.29	0.17	0.35	0.15	.	0.22	0.32	0.21	0.25
2000	0.33	.	0.24	0.19	0.37	0.17	.	0.31	.	.	0.27	0.28	0.20	0.39	0.15	.	0.24	0.35	0.22	0.25
2001	0.38	.	0.23	0.28	0.38	0.21	.	0.31	.	.	0.31	0.34	0.26	0.40	0.17	.	0.23	0.37	0.28	0.32
2002	0.55	.	0.30	0.29	0.47	0.26	.	0.34	.	.	0.33	0.40	0.21	0.47	0.22	.	0.27	0.47	0.24	0.33
2003	0.70	.	0.27	0.26	0.45	0.29	.	0.34	.	.	0.33	0.35	0.26	0.42	0.20	.	0.36	0.43	0.20	0.31
2004	0.56	.	0.23	0.20	0.46	0.21	.	0.29	.	.	0.38	0.38	0.27	0.44	0.20	.	0.21	0.44	0.18	0.42
2005	0.63	.	0.38	0.27	0.52	0.34	.	0.42	.	.	0.37	0.40	0.24	0.52	0.21	.	0.24	0.45	0.39	.
2006	0.40	.	0.41	0.35	0.59	0.33	.	0.43	.	.	.	0.50	0.29	0.57	0.25	.	0.27	0.52	0.52	.
2007	0.56	.	0.43	0.36	0.54	0.38	.	0.45	.	.	.	0.49	0.31	0.51	0.29	.	0.33	0.52	0.33	.
2008	0.75	.	0.52	0.32	0.58	0.31	.	0.50	.	.	.	0.48	.	0.63	0.36	.	0.34	0.67	0.52	.
2009	0.70	.	0.45	0.39	0.59	0.31	.	0.41	.	.	.	0.49	0.32	0.54	0.22	.	0.34	0.66	0.65	.
2010	0.85	.	0.37	0.31	0.62	0.32	.	0.48	.	.	.	0.54	0.39	0.70	0.30	.	0.41	0.60	0.64	.
2011	0.78	.	0.33	0.45	0.59	0.34	.	0.51	.	.	.	0.60	0.46	0.69	0.35	.	0.41	0.63	0.91	.
2012	0.92	.	.	0.37	0.69	0.40	.	0.54	.	.	.	0.66	0.57	0.72	0.48	.	0.59	0.71	1.15	.
2013	.	.	.	.	0.76	0.43	.	0.55	.	.	.	0.58	0.33	0.75	0.35	.	0.46	.	0.59	.
2014	.	.	.	.	0.64	0.23	.	0.68	.	.	.	0.50	0.55	0.65	0.36	.	0.39	.	1.10	.
2015	.	.	.	.	0.60	0.46	.	0.55	.	.	.	0.53	.	0.71	0.37	.	0.50	.	1.20	.

YEAR	New York	North Carolina	Ohio	Oregon	Pennsylvania	Rhode Island	South Carolina	Tennessee	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	Other States	United States
1971	0.06	0.05	0.08	0.06	0.07	.	.	.	.	0.08	0.07	0.07	0.08	0.09	0.08	0.07
1972	0.10	0.05	0.09	0.06	0.08	.	.	.	.	0.10	0.09	0.09	0.09	0.09	0.09	0.09
1973	0.14	0.07	0.13	0.07	0.12	.	0.08	.	0.08	0.14	0.12	0.09	0.13	0.13	0.10	0.11
1974	0.12	0.07	0.12	0.07	0.13	.	0.12	.	0.10	0.12	0.13	0.11	0.14	0.11	0.12	0.11
1975	0.12	0.07	0.11	0.06	0.10	.	0.11	0.11	0.08	0.12	0.10	0.07	0.10	0.11	0.09	0.09
1976	0.13	0.11	0.16	0.08	0.12	.	0.12	.	0.10	0.14	0.12	0.10	0.14	0.13	0.11	0.12
1977	0.14	0.11	0.16	0.11	0.14	0.14	0.12	.	.	0.14	0.15	0.15	0.16	0.15	0.13	0.14
1978	0.14	0.11	0.16	0.13	0.15	.	0.16	.	0.12	0.14	0.16	0.14	0.16	0.14	0.15	0.14
1979	0.18	0.11	0.17	0.14	0.15	.	0.19	.	0.14	0.14	0.17	0.16	0.14	0.17	0.15	0.15
1980	0.18	0.10	0.17	0.09	0.13	.	.	.	0.12	0.17	0.15	0.10	0.14	0.16	0.16	0.12
1981	0.21	0.10	0.22	0.14	0.16	.	0.10	.	0.13	0.20	0.18	0.13	0.17	0.17	0.16	0.15
1982	0.15	0.13	0.16	0.11	0.15	.	.	.	0.15	0.16	0.17	0.11	0.15	0.17	0.17	0.13
1983	0.17	0.10	0.19	0.11	0.14	.	0.12	.	0.12	0.17	0.16	0.14	0.14	0.20	0.17	0.15
1984	0.20	0.09	0.20	0.12	0.15	.	0.15	.	0.13	0.18	0.16	0.13	0.15	0.26	0.16	0.16
1985	0.12	0.11	0.17	0.15	0.16	.	0.14	.	0.14	0.19	0.16	0.20	0.15	0.18	0.17	0.17
1986	0.17	0.13	0.22	0.13	0.17	.	0.19	.	0.16	0.22	0.15	0.19	0.17	0.21	0.21	0.19
1987	0.14	0.09	0.18	0.08	0.16	.	0.13	.	0.11	0.22	0.13	0.10	0.12	0.19	0.19	0.13
1988	0.15	0.11	0.22	0.15	0.16	.	0.21	.	0.15	0.22	0.14	0.16	0.14	0.27	0.21	0.17
1989	0.15	0.13	0.20	0.06	0.17	.	0.21	.	0.15	0.23	0.13	0.12	0.17	0.20	0.23	0.14
1990	0.18	0.14	0.22	0.15	0.19	.	0.19	.	0.22	0.25	0.14	0.21	0.18	0.29	0.25	0.21
1991	0.20	0.13	0.28	0.22	0.19	.	0.18	.	0.21	0.25	0.18	0.26	0.16	0.24	0.29	0.25
1992	0.14	0.12	0.25	0.13	0.20	.	0.26	.	0.16	0.15	0.14	0.19	0.16	0.26	0.27	0.20
1993	0.17	0.10	0.21	0.16	0.15	.	0.22	.	0.14	0.19	0.15	0.18	0.16	0.26	0.25	0.18
1994	0.18	0.14	0.22	0.13	0.18	.	0.21	.	0.14	0.19	0.16	0.18	0.18	0.25	0.27	0.19
1995	0.19	0.14	0.25	0.12	0.16	.	0.21	.	0.22	0.21	0.15	0.26	0.22	0.27	0.30	0.24
1996	0.18	0.19	0.30	0.10	0.20	.	0.24	.	0.17	0.22	0.15	0.20	0.19	0.37	0.34	0.21
1997	0.18	0.23	0.27	0.32	0.23	.	0.21	.	0.18	0.22	0.20	0.21	0.19	0.33	0.35	0.22
1998	0.16	0.17	0.27	0.21	0.22	.	0.29	.	0.17	0.29	0.19	0.15	0.16	0.32	0.36	0.17
1999	0.17	0.24	0.26	0.13	0.21	.	0.26	.	0.24	0.28	0.18	0.22	0.22	0.32	0.31	0.21
2000	0.17	0.20	0.26	0.14	0.25	.	0.25	.	0.17	0.29	0.17	0.16	0.22	0.32	0.35	0.18
2001	0.18	0.25	0.27	0.15	0.20	.	0.26	.	0.25	0.30	0.21	0.23	0.20	0.34	0.32	0.23
2002	0.28	0.27	0.30	0.22	0.22	.	0.20	.	0.24	0.39	0.20	0.25	0.18	0.39	0.41	0.26
2003	0.23	0.26	0.30	0.23	0.21	.	0.27	.	0.27	0.30	0.22	0.31	0.22	0.39	0.33	0.29
2004	0.23	0.23	0.31	0.22	0.17	.	0.20	.	0.28	0.25	0.25	0.15	0.17	0.38	0.34	0.18
2005	0.26	0.23	0.32	0.21	0.19	.	0.26	.	0.20	0.36	0.21	0.23	0.17	0.45	0.44	0.24
2006	0.30	0.25	0.39	0.27	0.26	.	0.29	.	0.33	0.36	0.24	0.31	0.17	0.49	0.42	0.32
2007	0.34	0.34	0.48	0.39	0.29	.	0.65	.	0.37	0.47	0.29	0.39	0.19	0.54	0.72	0.38
2008	0.31	0.26	0.47	0.32	0.28	.	0.35	.	0.32	0.40	0.33	0.27	0.26	0.58	0.54	0.30
2009	0.23	0.29	0.40	0.27	0.27	.	.	.	0.32	0.37	0.31	0.32	0.31	0.45	0.57	0.31
2010	0.26	0.28	0.46	0.29	0.26	.	.	.	0.26	0.36	0.27	0.32	0.32	0.57	0.69	0.33
2011	0.33	0.31	0.46	0.24	0.29	.	.	.	0.23	0.45	0.36	0.40	0.37	0.56	0.70	0.39
2012	0.54	0.41	0.42	0.28	0.39	.	.	.	0.27	0.55	0.39	0.45	0.48	0.71	0.51	0.45
2013	0.26	0.33	0.54	0.40	0.33	.	.	.	.	0.52	0.28	0.43	0.28	0.56	0.50	0.41
2014	0.31	0.38	0.55	0.32	0.29	.	.	.	.	0.46	0.28	0.31	0.34	0.72	0.56	0.33
2015	0.29	0.29	0.49	0.41	0.33	.	.	.	.	0.49	0.24	0.48	0.33	0.68	0.54	0.45

Table 4: Fresh Utilization

YEAR	Arizona	Arkansas	California	Colorado	Connecticut	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Maine	Maryland	Massachusetts	Michigan	Minnesoda	Missouri	New Hampshire	New Jersey	New Mexico
1971	.	4.60	112.00	.	33.10	76.00	.	69.70	.	.	.	.	39.00	88.00	280.00	.	.	55.60	68.00	.
1972	.	4.50	150.00	.	27.40	37.00	.	62.70	.	.	.	65.80	36.50	79.20	235.00	.	.	48.40	57.00	.
1973	.	.	108.00	.	26.40	85.00	72.20	49.80	.	11.30	.	48.00	36.00	67.80	160.00	.	43.50	40.10	55.00	.
1974	.	.	120.00	.	39.20	67.70	69.00	30.00	.	7.90	.	57.50	33.50	70.80	240.00	.	46.60	50.80	65.00	.
1975	.	.	130.00	.	42.00	65.60	.	59.00	7.40	.	.	61.00	45.10	81.80	305.00	.	57.00	46.00	60.00	.
1976	.	.	110.00	.	31.40	88.00	73.00	20.60	.	.	.	63.50	31.30	81.90	215.00	19.50	42.10	46.40	44.00	20.00
1977	.	16.00	75.00	50.00	40.30	61.00	82.00	39.30	9.50	10.40	18.50	67.00	42.00	80.00	225.00	.	44.20	48.90	67.00	23.50
1978	.	.	140.00	23.40	43.50	84.00	73.00	46.30	.	7.10	13.60	62.20	40.20	84.30	350.00	22.90	36.90	50.80	54.00	16.00
1979	.	.	130.00	42.00	38.00	79.00	81.00	53.20	.	10.10	18.90	72.00	47.10	80.00	235.00	.	52.00	49.50	58.00	12.60
1980	.	.	160.00	43.00	35.00	112.00	72.40	53.80	.	.	15.60	71.00	40.90	75.00	325.00	.	45.00	35.00	52.00	.
1981	.	.	144.00	41.00	31.00	85.00	72.50	52.40	.	9.20	18.90	69.00	41.20	70.50	240.00	.	49.10	35.00	55.00	.
1982	.	.	147.00	23.00	41.00	92.00	63.00	56.20	.	8.90	11.10	78.00	48.00	83.50	365.00	.	35.50	40.00	56.00	.
1983	.	.	151.00	50.00	31.00	84.00	61.00	41.10	.	7.60	11.00	68.00	41.00	77.00	270.00	.	33.80	40.50	50.00	.
1984	.	.	185.00	40.00	36.00	86.00	67.00	49.50	.	4.20	15.00	57.00	45.00	75.00	290.00	.	31.80	38.00	64.00	.
1985	.	.	160.00	68.00	29.50	85.00	70.50	56.00	.	11.30	13.00	66.50	41.00	62.00	435.00	.	51.70	44.00	58.00	.
1986	.	.	217.00	11.20	35.50	66.00	64.00	26.50	.	2.90	3.50	71.00	47.00	68.00	225.00	.	31.90	38.00	37.00	.
1987	.	.	230.00	66.00	31.00	86.00	58.50	60.50	.	9.30	15.00	61.00	20.00	62.00	390.00	.	27.00	36.00	37.00	12.60
1988	.	.	305.00	46.00	31.00	85.00	59.00	43.00	.	9.10	8.50	70.00	27.00	66.50	230.00	.	38.40	42.00	20.00	10.00
1989	12.80	.	278.00	44.00	18.00	92.30	61.50	56.00	.	.	10.00	53.00	16.00	55.00	320.00	.	40.60	32.00	22.00	5.30
1990	11.00	.	310.00	21.50	26.00	83.50	49.50	48.00	.	.	7.00	65.00	19.00	64.00	250.00	.	30.00	35.00	20.50	6.80
1991	14.90	.	350.00	52.00	20.00	77.70	45.50	43.00	.	.	15.00	49.00	24.00	43.00	280.00	.	31.00	25.00	45.00	2.30
1992	7.30	.	370.00	56.00	27.00	42.80	67.00	43.00	.	.	14.00	59.00	22.00	59.00	400.00	.	30.00	32.00	27.00	15.00
1993	4.00	.	370.00	59.00	20.00	95.00	65.00	56.00	.	.	16.00	44.00	27.00	45.00	360.00	.	38.00	25.00	38.00	7.00
1994	8.00	.	350.00	60.00	20.50	81.00	34.00	38.00	.	.	5.80	43.50	21.00	48.00	320.00	.	27.00	27.00	35.00	8.00
1995	0.20	.	300.00	28.00	16.00	38.00	51.00	50.00	.	.	10.80	44.00	17.00	46.00	400.00	.	24.00	26.00	37.00	3.00
1996	4.00	.	350.00	16.50	16.00	87.00	39.00	35.00	.	.	8.50	40.00	11.50	41.00	225.00	.	27.00	26.00	27.00	5.00
1997	0.50	.	375.00	22.50	18.00	50.00	57.00	34.50	.	.	4.90	43.00	30.20	43.50	300.00	.	38.50	28.00	22.00	7.00
1998	11.70	.	400.00	45.00	14.00	70.00	26.00	34.90	.	.	9.00	33.00	20.00	22.00	320.00	.	20.50	14.50	22.00	8.00
1999	5.40	.	420.00	5.00	16.50	50.00	.	40.80	.	.	6.60	40.00	9.20	42.00	370.00	.	33.50	26.50	20.00	2.00
2000	3.00	.	260.00	17.00	16.00	80.00	.	32.10	.	.	4.90	26.00	17.90	34.00	260.00	.	21.00	20.50	20.00	8.00
2001	0.10	.	220.00	15.00	16.50	49.00	.	23.00	.	.	6.50	33.00	19.10	26.50	270.00	.	28.00	18.00	23.00	6.00
2002	6.00	.	230.00	11.00	10.00	55.00	.	26.00	.	.	3.80	39.00	14.80	22.50	150.00	.	20.00	13.50	20.00	1.80
2003	0.10	.	220.00	13.00	16.00	45.00	.	35.00	.	.	7.00	33.00	16.70	29.50	310.00	.	20.00	14.50	24.00	1.80
2004	3.00	.	165.00	18.00	15.50	40.00	.	39.00	.	.	6.70	35.00	10.50	31.50	240.00	.	33.00	18.00	28.00	2.50
2005	5.00	.	160.00	14.00	13.00	35.00	.	26.50	.	.	4.30	24.00	17.80	22.00	265.00	.	27.00	12.50	33.00	.
2006	4.00	.	155.00	10.00	14.50	30.00	.	20.00	.	.	.	19.00	18.70	26.00	295.00	.	20.50	17.50	33.00	.
2007	4.00	.	155.00	6.00	19.50	20.00	.	10.00	.	.	.	28.50	15.00	30.50	265.00	.	0.70	21.00	26.00	.
2008	2.00	.	160.00	10.00	16.00	50.00	.	15.00	.	.	.	26.50	.	30.00	165.00	.	20.00	22.50	25.00	.
2009	1.20	.	110.00	9.00	15.00	30.00	.	19.00	.	.	.	26.00	16.00	34.00	400.00	.	13.00	18.00	31.00	.
2010	2.00	.	115.00	8.00	18.50	40.00	.	19.00	.	.	.	24.00	14.00	27.00	210.00	.	22.00	14.50	30.00	.
2011	1.00	.	125.00	4.00	17.50	35.00	.	13.00	.	.	.	17.00	18.00	31.00	350.00	.	9.00	13.00	25.00	.
2012	1.10	.	.	12.00	14.50	55.00	.	3.00	.	.	.	22.50	16.70	23.00	45.00	.	22.00	10.50	24.00	.
2013	.	.	.	.	25.50	50.00	.	17.00	.	.	.	22.50	11.60	25.50	500.00	.	10.00	.	19.00	.
2014	.	.	.	.	19.10	34.00	.	9.00	.	.	.	29.60	15.20	28.30	425.00	.	11.60	.	26.00	.
2015	.	.	.	.	23.30	30.00	.	12.50	.	.	.	33.10	.	29.70	410.00	.	23.60	.	26.00	.

YEAR	New York	North Carolina	Ohio	Oregon	Pennsylvania	Rhode Island	South Carolina	Tennessee	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	Other States	United States
1971	353.00	155.00	122.90	100.00	185.00	.	.	.	.	33.00	196.00	932.00	122.40	54.40	402.20	3481.90
1972	290.00	175.00	103.20	88.00	169.90	.	.	.	.	35.40	186.00	1094.50	99.40	54.50	245.50	3344.90
1973	300.00	135.00	76.00	109.00	186.90	.	13.50	.	29.10	22.70	147.80	1405.00	94.00	42.50	150.80	3515.40
1974	300.00	183.00	120.00	113.00	168.10	.	15.50	.	34.00	31.10	160.10	1365.60	97.00	48.60	115.50	3649.50
1975	405.00	212.00	132.00	110.00	228.20	.	18.00	10.00	30.00	34.50	153.40	1669.10	91.70	55.00	248.20	4357.00
1976	295.00	177.00	94.00	119.00	151.50	.	18.00	.	34.00	36.60	66.20	1801.00	73.90	42.00	121.90	3916.80
1977	360.00	154.00	60.00	109.00	166.10	4.50	13.00	.	.	37.00	90.00	1599.00	74.40	44.00	83.00	3793.60
1978	425.00	150.00	106.40	112.00	158.90	.	16.00	.	28.00	42.80	146.00	1680.00	102.10	48.00	47.00	4210.40
1979	405.00	139.00	92.00	115.00	187.70	.	20.00	.	43.00	38.70	140.00	1859.70	88.40	36.00	81.70	4304.60
1980	410.00	186.00	145.00	139.00	207.80	.	.	.	42.00	43.00	132.00	2250.00	88.60	47.60	115.40	4942.10
1981	350.00	163.00	91.00	119.00	152.20	.	22.00	.	40.50	22.50	173.00	2070.00	97.40	40.50	98.80	4453.70
1982	410.00	60.00	122.00	121.00	183.80	.	.	.	43.00	45.00	172.00	2030.00	87.20	39.80	74.70	4536.70
1983	435.00	170.00	79.00	120.00	175.00	.	8.00	.	44.00	37.50	111.00	2255.00	57.90	43.00	68.10	4620.50
1984	401.00	129.00	102.00	92.00	207.00	.	30.00	.	33.00	31.00	173.00	2172.00	84.90	41.50	86.20	4666.10
1985	379.00	115.00	115.00	120.00	210.00	.	10.00	.	44.50	38.00	136.00	1590.00	99.50	41.50	77.70	4227.70
1986	360.00	40.00	63.40	77.00	136.00	.	17.00	.	26.50	35.00	182.00	2440.00	87.70	41.50	81.20	4531.80
1987	380.00	159.00	118.00	125.00	170.00	.	19.00	.	36.00	31.00	185.00	3000.00	53.00	47.00	85.20	5610.10
1988	405.00	131.00	70.00	110.00	138.00	.	15.00	.	30.00	32.00	200.00	2850.00	65.00	32.00	69.80	5238.30
1989	440.00	81.00	110.00	103.00	120.00	.	12.00	.	40.00	33.00	145.00	3500.00	35.00	45.00	84.80	5865.30
1990	520.00	78.00	85.00	105.00	184.00	.	15.00	.	18.00	33.00	63.00	3250.00	40.00	39.00	74.20	5551.00
1991	420.00	82.00	96.00	83.00	126.00	.	10.00	.	38.00	37.00	134.00	3150.00	55.00	45.00	75.60	5469.00
1992	520.00	60.00	70.00	110.00	80.00	.	30.00	.	38.00	28.00	89.00	3300.00	35.00	49.00	86.90	5767.00
1993	400.00	75.00	73.00	120.00	150.00	.	22.00	.	39.00	29.00	74.00	3700.00	40.00	49.60	83.30	6123.90
1994	490.00	80.00	70.00	150.00	120.00	.	27.00	.	32.00	30.00	65.00	4000.00	35.00	68.00	72.40	6366.20
1995	480.00	75.00	90.00	105.00	140.00	.	25.00	.	13.00	32.00	140.00	3500.00	40.00	42.00	70.10	5843.10
1996	500.00	61.00	75.00	100.00	135.00	.	10.00	.	33.00	33.00	90.00	4100.00	20.00	35.00	56.40	6206.90
1997	520.00	36.00	47.00	112.00	175.00	.	18.00	.	34.00	38.00	53.00	3600.00	20.00	39.00	47.90	5814.50
1998	420.00	47.00	52.00	89.00	151.00	.	23.00	.	26.00	23.50	100.00	4300.00	17.00	52.60	40.80	6412.50
1999	590.00	80.00	73.00	100.00	127.00	.	12.00	.	8.00	36.00	125.00	3600.00	20.00	52.90	83.40	5994.80
2000	460.00	61.00	79.00	122.00	127.00	.	5.50	.	28.00	28.50	99.00	4300.00	15.00	49.00	72.40	6266.80
2001	420.00	45.00	70.00	94.00	120.00	.	1.10	.	13.00	29.00	88.00	3700.00	15.00	41.00	77.70	5467.50
2002	310.00	53.00	59.00	115.00	74.00	.	3.30	.	5.50	23.50	70.00	3900.00	15.00	46.00	68.30	5366.00
2003	510.00	40.00	78.00	90.00	95.00	.	3.00	.	23.00	32.00	52.00	3600.00	16.00	48.00	89.20	5461.80
2004	660.00	47.00	78.10	110.00	110.00	.	1.20	.	29.20	33.00	132.00	4600.00	15.00	47.00	89.80	6638.00
2005	490.00	35.00	85.40	95.00	127.00	.	1.20	.	27.40	24.00	51.00	4400.00	16.00	42.00	64.30	6117.40
2006	690.00	68.00	87.30	105.00	132.00	.	0.90	.	8.90	27.50	34.00	4350.00	16.00	44.00	81.70	6308.50
2007	690.00	4.80	48.70	90.00	137.00	.	0.20	.	15.60	21.00	37.00	4350.00	14.00	41.00	26.80	6077.30
2008	550.00	49.50	79.00	79.00	160.00	.	2.20	.	9.90	35.00	51.00	4550.00	16.00	47.50	102.80	6273.90
2009	685.00	42.00	90.70	90.00	170.00	.	.	.	14.20	21.00	60.00	4300.00	20.00	32.00	66.80	6313.90
2010	560.00	56.00	56.20	85.00	190.00	.	.	.	11.30	27.00	70.00	4550.00	14.00	28.20	65.10	6256.80
2011	530.00	59.00	43.40	75.00	184.00	.	.	.	17.50	16.00	60.00	4550.00	19.00	32.50	57.20	6302.10
2012	335.00	16.00	17.80	107.00	197.00	.	.	.	13.50	17.50	120.00	5350.00	13.00	26.50	132.30	6594.90
2013	650.00	75.00	37.00	120.00	180.00	.	.	.	.	26.00	80.00	4800.00	20.00	41.00	185.20	6895.30
2014	625.00	65.00	34.00	132.00	191.00	.	.	.	.	23.80	75.00	5900.00	20.00	42.30	176.40	7882.70
2015	715.00	50.00	40.00	106.00	198.00	.	.	.	.	30.90	65.00	4840.00	17.00	39.30	166.30	6855.70

Table 5: Processed Price

YEAR	Arizona	Arkansas	California	Colorado	Connecticut	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Maine	Maryland	Massachusetts	Michigan	Minnesoda	Missouri	New Hampshire	New Jersey	New Mexico	New York	North Carolina	Ohio	Oregon	Pennsylvania	Rhode Island	South Carolina	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	Other States	United States
1971		46.00	54.50	.	39.40	37.20	.	36.20	.	.	.	.	41.30	32.90	41.50	.	.	31.80	46.80	.	39.00	47.00	41.40	37.50	41.00	.	.	.	32.70	42.10	53.10	42.60	44.00	34.70	43.40
1972	.	58.00	64.40	.	57.20	61.80	.	49.30	.	.	.	52.20	65.20	64.00	59.30	.	.	53.80	65.60	.	59.60	55.00	57.30	59.60	64.40	.	.	.	56.20	61.10	77.80	63.10	42.00	49.40	62.80
1973	.	.	109.00	.	97.00	114.00	94.90	82.00	.	88.00	.	107.00	127.00	132.00	169.00	.	139.00	114.00	129.00	.	133.00	108.00	120.00	128.00	134.00	.	99.60	91.00	121.00	121.00	106.00	126.00	144.00	104.00	125.00
1974	.	.	110.00	.	58.00	76.00	61.50	68.00	.	156.00	.	71.10	110.00	72.50	85.10	.	87.60	56.80	102.00	.	98.30	89.80	65.70	96.20	116.00	.	92.70	72.00	57.60	106.00	76.40	110.00	76.60	112.00	95.90
1975	.	.	79.00	.	53.00	104.00	.	47.80	60.00	.	.	46.00	48.70	61.00	55.10	.	68.00	61.00	53.00	.	47.40	49.00	50.00	46.40	53.00	.	39.00	50.00	63.00	42.60	64.30	48.10	39.00	50.40	56.80
1976	.	.	89.20	.	98.50	90.30	92.00	109.00	.	.	.	90.60	115.00	102.00	128.00	66.40	82.10	89.80	99.00	110.00	104.00	107.00	108.00	99.10	110.00	.	118.00	86.00	91.00	110.00	121.00	106.00	99.70	111.00	108.00
1977	96.50	.	146.00	100.00	109.00	118.00	85.70	94.00	64.00	79.30	120.00	108.00	125.00	96.60	117.00	.	88.10	88.60	108.00	80.00	104.00	108.00	113.00	104.00	124.00	106.00	114.00	.	86.50	112.00	144.00	118.00	92.00	103.00	122.00
1978	.	.	153.00	110.00	83.10	142.00	101.00	111.00	.	108.00	88.00	88.80	102.00	94.50	108.00	72.00	105.00	93.00	94.90	110.00	103.00	104.00	102.00	106.00	103.00	.	105.00	103.00	94.20	92.40	170.00	97.40	83.90	96.00	117.00
1979	.	.	163.00	108.00	106.00	99.00	100.00	95.00	.	93.00	76.00	102.00	107.00	112.00	118.00	.	82.00	114.00	103.00	118.00	103.00	98.00	112.00	93.00	108.00	.	103.00	130.00	110.00	99.00	114.00	103.00	96.00	102.00	114.00
1980	.	.	81.00	82.00	88.00	68.00	92.00	78.00	.	.	88.00	92.00	86.00	90.00	85.00	.	86.00	90.00	92.00	.	86.00	80.00	84.00	62.00	88.00	.	.	108.00	94.00	88.00	77.00	90.00	88.00	86.00	84.00
1981	.	.	68.00	102.00	139.00	68.00	108.00	96.00	.	99.00	108.00	134.00	126.00	136.00	136.00	.	99.00	129.00	116.00	.	127.00	112.00	123.00	70.00	109.00	.	106.00	65.00	128.00	119.00	70.00	125.00	110.00	108.00	102.00
1982	.	.	138.00	110.00	115.00	108.00	108.00	92.00	.	146.00	108.00	106.00	122.00	112.00	105.00	.	109.00	106.00	116.00	.	114.00	114.00	95.00	128.00	123.00	.	.	114.00	107.00	122.00	121.00	127.00	99.00	113.00	118.00
1983	.	.	132.00	95.00	120.00	85.00	108.00	100.00	.	112.00	106.00	103.00	110.00	107.00	116.00	.	92.00	101.00	105.00	.	102.00	81.00	87.00	107.00	106.00	.	77.00	72.00	103.00	98.00	94.00	111.00	91.00	100.00	103.00
1984	.	.	121.00	98.00	126.00	96.00	108.00	91.00	.	95.00	88.00	104.00	126.00	108.00	118.00	.	95.00	102.00	114.00	.	107.00	106.00	112.00	113.00	122.00	.	112.00	60.00	107.00	116.00	96.00	154.00	86.00	115.00	111.00
1985	.	.	98.00	76.00	131.00	96.00	98.00	80.00	.	70.00	64.00	98.00	118.00	116.00	101.00	.	88.00	100.00	124.00	.	89.00	101.00	84.00	110.00	112.00	.	110.00	80.00	116.00	135.00	105.00	111.00	81.00	121.00	103.00
1986	.	.	115.00	78.80	133.00	87.80	119.00	105.00	.	.	130.00	117.00	123.00	143.00	129.00	.	101.00	112.00	123.00	.	118.00	124.00	124.00	104.00	113.00	.	131.00	120.00	119.00	126.00	95.60	136.00	99.30	133.00	116.00
1987	.	.	87.30	62.60	199.00	42.20	111.00	102.00	.	79.10	84.00	160.00	110.00	159.00	111.00	.	84.30	150.00	105.00	.	114.00	87.90	125.00	37.30	102.00	.	83.70	50.00	159.00	119.00	39.80	116.00	89.60	106.00	79.30
1988	.	.	123.00	99.50	220.00	81.40	131.00	115.00	.	180.00	140.00	160.00	135.00	169.00	141.00	.	83.40	150.00	134.00	.	143.00	118.00	122.00	87.70	135.00	.	119.00	79.80	159.00	161.00	87.00	148.00	101.00	143.00	123.00
1989	47.90	.	141.00	79.40	240.00	65.90	127.00	185.00	.	.	160.00	150.00	142.00	164.00	127.00	.	84.90	160.00	130.00	.	133.00	131.00	109.00	62.30	140.00	.	134.00	93.60	149.00	164.00	66.60	134.00	86.00	142.00	107.00
1990	98.40	.	134.00	115.00	260.00	104.00	176.00	144.00	.	.	200.00	160.00	197.00	180.00	161.00	.	113.00	180.00	143.00	.	150.00	155.00	134.00	116.00	211.00	.	151.00	85.00	160.00	163.00	128.00	131.00	110.00	172.00	144.00
1991	144.00	.	159.00	160.00	280.00	219.00	162.00	176.00	.	.	160.00	175.00	144.00	219.00	168.00	.	124.00	170.00	144.00	.	153.00	140.00	144.00	219.00	143.00	.	136.00	220.00	189.00	153.00	206.00	152.00	143.00	153.00	171.00
1992	105.00	.	162.00	112.00	180.00	111.00	142.00	117.00	.	.	220.00	130.00	130.00	140.00	140.00	.	118.00	130.00	119.00	.	129.00	119.00	130.00	115.00	130.00	.	117.00	100.00	114.00	136.00	117.00	136.00	134.00	136.00	130.00
1993	108.00	.	126.00	95.40	320.00	64.70	107.00	117.00	.	.	140.00	170.00	112.00	200.00	131.00	.	89.80	140.00	125.00	.	133.00	85.60	104.00	85.50	124.00	.	136.00	106.00	150.00	114.00	71.30	120.00	105.00	126.00	107.00
1994	141.00	.	113.00	97.40	360.00	67.10	125.00	110.00	.	.	200.00	180.00	148.00	175.00	135.00	.	106.00	130.00	125.00	.	135.00	127.00	110.00	75.70	144.00	.	125.00	112.00	143.00	141.00	86.20	138.00	121.00	144.00	114.00
1995	130.00	.	165.00	186.00	360.00	193.00	133.00	166.00	.	.	224.00	130.00	131.00	170.00	147.00	.	103.00	140.00	143.00	.	141.00	121.00	130.00	187.00	136.00	.	116.00	240.00	160.00	142.00	189.00	142.00	105.00	146.00	159.00
1996	222.00	.	150.00	194.00	440.00	144.00	168.00	142.00	.	.	510.00	204.00	190.00	200.00	210.00	.	168.00	160.00	192.00	.	190.00	178.00	166.00	158.00	184.00	.	166.00	98.00	170.00	196.00	150.00	182.00	138.00	205.00	171.00
1997	204.00	.	130.00	146.00	276.00	98.00	124.00	130.00	.	.	420.00	176.00	174.00	160.00	152.00	.	116.00	140.00	170.00	.	166.00	146.00	126.00	110.00	172.00	.	166.00	150.00	146.00	162.00	78.00	168.00	170.00	160.00	130.00
1998	117.00	.	98.00	143.00	114.00	37.00	127.00	145.00	.	.	.	96.00	164.00	96.00	120.00	.	100.00	98.00	138.00	.	160.00	158.00	115.00	57.00	172.00	.	162.00	24.00	102.00	149.00	42.00	155.00	130.00	161.00	94.60
1999	140.00	.	158.00	160.00	80.00	117.00	.	114.00	.	.	188.00	70.00	139.00	80.00	123.00	.	106.00	70.00	141.00	.	134.00	154.00	118.00	122.00	150.00	.	110.00	100.00	70.00	136.00	112.00	142.00	72.00	144.00	128.00
2000	131.00	.	162.00	124.00	100.00	48.00	.	112.00	.	.	166.00	76.00	123.00	110.00	134.00	.	107.00	80.00	131.00	.	130.00	142.00	114.00	95.00	132.00	.	130.00	40.00	80.00	146.00	58.00	137.00	82.00	156.00	101.00
2001	120.00	.	198.00	161.00	100.00	55.00	.	117.00	.	.	188.00	110.00	121.00	110.00	122.00	.	106.00	90.00	131.00	.	133.00	151.00	123.00	111.00	122.00	.	184.00	34.00	100.00	129.00	62.00	128.00	107.00	179.00	108.00
2002	120.00	.	210.00	120.00	120.00	84.00	.	122.00	.	.	180.00	120.00	165.00	130.00	168.00	.	132.00	130.00	140.00	.	153.00	160.00	148.00	103.00	144.00	.	141.00	128.00	120.00	136.00	93.00	133.00	75.00	163.00	130.00
2003	139.00	.	179.00	121.00	110.00	86.60	.	109.00	.	.	240.00	110.00	157.00	110.00	150.00	.	121.00	120.00	145.00	.	134.00	153.00	146.00	95.50	145.00	.	237.00	98.70	130.00	129.00	100.00	138.00	125.00	182.00	131.00
2004	234.00	.	165.00	139.00	120.00	53.20	.	133.00	.	.	180.00	110.00	151.00	90.20	169.00	.	107.00	100.00	140.00	.	139.00	157.00	130.00	65.50	148.00	.	93.30	111.00	120.00	136.00	49.80	144.00	160.00	160.00	107.00
2005	250.00	.	146.00	158.00	170.00	34.50	.	114.00	.	.	140.00	120.00	139.00	110.00	161.00	.	121.00	120.00	147.00	.	141.00	141.00	131.00	69.20	142.00	.	174.00	46.00	120.00	135.00	43.50	127.00	206.00	183.00	106.00
2006	295.00	.	212.00	140.00	324.00	58.00	.	115.00	.	.	.	156.00	160.00	112.00	172.00	.	186.00	117.00	140.00	.	152.00	147.00	136.00	74.50	155.00	.	148.00	166.00	100.00	143.00	69.60	147.00	187.00	221.00	129.00
2007	295.00	.	252.00	180.00	266.00	176.00	.	136.00	.	.	.	206.00	156.00	135.00	212.00	.	194.00	138.00	138.00	.	174.00	153.00	185.00	138.00	159.00	.	240.00	120.00	182.00	173.00	197.00	157.00	194.00	247.00	190.00
2008	315.00	.	262.00	220.00	234.00	95.00	.	195.00	.	.	.	215.00	.	215.00	280.00	.	180.00	196.00	263.00	.	259.00	211.00	170.00	124.00	245.00	.	170.00	173.00	193.00	236.00	100.00	231.00	202.00	160.00	198.00
2009	216.00	.	170.00	120.00	305.00	86.00	.	100.00	.	.	.	295.00	132.00	156.00	148.00	.	132.00	150.00	146.00	.	168.00	175.00	211.00	66.10	141.00	.	.	220.00	124.00	158.00	72.30	158.00	205.00	248.00	132.00
2010	180.00	.	181.00	180.00	219.00	131.00	.	190.00	.	.	.	164.00	156.00	133.00	224.00	.	145.00	134.00	163.00	.	209.00	239.00	203.00	126.00	183.00	.	.	120.00	163.00	186.00	162.00	184.00	155.00	220.00	187.00
2011	373.00	.	239.00	270.00	182.00	210.00	.	230.00	.	.	.	204.00	175.00	182.00	253.00	.	290.00	199.00	166.00	.	199.00	215.00	231.00	208.00	207.00	.	.	160.00	176.00	228.00	237.00	193.00	146.00	234.00	226.00
2012	210.00	.	.	240.00	250.00	200.00	.	231.00	.	.	.	260.00	491.00	250.00	539.00	.	460.00	260.00	188.00	.	369.00	428.00	307.00	186.00	414.00	.	.	.	240.00	400.00	175.00	441.00	210.00	283.00	281.00
2013	.	.	.	.	500.00	190.00	.	218.00	.	.	.	130.00	212.00	249.00	220.00	.	358.00	.	340.00	.	193.00	213.00	190.00	173.00	188.00	.	.	.	180.00	200.00	162.00	200.00	218.00	360.00	197.00
2014	.	.	.	.	312.00	78.40	.	217.00	.	.	.	196.00	178.00	230.00	227.00	.	274.00	.	368.00	.	188.00	202.00	170.00	89.50	193.00	.	.	.	194.00	223.00	121.00	201.00	191.00	284.00	178.00
2015	.	.	.	.	278.00	155.00	.	240.00	.	.	.	140.00	.	220.00	244.00	.	286.00	.	276.00	.	205.00	250.00	220.00	142.00	202.00	.	.	.	200.00	294.00	155.00	217.00	250.00	248.00	201.00

Table 6: Processed Utilization

YEAR	Arizona	Arkansas	California	Colorado	Connecticut	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Maine	Maryland	Massachusetts	Michigan	Minnesoda	Missouri	New Hampshire	New Jersey	New Mexico
1971	.	5.00	288.00	.	12.10	14.00	.	20.30	.	.	.	.	30.00	17.00	420.00	.	.	9.40	42.00	.
1972	.	4.10	380.00	.	2.60	13.00	.	12.30	.	.	.	9.20	29.50	11.80	495.00	.	.	6.60	31.00	.
1973	.	.	382.00	.	3.60	45.00	10.80	13.20	.	3.70	.	7.00	34.00	8.20	310.00	.	7.50	3.90	45.00	.
1974	.	.	320.00	.	5.80	25.30	10.00	8.20	.	4.80	.	11.50	31.50	20.20	430.00	.	6.40	10.20	55.00	.
1975	.	.	330.00	.	5.50	29.40	.	17.00	1.90	.	.	12.00	33.90	16.20	375.00	.	10.00	9.00	50.00	.
1976	.	.	370.00	.	1.60	37.00	13.00	4.40	.	.	.	11.50	31.70	13.10	265.00	4.00	7.90	10.60	46.00	1.00
1977	.	7.50	405.00	25.00	2.70	24.00	23.00	11.00	1.00	5.60	1.30	21.00	28.00	12.00	345.00	.	13.80	8.60	63.00	1.50
1978	.	.	360.00	12.60	6.50	46.00	16.00	9.80	.	2.90	0.60	12.80	43.50	20.70	540.00	5.10	3.10	9.20	36.00	1.00
1979	.	.	470.00	49.00	7.00	46.00	29.00	13.00	.	4.00	1.50	14.00	36.80	15.00	445.00	.	18.00	8.50	52.00	1.40
1980	.	.	360.00	25.00	7.00	53.00	28.60	14.60	.	.	1.50	14.00	48.10	25.00	575.00	.	11.00	23.00	58.00	.
1981	.	.	462.00	34.00	7.00	45.00	30.50	14.60	.	2.70	1.50	11.00	28.80	12.50	420.00	.	12.90	10.00	40.00	.
1982	.	.	333.00	17.00	9.00	34.00	25.00	18.80	.	2.40	0.30	14.00	32.00	16.50	615.00	.	9.50	10.00	84.00	.
1983	.	.	309.00	34.00	9.00	44.00	29.00	12.30	.	3.70	2.00	17.00	29.00	20.00	480.00	.	11.20	14.50	50.00	.
1984	.	.	335.00	25.00	11.00	48.00	23.00	14.50	.	0.60	1.50	13.00	35.00	22.00	480.00	.	8.20	12.00	46.00	.
1985	.	.	460.00	42.00	10.50	46.00	31.50	19.00	.	1.50	2.00	15.50	35.00	23.00	635.00	.	10.30	11.00	45.00	.
1986	.	.	298.00	6.40	10.50	28.00	26.00	10.50	.	.	0.40	15.00	38.00	24.00	475.00	.	5.10	12.00	63.00	.
1987	.	.	420.00	52.00	7.00	64.00	37.50	9.50	.	1.10	1.50	13.00	18.00	22.00	660.00	.	23.00	8.00	40.00	.
1988	.	.	325.00	19.00	7.00	50.00	23.00	8.00	.	0.40	1.00	20.00	25.00	18.50	600.00	.	15.60	13.00	40.00	.
1989	21.20	.	397.00	24.00	5.00	65.70	25.50	7.00	.	.	2.00	15.00	21.00	19.00	630.00	.	13.40	9.00	21.00	.
1990	50.00	.	470.00	11.50	5.00	81.50	8.50	8.00	.	.	1.00	19.00	14.00	17.00	500.00	.	11.00	13.00	38.50	.
1991	41.10	.	450.00	18.00	4.00	42.30	22.50	13.50	.	.	1.00	14.00	18.00	12.00	600.00	.	9.00	11.00	42.00	.
1992	65.70	.	470.00	32.00	8.00	32.20	21.00	23.00	.	.	1.00	19.00	28.00	20.00	650.00	.	7.00	20.00	27.00	.
1993	51.00	.	510.00	31.00	4.00	98.80	20.00	18.00	.	.	2.00	9.00	15.00	10.00	660.00	.	9.00	11.00	35.00	.
1994	51.00	.	700.00	23.00	3.50	77.00	7.00	9.50	.	.	0.70	8.50	14.00	10.00	700.00	.	6.00	13.00	33.00	.
1995	10.80	.	550.00	23.00	4.00	42.00	20.00	20.00	.	.	1.70	18.00	17.00	13.00	820.00	.	13.00	16.00	35.00	.
1996	96.00	.	600.00	7.50	4.00	103.00	12.00	11.00	.	.	1.10	23.00	16.00	12.00	475.00	.	5.00	12.00	31.00	.
1997	43.60	.	587.00	11.50	5.00	60.00	10.00	13.50	.	.	0.90	19.00	14.30	15.00	700.00	.	12.00	12.00	33.00	.
1998	33.30	.	460.00	14.00	3.00	45.00	9.00	15.10	.	.	.	10.00	14.00	7.50	640.00	.	8.50	4.50	32.00	.
1999	26.60	.	476.00	3.00	5.50	20.00	.	14.00	.	.	0.40	21.00	28.80	15.00	810.00	.	12.50	15.50	30.00	.
2000	91.50	.	250.00	10.00	4.00	60.00	.	11.70	.	.	0.70	9.00	15.10	9.00	535.00	.	13.00	12.00	26.00	.
2001	5.20	.	270.00	8.00	3.50	30.00	.	23.00	.	.	0.50	7.00	21.60	7.50	630.00	.	13.00	10.50	27.00	.
2002	20.00	.	230.00	9.00	1.50	24.00	.	10.00	.	.	0.20	5.00	17.10	5.50	365.00	.	16.00	11.00	12.00	.
2003	6.90	.	220.00	8.00	4.00	25.00	.	13.00	.	.	0.10	7.00	21.70	7.50	580.00	.	20.00	10.00	16.00	.
2004	34.00	.	190.00	9.00	3.00	40.00	.	19.00	.	.	0.30	8.00	22.50	5.50	490.00	.	14.00	10.00	10.00	.
2005	17.00	.	195.00	13.00	2.00	35.00	.	13.50	.	.	0.40	5.00	23.00	4.00	490.00	.	20.00	7.00	11.00	.
2006	26.00	.	200.00	4.00	2.00	25.00	.	12.00	.	.	.	4.50	14.00	4.50	560.00	.	10.00	10.00	11.00	.
2007	19.00	.	190.00	7.00	2.50	15.00	.	8.00	.	.	.	7.50	14.00	6.00	505.00	.	0.70	12.00	16.00	.
2008	16.00	.	200.00	7.00	3.00	35.00	.	6.50	.	.	.	8.50	.	8.50	425.00	.	10.00	12.50	14.00	.
2009	4.30	.	155.00	6.00	3.00	15.00	.	8.00	.	.	.	6.00	30.00	7.00	595.00	.	5.00	10.00	11.00	.
2010	15.00	.	165.00	6.00	3.50	20.00	.	5.00	.	.	.	5.00	28.00	7.00	360.00	.	10.00	5.00	12.00	.
2011	10.00	.	145.00	4.00	2.00	25.00	.	5.00	.	.	.	5.50	21.00	5.00	625.00	.	5.00	4.00	10.00	.
2012	6.90	.	.	4.00	1.00	20.00	.	1.50	.	.	.	5.00	18.00	4.50	70.00	.	11.00	3.00	10.00	.
2013	12.90	.	.	1.00	1.00	20.00	.	10.00	.	.	.	3.00	21.00	15.00	750.00	.	5.00	11.00	9.50	.
2014	.	.	.	.	0.50	26.00	.	7.00	.	.	.	7.20	30.00	12.00	600.00	.	8.20	2.00	10.00	.
2015	.	.	.	.	1.00	16.00	.	8.00	.	.	.	2.00	.	12.70	580.00	.	4.50	.	10.00	.

YEAR	New York	North Carolina	Ohio	Oregon	Pennsylvania	Rhode Island	South Carolina	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	Other States	United States
1971	572.00	30.00	27.10	25.00	320.00	.	.	.	7.70	284.00	268.00	127.60	10.60	68.90	2598.70
1972	480.00	70.00	31.80	17.00	230.10	.	.	.	5.20	234.00	295.50	115.60	10.50	40.30	2525.10
1973	420.00	75.00	24.00	58.00	313.10	.	3.50	23.60	5.30	252.20	455.00	131.00	7.50	67.50	2709.50
1974	589.00	112.00	12.00	52.00	311.90	.	4.50	3.00	6.90	218.30	440.40	113.00	11.40	21.20	2834.50
1975	455.00	68.00	20.00	40.00	275.30	.	3.00	14.00	7.50	241.60	530.90	124.30	9.00	67.10	2745.60
1976	525.00	88.00	11.00	51.00	207.50	.	5.00	6.00	10.40	145.80	507.00	126.10	10.00	41.50	2551.10
1977	540.00	110.00	5.00	38.00	293.90	0.50	12.00	.	7.00	200.00	484.00	120.60	12.00	27.40	2849.40
1978	655.00	172.00	19.00	30.00	241.00	.	10.00	7.00	6.20	369.00	468.00	192.00	13.00	24.60	3333.60
1979	630.00	222.00	13.00	55.00	347.30	.	13.00	8.00	10.30	330.00	759.30	171.60	13.00	30.90	3813.60
1980	690.00	220.00	25.00	56.00	362.20	.	.	8.00	7.00	288.00	755.00	156.40	14.40	42.50	3868.30
1981	450.00	209.00	9.00	36.00	247.80	.	13.00	12.50	5.50	292.00	690.00	102.60	14.50	37.80	3252.20
1982	720.00	110.00	28.00	29.00	341.20	.	.	11.00	7.00	328.00	585.00	152.80	15.20	25.80	3573.50
1983	665.00	245.00	21.00	35.00	325.00	.	8.00	14.00	10.50	344.00	800.00	158.10	12.00	35.10	3737.40
1984	619.00	231.00	33.00	38.00	368.00	.	13.00	12.00	10.00	292.00	778.00	140.10	9.50	33.60	3652.00
1985	700.00	160.00	30.00	40.00	375.00	.	5.00	10.50	9.00	252.00	460.00	130.50	16.50	32.30	3608.10
1986	540.00	80.00	26.60	28.00	484.00	.	13.00	7.50	13.00	268.00	720.00	142.30	13.50	27.70	3375.50
1987	500.00	231.00	32.00	80.00	330.00	.	20.00	27.00	11.00	256.00	1800.00	127.00	14.00	36.60	4841.20
1988	505.00	219.00	25.00	45.00	382.00	.	21.00	9.00	11.00	217.00	1050.00	150.00	11.00	29.60	3840.10
1989	520.00	139.00	15.00	57.00	200.00	.	21.00	14.00	10.00	175.00	1500.00	80.00	17.00	28.30	4052.10
1990	470.00	152.00	35.00	75.00	266.00	.	18.00	4.00	8.00	140.00	1550.00	110.00	7.00	24.20	4107.20
1991	630.00	178.00	24.00	37.00	344.00	.	27.00	16.00	10.00	282.00	1150.00	140.00	12.00	41.40	4189.80
1992	650.00	180.00	30.00	65.00	420.00	.	43.00	15.00	14.00	277.00	1350.00	185.00	11.00	32.40	4696.30
1993	470.00	225.00	32.00	40.00	380.00	.	30.00	11.00	6.00	289.00	1300.00	135.00	9.40	38.80	4450.00
1994	610.00	170.00	20.00	50.00	280.00	.	30.00	11.00	8.00	234.00	1750.00	110.00	9.00	27.00	4965.20
1995	630.00	195.00	30.00	35.00	353.00	.	30.00	6.00	9.00	252.00	1250.00	115.00	7.50	29.80	4546.80
1996	530.00	139.00	15.00	56.00	256.00	.	18.00	11.00	11.00	170.00	1400.00	80.00	6.50	22.00	4123.10
1997	600.00	114.00	13.00	48.00	350.00	.	38.00	7.00	11.00	209.00	1400.00	90.00	6.50	16.50	4439.80
1998	540.00	88.00	23.00	54.00	237.00	.	19.00	5.00	10.00	169.00	1800.00	90.00	9.40	9.70	4350.00
1999	640.00	90.00	18.00	45.00	378.00	.	18.00	1.00	16.00	225.00	1400.00	115.00	7.70	19.70	4451.70
2000	475.00	84.00	17.00	40.00	348.00	.	10.50	15.00	10.00	215.00	1700.00	68.00	9.00	16.90	4055.40
2001	520.00	62.00	14.00	47.00	360.00	.	0.90	6.00	9.00	218.00	1350.00	80.00	8.00	10.00	3741.70
2002	320.00	102.00	11.00	72.00	295.00	.	3.70	1.00	4.50	177.00	1200.00	77.00	6.00	12.60	3008.10
2003	550.00	90.00	10.00	42.00	347.00	.	1.50	4.50	5.50	210.00	950.00	69.00	10.00	12.50	3241.20
2004	620.00	85.00	11.90	50.00	290.00	.	1.80	2.20	5.00	165.00	1550.00	65.00	8.00	14.10	3723.30
2005	545.00	83.00	12.60	40.00	368.00	.	1.30	8.30	5.50	196.00	1300.00	67.00	7.50	15.00	3485.10
2006	560.00	102.00	13.70	45.00	335.00	.	1.50	1.00	4.50	180.00	1200.00	72.00	9.00	15.00	3421.70
2007	610.00	55.20	6.90	45.00	330.00	.	0.10	2.40	12.00	178.00	850.00	63.00	8.00	4.80	2968.10
2008	690.00	115.50	9.90	40.00	270.00	.	4.10	1.70	6.00	175.00	1100.00	65.00	7.00	35.60	3265.80
2009	675.00	63.00	19.30	40.00	313.00	.	.	1.80	16.00	185.00	900.00	59.00	4.50	7.30	3139.20
2010	710.00	78.00	15.50	35.00	283.00	.	.	0.40	6.00	130.00	1000.00	47.00	3.70	6.10	2956.20
2011	680.00	81.00	16.00	15.00	255.00	.	.	0.80	10.50	160.00	870.00	46.00	6.20	8.90	3015.90
2012	375.00	16.00	8.20	21.00	278.00	.	.	.	6.50	110.00	1100.00	77.00	2.90	182.90	2331.60
2013	740.00	70.00	14.00	17.00	275.00	.	.	.	5.00	110.00	1100.00	75.00	5.00	174.20	3444.60
2014	625.00	60.00	9.00	23.00	332.00	.	.	.	4.40	130.00	1150.00	74.00	8.70	169.50	3288.50
2015	635.00	53.00	9.00	19.00	317.00	.	.	.	5.00	130.00	1070.00	73.00	8.80	114.70	3068.70

Table 7: Total Price

YEAR	Arizona	Arkansas	California	Colorado	Connecticut	Delaware	Georgia	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Maine	Maryland	Massachusetts	Michigan	Minnesota	Missouri	New Hampshire
1971	.	0.05	0.04	0.07	0.06	0.05	.	0.07	0.06	0.05	0.08	0.07	0.06	0.07	0.05	0.07	0.04	0.08	0.08	0.07
1972	.	0.06	0.05	0.13	0.10	0.06	.	0.09	0.07	0.07	0.11	0.05	0.07	0.10	0.07	0.09	0.04	0.09	0.09	0.10
1973	.	0.09	0.07	0.08	0.13	0.09	.	0.10	0.09	0.11	0.12	0.07	0.11	0.13	0.10	0.13	0.09	0.12	0.11	0.14
1974	.	0.12	0.07	0.09	0.11	0.09	.	0.12	0.11	0.10	0.15	0.10	0.11	0.11	0.09	0.10	0.06	0.13	0.13	0.11
1975	.	0.08	0.06	0.05	0.11	0.07	.	0.11	0.08	0.08	0.10	0.09	0.10	0.10	0.07	0.10	0.05	0.13	0.12	0.10
1976	.	0.11	0.06	0.09	0.14	0.10	0.09	0.12	0.10	0.12	0.11	0.08	0.11	0.13	0.10	0.15	0.09	0.12	0.15	0.13
1977	.	0.09	0.08	0.09	0.14	0.10	0.09	0.15	0.10	0.11	0.13	0.09	0.11	0.12	0.12	0.13	0.08	0.16	0.12	0.13
1978	.	0.11	0.09	0.11	0.14	0.09	0.12	0.15	0.13	0.14	0.14	0.11	0.13	0.13	0.10	0.14	0.08	0.15	0.15	0.13
1979	.	0.12	0.10	0.08	0.15	0.09	0.11	0.15	0.12	0.15	0.14	0.10	0.12	0.15	0.12	0.16	0.08	0.18	0.13	0.13
1980	.	0.09	0.07	0.08	0.15	0.09	0.12	0.14	0.12	0.12	0.14	0.10	0.14	0.14	0.10	0.15	0.06	0.17	0.12	0.11
1981	.	0.10	0.07	0.10	0.18	0.14	0.09	0.16	0.13	0.14	0.16	0.10	0.13	0.17	0.14	0.20	0.09	0.19	0.16	0.19
1982	.	0.15	0.11	0.10	0.16	0.10	0.11	0.16	0.13	0.14	0.15	0.14	0.15	0.15	0.14	0.17	0.07	0.19	0.15	0.16
1983	.	0.09	0.12	0.09	0.16	0.09	0.09	0.17	0.13	0.15	0.16	0.12	0.14	0.15	0.11	0.17	0.08	0.20	0.15	0.17
1984	.	0.14	0.13	0.11	0.16	0.09	0.08	0.18	0.15	0.13	0.19	0.17	0.13	0.18	0.11	18.60	0.08	0.24	0.17	0.19
1985	.	0.12	0.09	0.10	0.17	0.09	0.11	0.20	0.12	0.13	0.15	0.12	0.14	0.16	0.10	0.18	0.08	0.22	0.16	0.19
1986	.	0.13	0.16	0.10	0.19	0.09	0.16	0.22	0.16	0.19	0.27	0.24	0.21	0.19	0.11	0.20	0.09	0.31	0.21	0.20
1987	.	0.12	0.11	0.07	0.21	0.11	0.11	0.11	0.12	0.17	0.20	0.15	0.15	0.19	0.10	0.21	0.08	0.23	0.10	0.22
1988	.	0.17	0.19	0.11	0.25	0.12	0.13	0.14	0.16	0.18	0.21	0.18	0.16	0.20	0.12	0.23	0.09	0.30	0.17	0.23
1989	0.07	0.19	0.15	0.10	0.24	0.11	0.14	0.08	0.13	0.19	0.21	0.21	0.18	0.21	0.11	0.22	0.08	0.28	0.14	0.23
1990	0.08	0.19	0.16	0.15	0.26	0.12	0.13	0.14	0.18	0.20	0.22	0.22	0.21	0.22	0.14	0.24	0.10	0.37	0.17	0.24
1991	0.14	0.17	0.21	0.16	0.27	0.11	0.14	0.19	0.17	0.21	0.29	0.24	0.22	0.23	0.15	0.25	0.11	0.43	0.21	0.24
1992	0.08	0.13	0.20	0.15	0.21	0.11	0.19	0.16	0.20	0.16	0.23	0.25	0.22	0.16	0.10	0.16	0.09	0.37	0.20	0.17
1993	0.07	0.16	0.16	0.15	0.24	0.11	0.15	0.11	0.17	0.17	0.29	0.17	0.19	0.21	0.14	0.20	0.09	0.33	0.19	0.21
1994	0.08	0.16	0.13	0.16	0.28	0.17	0.14	0.10	0.21	0.20	0.24	0.21	0.22	0.17	0.17	0.23	0.09	0.33	0.20	0.22
1995	0.07	0.14	0.18	0.15	0.28	0.13	0.16	0.17	0.21	0.20	0.30	0.31	0.26	0.18	0.13	0.21	0.10	0.40	0.16	0.20
1996	0.12	0.18	0.17	0.20	0.32	0.19	0.16	0.14	0.29	0.27	0.31	0.26	0.32	0.20	0.16	0.26	0.13	0.46	0.23	0.22
1997	0.11	0.29	0.17	0.15	0.31	.	0.14	0.14	0.20	0.22	0.29	0.19	0.26	0.19	0.20	0.26	0.10	0.44	0.19	0.21
1998	0.15	0.23	0.15	0.12	0.34	.	0.16	0.09	0.19	0.24	0.29	0.26	0.28	0.22	0.18	0.31	0.09	0.44	0.17	0.28
1999	0.13	0.24	0.16	0.22	0.28	.	0.17	0.17	0.21	0.23	0.32	0.28	0.29	0.20	0.09	0.27	0.09	0.41	0.18	0.22
2000	0.07	0.25	0.16	0.14	0.30	.	0.19	0.11	0.29	0.25	0.32	0.27	0.25	0.22	0.14	0.32	0.09	0.43	0.17	0.24
2001	0.07	0.25	0.16	0.21	0.32	.	0.23	0.14	0.24	0.19	0.33	0.33	0.29	0.29	0.16	0.32	0.09	0.48	0.17	0.25
2002	0.17	0.27	0.20	0.18	0.41	.	0.18	0.19	0.36	0.27	0.34	0.36	0.32	0.36	0.14	0.39	0.12	0.51	0.18	0.29
2003	0.08	0.24	0.18	0.19	0.37	.	0.11	0.20	0.29	0.26	0.42	0.27	0.33	0.30	0.16	0.35	0.12	0.44	0.21	0.28
2004	0.15	0.36	0.15	0.15	0.40	.	0.23	0.12	0.24	0.22	0.47	0.28	0.37	0.32	0.14	0.38	0.12	0.47	0.16	0.30
2005	0.24	.	0.21	0.18	0.46	.	0.24	0.18	0.37	0.29	0.45	.	0.35	0.34	0.14	0.45	0.13	0.54	0.17	0.31
2006	0.18	.	0.24	0.27	0.53	.	0.20	0.19	0.35	0.29	0.50	.	0.38	0.42	0.20	0.49	0.14	0.54	0.21	0.35
2007	0.22	.	0.26	0.22	0.49	.	0.50	0.25	0.69	0.28	0.64	.	0.52	0.41	0.20	0.44	0.17	0.64	0.21	0.36
2008	0.22	.	0.31	0.23	0.51	.	0.37	0.20	0.46	0.38	0.55	.	0.54	0.39	0.19	0.52	0.20	0.73	0.25	0.47
2009	0.24	.	0.24	0.26	0.52	.	.	0.22	0.52	0.30	0.66	.	.	0.43	0.15	0.46	0.13	0.59	0.27	0.45
2010	0.18	.	0.21	0.22	0.54	.	.	0.23	0.62	0.40	0.72	.	.	0.46	0.18	0.57	0.18	0.80	0.30	0.46
2011	0.24	.	0.22	0.29	0.54	.	.	0.24	0.58	0.40	0.66	.	.	0.47	0.26	0.60	0.21	0.81	0.31	0.51
2012	0.22	.	0.24	0.30	0.65	.	.	0.32	0.56	0.40	0.68	.	.	0.56	0.40	0.62	0.35	0.83	0.47	0.58
2013	0.25	.	0.23	0.36	0.74	.	.	0.33	0.53	0.39	0.70	.	.	0.52	0.19	0.52	0.20	0.83	0.37	0.43
2014	0.42	.	0.24	0.89	0.63	.	.	0.15	0.76	0.43	0.78	.	.	0.42	0.25	0.49	0.22	0.84	0.28	0.62
2015	.	.	0.28	.	0.59	.	.	0.33	0.56	0.38	0.86	.	.	0.50	0.20	0.53	0.22	0.81	0.44	0.64

YEAR	New Jersey	New Mexico	New York	North Carolina	Ohio	Oregon	Pennsylvania	Rhode Island	South Carolina	Tennessee	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	United States	Other States
1971	0.05	0.07	0.04	0.04	0.07	0.05	0.04	0.07	0.10	0.06	0.07	0.06	0.04	0.06	0.05	0.08	0.05	.
1972	0.07	0.10	0.06	0.05	0.07	0.06	0.05	0.10	0.07	0.07	0.09	0.09	0.06	0.08	0.06	0.08	0.06	.
1973	0.10	0.08	0.10	0.06	0.11	0.07	0.09	0.14	0.08	0.10	0.07	0.13	0.08	0.08	0.09	0.12	0.09	.
1974	0.09	0.10	0.07	0.06	0.11	0.06	0.08	0.12	0.10	0.10	0.09	0.10	0.08	0.09	0.09	0.10	0.08	.
1975	0.06	0.13	0.07	0.06	0.10	0.05	0.06	0.12	0.10	0.11	0.06	0.10	0.05	0.06	0.05	0.09	0.07	.
1976	0.09	0.12	0.08	0.09	0.14	0.07	0.08	0.13	0.10	0.11	0.09	0.12	0.08	0.09	0.08	0.12	0.09	.
1977	0.10	0.12	0.09	0.09	0.16	0.09	0.09	0.13	0.09	0.11	0.11	0.13	0.08	0.13	0.10	0.13	0.11	.
1978	0.11	0.10	0.09	0.08	0.14	0.11	0.09	0.14	0.12	0.14	0.11	0.13	0.08	0.13	0.09	0.12	0.10	.
1979	0.11	0.13	0.10	0.07	0.16	0.11	0.09	0.13	0.14	0.15	0.13	0.12	0.09	0.13	0.08	0.14	0.11	.
1980	0.10	0.12	0.09	0.07	0.15	0.08	0.08	0.15	0.11	0.16	0.11	0.15	0.08	0.08	0.08	0.14	0.09	.
1981	0.13	0.13	0.13	0.08	0.21	0.11	0.10	0.19	0.08	0.13	0.11	0.17	0.10	0.11	0.12	0.14	0.11	.
1982	0.10	0.12	0.09	0.08	0.14	0.10	0.09	0.16	0.11	0.18	0.13	0.15	0.10	0.10	0.09	0.14	0.10	.
1983	0.11	0.14	0.10	0.06	0.16	0.10	0.09	0.19	0.08	0.15	0.10	0.14	0.08	0.11	0.08	0.17	0.11	.
1984	0.13	0.18	0.11	0.07	0.16	0.10	0.09	0.20	0.12	0.16	0.10	0.15	0.10	0.11	0.11	0.22	0.11	.
1985	0.12	0.13	0.07	0.07	0.14	0.13	0.09	0.22	0.11	0.14	0.12	0.17	0.10	0.17	0.10	0.14	0.12	.
1986	0.12	0.19	0.10	0.09	0.17	0.11	0.08	0.22	0.14	0.19	0.14	0.18	0.10	0.16	0.11	0.17	0.13	.
1987	0.12	0.16	0.09	0.06	0.16	0.05	0.09	0.24	0.08	0.13	0.07	0.18	0.09	0.07	0.08	0.16	0.09	.
1988	0.12	0.20	0.11	0.08	0.18	0.12	0.09	0.25	0.12	0.16	0.13	0.18	0.11	0.13	0.10	0.21	0.13	.
1989	0.15	0.20	0.10	0.09	0.18	0.05	0.11	0.24	0.12	0.15	0.12	0.19	0.10	0.09	0.10	0.16	0.10	.
1990	0.13	0.18	0.13	0.10	0.17	0.11	0.14	0.26	0.13	0.18	0.19	0.21	0.10	0.16	0.10	0.25	0.15	.
1991	0.17	0.23	0.13	0.09	0.24	0.19	0.10	0.29	0.10	0.15	0.18	0.22	0.11	0.22	0.10	0.21	0.18	.
1992	0.14	0.17	0.10	0.08	0.20	0.10	0.09	0.28	0.14	0.18	0.13	0.12	0.09	0.15	0.08	0.23	0.14	.
1993	0.16	0.25	0.12	0.06	0.16	0.13	0.09	0.29	0.13	0.17	0.12	0.17	0.08	0.14	0.08	0.22	0.13	.
1994	0.16	0.22	0.12	0.09	0.18	0.11	0.10	0.31	0.13	0.20	0.12	0.17	0.09	0.14	0.10	0.23	0.13	.
1995	0.16	0.30	0.12	0.08	0.20	0.12	0.10	0.30	0.13	0.22	0.19	0.18	0.10	0.22	0.11	0.24	0.17	.
1996	0.15	0.31	0.14	0.12	0.27	0.09	0.13	0.25	0.14	0.24	0.14	0.19	0.12	0.17	0.11	0.32	0.16	.
1997	0.13	0.34	0.13	0.11	0.22	0.24	0.13	0.27	0.12	0.24	0.17	0.19	0.11	0.16	0.10	0.29	0.15	.
1998	0.12	0.21	0.11	0.11	0.21	0.14	0.14	0.30	0.20	0.22	0.15	0.22	0.12	0.12	0.09	0.28	0.12	.
1999	0.13	0.25	0.11	0.15	0.22	0.11	0.11	0.37	0.14	0.21	0.22	0.21	0.11	0.17	0.09	0.28	0.15	.
2000	0.13	0.25	0.12	0.13	0.23	0.12	0.11	0.36	0.13	0.24	0.12	0.23	0.10	0.13	0.10	0.28	0.13	.
2001	0.16	0.32	0.12	0.15	0.24	0.12	0.10	0.38	0.19	0.24	0.18	0.24	0.11	0.18	0.09	0.29	0.16	.
2002	0.18	0.33	0.18	0.14	0.27	0.15	0.10	0.40	0.13	0.27	0.21	0.34	0.10	0.20	0.09	0.35	0.19	.
2003	0.15	0.31	0.15	0.13	0.27	0.18	0.10	0.39	0.22	0.25	0.23	0.27	0.10	0.26	0.10	0.33	0.21	.
2004	0.15	0.42	0.15	0.13	0.28	0.16	0.10	0.48	0.11	0.26	0.27	0.23	0.15	0.12	0.09	0.34	0.14	.
2005	0.31	.	0.16	0.12	0.29	0.16	0.10	0.52	0.17	0.27	0.16	0.30	0.10	0.18	0.08	0.40	0.17	.
2006	0.41	.	0.20	0.14	0.35	0.20	0.13	0.54	0.16	0.27	0.31	0.32	0.10	0.25	0.09	0.42	0.23	.
2007	0.23	.	0.22	0.10	0.44	0.28	0.14	0.56	0.47	0.40	0.33	0.33	0.12	0.34	0.10	0.47	0.29	.
2008	0.38	.	0.21	0.15	0.42	0.23	0.18	0.67	0.18	0.34	0.29	0.36	0.17	0.23	0.14	0.52	0.23	.
2009	0.50	.	0.16	0.17	0.35	0.20	0.14	0.61	.	0.33	0.30	0.24	0.14	0.27	0.14	0.41	0.23	.
2010	0.48	.	0.18	0.19	0.38	0.22	0.16	0.82	.	0.31	0.25	0.31	0.15	0.28	0.14	0.52	0.25	.
2011	0.67	.	0.20	0.19	0.37	0.22	0.18	0.79	.	0.28	0.22	0.30	0.18	0.36	0.18	0.49	0.30	.
2012	0.84	.	0.35	0.31	0.34	0.25	0.28	0.85	.	0.48	0.26	0.43	0.30	0.39	0.26	0.65	0.37	.
2013	0.45	.	0.17	0.22	0.42	0.36	0.19	0.86	.	0.44	0.48	0.45	0.18	0.36	0.14	0.51	0.30	.
2014	0.85	.	0.20	0.25	0.45	0.25	0.17	0.74	.	0.44	0.22	0.41	0.17	0.27	0.15	0.61	0.26	.
2015	0.91	.	0.20	0.21	0.42	0.36	0.19	0.83	.	0.30	0.33	0.43	0.18	0.41	0.15	0.58	0.34	0.46

Table 8: Total Production

YEAR	Arizona	Arkansas	California	Colorado	Connecticut	Delaware	Georgia	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Maine	Maryland	Massachusetts	Michigan	Minnesota	Missouri	New Hampshire
1971	.	9.60	400.00	74.00	50.00	13.00	.	90.00	106.00	90.00	10.60	15.50	20.00	97.00	72.00	115.00	730.00	25.00	56.20	68.90
1972	.	8.60	530.00	11.00	30.00	11.00	.	50.00	100.00	75.00	13.30	12.40	15.00	75.00	66.00	91.00	730.00	26.00	60.00	55.00
1973	.	6.00	490.00	115.00	30.00	12.00	.	130.00	85.00	63.00	10.40	15.00	10.00	55.00	70.00	76.00	470.00	20.00	51.00	44.00
1974	.	13.00	440.00	45.00	47.00	12.50	.	93.00	80.00	39.00	11.30	13.00	15.00	72.00	65.00	98.00	670.00	25.60	53.00	64.00
1975	.	22.50	460.00	105.00	50.00	14.00	.	95.00	115.00	88.00	9.30	17.00	22.00	74.00	86.00	105.00	700.00	18.50	77.00	60.00
1976	.	11.00	480.00	74.00	33.00	13.00	22.00	125.00	86.00	25.00	6.00	11.40	14.00	75.00	63.00	95.00	480.00	23.50	50.00	57.00
1977	.	24.00	480.00	75.00	46.00	13.50	22.00	85.00	108.00	52.00	10.70	16.00	22.00	92.00	70.00	95.00	570.00	19.90	58.00	58.00
1978	.	13.00	500.00	41.00	50.00	14.00	22.00	130.00	89.00	60.00	8.90	10.00	15.00	75.00	85.00	105.00	920.00	28.00	40.00	60.00
1979	.	24.00	600.00	100.00	45.00	13.00	35.00	125.00	110.00	70.00	12.10	15.00	21.00	86.00	85.00	95.00	680.00	15.00	70.00	58.00
1980	.	10.00	520.00	70.00	42.00	13.50	36.00	165.00	101.00	71.00	8.40	11.00	19.00	85.00	90.00	100.00	900.00	23.00	56.00	58.00
1981	.	23.00	626.00	75.00	38.00	13.10	45.00	135.00	103.00	68.00	11.00	14.00	21.00	80.00	70.00	83.00	660.00	22.00	62.00	45.00
1982	.	8.00	480.00	40.00	50.00	14.50	15.00	126.00	88.00	77.00	11.50	12.50	12.00	92.00	80.00	100.00	980.00	25.00	45.00	50.00
1983	.	15.00	460.00	85.00	40.00	19.00	20.00	128.00	90.00	56.00	12.50	13.50	14.00	85.00	70.00	97.00	750.00	22.00	45.00	55.00
1984	.	8.00	520.00	65.00	47.00	24.00	50.00	135.00	90.00	64.00	5.00	5.00	18.00	70.00	80.00	97.00	770.00	15.00	40.00	50.00
1985	.	16.00	620.00	110.00	42.00	19.00	20.00	131.00	106.00	75.00	13.50	15.00	17.00	85.00	80.00	89.00	1100.00	23.00	62.00	56.00
1986	.	10.00	515.00	18.00	47.00	27.00	30.00	94.00	90.00	37.00	5.50	3.00	4.00	88.00	87.00	95.00	700.00	19.00	37.00	50.00
1987	.	4.00	650.00	125.00	39.00	26.00	50.00	155.00	103.00	72.00	10.00	12.00	21.00	75.00	40.00	86.00	1050.00	26.00	53.00	45.00
1988	.	10.00	630.00	65.00	38.00	19.00	33.00	135.00	85.00	56.00	9.50	12.00	11.00	94.00	54.00	88.00	830.00	14.00	56.00	57.00
1989	34.00	9.00	675.00	70.00	24.00	15.00	25.00	158.00	91.00	64.00	11.50	13.00	16.00	69.00	37.00	78.00	950.00	31.00	55.00	41.00
1990	64.00	12.00	780.00	35.00	33.00	17.00	22.00	165.00	60.00	57.00	9.50	8.00	9.00	88.00	33.00	85.00	750.00	20.00	41.00	48.00
1991	57.00	10.00	800.00	75.00	27.00	25.00	32.00	120.00	69.00	60.00	8.00	7.50	20.00	68.00	42.00	62.00	880.00	25.40	40.00	40.00
1992	90.00	8.00	840.00	90.00	39.00	27.00	25.00	75.00	88.00	70.00	14.00	6.00	16.00	82.00	50.00	85.00	1080.00	29.00	37.00	54.00
1993	61.00	12.00	880.00	92.00	24.50	28.00	34.00	195.00	90.00	80.00	9.50	7.00	22.00	54.00	42.00	59.00	1020.00	23.00	51.00	36.50
1994	64.00	8.00	1050.00	85.00	25.00	20.00	26.00	165.00	47.00	50.00	12.00	5.00	7.00	54.00	35.00	62.50	1020.00	23.20	33.00	41.00
1995	11.00	10.00	850.00	55.00	20.50	15.00	30.00	80.00	80.00	75.00	10.00	6.50	17.00	65.00	35.00	65.00	1220.00	22.00	38.00	44.00
1996	100.00	6.30	950.00	25.00	20.00	15.00	15.00	190.00	53.00	48.00	11.10	2.00	10.60	65.00	29.00	54.50	700.00	21.00	32.00	39.00
1997	45.00	7.20	962.00	35.00	24.00	.	15.00	110.00	74.00	50.00	13.00	7.50	6.50	64.00	46.00	60.00	1000.00	22.00	53.00	40.50
1998	46.00	4.50	860.00	65.00	17.50	.	11.00	155.00	45.00	54.00	8.70	1.60	11.00	44.50	34.60	32.00	1000.00	23.80	34.00	19.00
1999	34.30	5.40	896.00	8.00	23.00	.	12.00	70.00	58.50	60.30	11.00	7.20	9.00	72.00	38.00	65.00	1200.00	23.00	49.00	43.50
2000	95.00	7.20	570.00	30.00	20.50	.	14.00	140.00	42.00	45.00	7.50	3.00	6.50	39.00	33.70	50.00	800.00	22.00	38.00	34.00
2001	5.40	4.30	520.00	23.00	20.50	.	9.00	80.00	43.60	53.00	8.80	3.00	8.30	47.00	40.80	39.00	930.00	24.00	41.00	30.00
2002	26.20	3.30	470.00	21.00	12.00	.	10.00	80.00	43.00	40.00	8.50	2.50	5.60	48.50	32.00	33.00	520.00	25.00	38.00	26.50
2003	7.00	2.40	450.00	22.00	21.50	.	13.00	70.00	52.50	51.00	6.00	3.40	7.50	44.00	40.00	42.50	890.00	27.00	40.00	26.00
2004	37.00	1.90	355.00	28.00	19.50	.	12.00	80.00	56.50	60.00	5.30	2.80	7.70	47.00	34.10	42.00	730.00	25.00	48.00	30.50
2005	22.20	.	355.00	31.00	15.50	.	14.00	70.00	49.00	50.00	2.10	.	5.50	31.00	41.00	28.50	760.00	22.00	49.00	21.00
2006	30.10	.	355.00	15.00	17.50	.	13.00	60.00	52.50	36.50	6.70	.	6.90	23.50	32.70	32.00	880.00	23.00	32.50	28.50
2007	23.00	.	345.00	13.00	23.00	.	2.00	35.00	6.00	20.00	2.70	.	0.60	40.00	29.00	35.50	770.00	26.00	1.50	34.50
2008	18.00	.	360.00	18.00	19.50	.	12.00	85.00	46.20	23.00	4.70	.	7.70	38.50	41.50	41.00	590.00	27.10	30.20	36.50
2009	5.50	.	265.00	16.00	19.50	.	.	45.00	46.00	30.00	4.80	.	.	34.00	46.50	43.50	1150.00	23.20	18.50	30.00
2010	17.00	.	280.00	14.00	23.00	.	.	60.00	52.00	26.00	3.80	.	.	31.00	42.50	37.00	570.00	19.00	33.00	21.00
2011	11.00	.	280.00	9.00	22.00	.	.	60.00	40.00	20.00	4.00	.	.	29.00	40.00	38.50	980.00	23.50	15.00	18.00
2012	8.00	.	270.00	17.00	16.50	.	.	75.00	32.00	4.50	0.70	.	.	30.00	35.00	28.00	115.00	13.50	35.00	15.50
2013	16.50	.	270.00	5.60	27.00	.	.	70.60	16.00	30.00	8.10	.	.	27.00	33.00	43.50	1260.00	26.00	16.90	25.50
2014	7.10	.	240.00	8.90	19.90	.	.	63.30	21.00	17.10	4.50	.	.	38.00	45.40	43.30	1025.00	25.00	20.90	16.90
2015	.	.	146.00	.	25.10	.	.	46.10	20.50	22.50	4.80	.	.	35.60	41.00	43.10	995.00	26.10	28.30	20.20

YEAR	New Jersey	New Mexico	New York	North Carolina	Ohio	Oregon	Pennsylvanis	Rhode Island	South Caroline	Tennessee	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	United States	Other States
1971	125.00	12.50	1050.00	190.00	160.00	125.00	540.00	4.40	15.00	9.40	26.00	45.00	500.00	1206.00	255.00	65.00	6371.10	.
1972	88.00	2.00	770.00	250.00	135.00	105.00	400.00	3.30	20.00	9.20	4.00	42.50	420.00	1393.00	215.00	65.00	5881.30	.
1973	100.00	42.00	720.00	212.00	100.00	167.00	500.00	4.00	17.00	3.10	58.00	28.00	400.00	1860.00	225.00	50.00	6238.50	.
1974	120.00	6.00	900.00	300.00	135.00	165.00	480.00	4.00	20.00	7.00	37.00	42.00	380.00	1806.00	210.00	65.00	6533.40	.
1975	135.00	11.00	1020.00	315.00	160.00	150.00	550.00	6.70	24.00	10.00	49.00	47.00	430.00	2200.00	240.00	64.00	7530.00	.
1976	90.00	24.00	820.00	265.00	105.00	170.00	360.00	5.30	23.00	8.00	40.00	47.00	212.00	2308.00	200.00	52.00	6473.20	.
1977	130.00	25.00	900.00	270.00	65.00	147.00	460.00	5.50	25.00	10.00	47.00	47.00	290.00	2083.00	195.00	56.00	6672.60	.
1978	90.00	17.00	1080.00	324.00	130.00	142.00	400.00	6.00	26.00	8.00	35.00	49.00	515.00	2148.00	295.00	66.00	7596.90	.
1979	110.00	14.00	1035.00	362.00	105.00	170.00	535.00	5.00	35.00	10.00	51.00	49.00	470.00	2619.00	260.00	54.00	8143.10	.
1980	110.00	12.00	1100.00	410.00	170.00	195.00	570.00	5.50	32.00	8.00	52.00	50.00	420.00	3005.00	245.00	65.00	8828.40	.
1981	95.00	17.00	800.00	375.00	100.00	155.00	400.00	4.50	36.00	11.00	54.00	28.00	465.00	2760.00	200.00	59.00	7753.60	.
1982	140.00	12.00	1130.00	170.00	150.00	150.00	525.00	6.00	7.00	4.50	54.00	52.00	500.00	2615.00	240.00	60.00	8122.00	.
1983	100.00	6.00	1100.00	415.00	100.00	155.00	500.00	5.00	18.00	8.50	58.00	48.00	455.00	3055.00	220.00	58.00	8378.50	.
1984	110.00	8.00	1020.00	360.00	135.00	130.00	575.00	5.00	45.00	13.00	45.00	41.00	465.00	2950.00	225.00	53.00	8333.00	.
1985	105.00	10.00	1090.00	275.00	145.00	160.00	585.00	4.00	16.00	11.00	57.00	49.00	395.00	2050.00	230.00	62.00	7923.50	.
1986	100.00	6.00	900.00	120.00	90.00	105.00	620.00	5.50	30.00	9.00	34.00	49.00	460.00	3160.00	230.00	58.00	7933.00	.
1987	80.00	12.60	880.00	390.00	150.00	210.00	500.00	5.50	45.00	15.00	68.00	44.00	455.00	5000.00	180.00	65.00	10742.10	.
1988	65.00	10.00	910.00	350.00	95.00	155.00	520.00	6.00	38.00	12.50	40.00	45.00	425.00	3900.00	215.00	45.00	9128.00	.
1989	48.00	5.30	960.00	220.00	125.00	160.00	320.00	5.50	35.00	11.50	56.00	45.00	325.00	5000.00	115.00	65.00	9962.80	.
1990	60.00	6.80	990.00	230.00	120.00	180.00	450.00	6.00	34.00	8.50	24.00	43.00	210.00	4800.00	150.00	48.00	9696.80	.
1991	92.00	2.30	1050.00	260.00	120.00	120.00	470.00	5.50	40.00	13.00	55.00	53.00	420.00	4300.00	200.00	60.00	9728.70	.
1992	55.00	15.00	1170.00	240.00	100.00	175.00	500.00	6.50	75.00	13.00	56.00	50.00	370.00	4650.00	225.00	63.00	10568.50	.
1993	75.00	7.00	870.00	320.00	105.00	160.00	530.00	5.30	60.00	19.00	53.00	38.00	370.00	5000.00	190.00	62.00	10684.80	.
1994	70.00	8.00	1100.00	250.00	90.00	200.00	400.00	4.80	60.00	10.00	48.00	42.00	305.00	5850.00	150.00	80.00	11500.50	.
1995	75.00	3.00	1110.00	270.00	120.00	140.00	500.00	4.50	60.00	16.00	20.00	45.00	400.00	4850.00	165.00	57.50	10585.00	.
1996	60.00	5.00	1030.00	200.00	90.00	156.00	391.00	3.40	30.00	11.00	48.00	45.00	275.00	5500.00	105.00	46.00	10381.90	.
1997	55.00	7.00	1120.00	152.00	60.00	160.00	535.00	3.60	60.00	10.00	42.00	50.00	270.00	5000.00	115.00	49.50	10323.80	.
1998	55.00	8.00	1070.00	185.00	80.00	180.00	395.00	2.60	45.00	12.50	45.00	35.00	280.00	6600.00	110.00	76.10	11646.40	.
1999	50.00	2.00	1260.00	190.00	100.00	150.00	505.00	3.60	32.00	9.50	9.00	57.00	360.00	5000.00	140.00	77.40	10630.70	.
2000	50.00	8.00	995.00	190.00	103.00	167.00	475.00	2.30	20.00	9.50	49.00	41.50	320.00	6000.00	85.00	71.00	10583.70	.
2001	55.00	6.00	1000.00	112.00	86.00	142.00	480.00	1.80	6.00	10.50	25.00	41.00	310.00	5050.00	105.00	62.00	9423.00	.
2002	35.00	2.00	680.00	160.00	70.00	202.00	370.00	2.60	9.00	7.20	7.00	31.00	250.00	5100.00	95.00	58.00	8523.90	.
2003	40.00	2.00	1070.00	135.00	90.00	133.00	442.00	2.30	6.00	12.00	28.00	42.00	270.00	4550.00	87.00	68.00	8793.10	.
2004	40.00	4.60	1280.00	155.00	90.00	163.00	405.00	2.20	6.00	11.00	32.00	41.50	300.00	6150.00	81.00	57.00	10440.60	.
2005	45.00	.	1045.00	130.00	99.00	145.00	500.00	1.60	4.00	8.50	38.00	33.00	250.00	5700.00	87.00	52.00	9704.90	.
2006	45.00	.	1260.00	173.00	102.00	150.00	470.00	2.00	3.00	10.00	10.00	36.00	220.00	5550.00	90.00	57.00	9823.40	.
2007	42.00	.	1310.00	60.00	55.60	135.00	470.00	2.60	0.30	0.10	19.00	38.00	215.00	5200.00	80.00	52.00	9089.40	.
2008	43.00	.	1270.00	165.00	104.00	119.00	440.00	2.40	7.00	10.00	12.00	44.00	226.00	5650.00	85.00	57.00	9633.30	.
2009	43.00	.	1370.00	120.00	115.50	130.00	510.00	2.40	.	8.00	18.00	40.00	245.00	5200.00	82.00	43.50	9704.90	.
2010	43.00	.	1280.00	136.00	83.20	120.00	492.00	2.60	.	7.50	12.00	35.00	200.00	5550.00	64.00	37.00	9291.60	.
2011	36.00	.	1220.00	140.00	66.60	92.50	458.00	2.50	.	8.50	19.00	33.50	220.00	5420.00	67.00	51.40	9425.00	.
2012	35.00	.	720.00	33.50	33.00	130.00	494.00	1.70	.	6.40	14.00	25.50	230.00	6450.00	91.00	32.50	8992.30	.
2013	29.00	.	1410.00	155.00	54.00	141.00	469.00	2.50	.	6.90	16.50	34.00	195.00	5900.00	95.00	48.00	10431.60	.
2014	37.00	.	1260.00	125.00	44.00	155.00	534.00	1.80	.	5.50	23.00	29.40	205.00	7650.00	94.00	54.00	11814.00	.
2015	36.70	.	1360.00	105.00	50.50	125.40	519.00	2.40	.	4.60	15.00	36.20	195.20	5950.00	90.20	51.50	10003.90	7.90

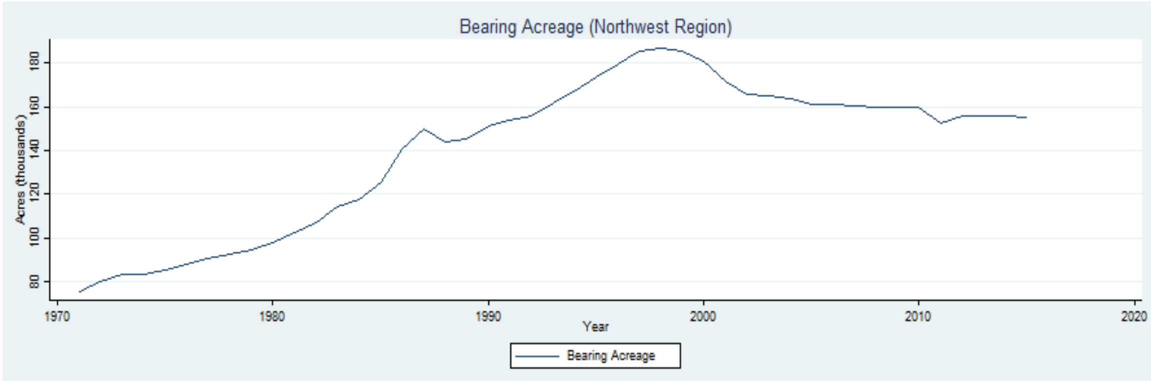
Table 9: Total Utilized Production

YEAR	Arizona	Arkansas	California	Colorado	Connecticut	Delaware	Georgia	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Maine	Maryland	Massachusetts	Michigan	Minnesota	Missouri	New Hampshire	New Jersey	New Mexico	New York	North Carolina	Ohio	Oregon	Pennsylvania	Rhode Island	South Carolina	Tennessee	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	United States	Other States
1971	.	9.60	400.00	74.00	45.20	12.00	.	90.00	103.00	90.00	10.60	15.00	19.40	92.00	69.00	105.00	700.00	23.50	56.20	65.00	110.00	12.00	925.00	185.00	150.00	125.00	505.00	4.00	15.00	9.40	25.00	40.70	480.00	1200.00	250.00	65.00	6080.60	.
1972	.	8.60	530.00	11.00	30.00	11.00	.	50.00	100.00	75.00	13.30	12.00	14.10	75.00	66.00	91.00	730.00	26.00	60.00	55.00	88.00	2.00	770.00	245.00	135.00	105.00	400.00	3.20	20.00	9.20	4.00	40.60	420.00	1390.00	215.00	65.00	5870.00	.
1973	.	6.00	490.00	115.00	30.00	12.00	.	130.00	83.00	63.00	10.40	15.00	9.80	55.00	70.00	76.00	470.00	20.00	51.00	44.00	100.00	38.00	720.00	210.00	100.00	167.00	500.00	4.00	17.00	3.10	52.70	28.00	400.00	1860.00	225.00	50.00	6225.00	.
1974	.	13.00	440.00	45.00	45.00	12.50	.	93.00	79.00	38.20	10.80	12.70	14.40	69.00	65.00	91.00	670.00	25.00	53.00	61.00	120.00	5.00	889.00	295.00	132.00	165.00	480.00	4.00	20.00	7.00	37.00	38.00	378.40	1806.00	210.00	50.00	6484.00	.
1975	.	21.10	460.00	95.00	47.50	14.00	.	95.00	112.00	76.00	9.30	16.60	21.40	73.00	79.00	98.00	680.00	18.50	67.00	55.00	110.00	11.00	860.00	280.00	152.00	150.00	503.50	5.70	21.00	10.00	44.00	42.00	395.00	2200.00	216.00	64.00	7102.60	.
1976	.	11.00	480.00	74.00	33.00	13.00	21.00	125.00	86.00	25.00	6.00	11.40	13.70	75.00	63.00	95.00	480.00	23.50	50.00	57.00	90.00	21.00	820.00	265.00	105.00	170.00	359.00	5.30	23.00	8.00	40.00	47.00	212.00	2308.00	200.00	52.00	6467.90	.
1977	.	23.50	480.00	75.00	43.00	13.50	20.00	85.00	105.00	50.30	10.50	16.00	19.80	88.00	70.00	92.00	570.00	19.90	58.00	57.50	130.00	25.00	900.00	264.00	65.00	147.00	460.00	5.00	25.00	10.00	47.00	44.00	290.00	2083.00	195.00	56.00	6643.00	.
1978	.	13.00	500.00	36.00	50.00	14.00	22.00	130.00	89.00	56.10	8.90	10.00	14.20	75.00	83.70	105.00	890.00	28.00	40.00	60.00	90.00	17.00	1080.00	322.00	125.40	142.00	400.00	6.00	26.00	7.70	35.00	49.00	515.00	2148.00	295.00	61.00	7544.00	.
1979	.	23.00	600.00	91.00	45.00	13.00	35.00	125.00	110.00	66.20	11.60	14.10	20.40	86.00	93.90	95.00	680.00	15.00	70.00	58.00	110.00	14.00	1035.00	361.00	105.00	170.00	535.00	5.00	32.00	10.00	51.00	49.00	470.00	2619.00	260.00	49.00	8118.20	.
1980	.	10.00	520.00	68.00	42.00	13.50	36.00	165.00	101.00	68.40	8.30	10.40	17.10	85.00	89.00	100.00	900.00	23.00	56.00	58.00	110.00	12.00	1100.00	406.00	170.00	195.00	570.00	5.50	32.00	7.20	50.00	50.00	420.00	3005.00	245.00	62.00	8810.40	.
1981	.	20.50	606.00	75.00	38.00	13.10	40.00	130.00	103.00	67.00	11.00	11.90	20.40	80.00	70.00	83.00	660.00	21.00	62.00	45.00	95.00	17.00	800.00	372.00	100.00	155.00	400.00	4.50	35.00	9.50	53.00	28.00	465.00	2760.00	200.00	55.00	7705.90	.
1982	.	8.00	480.00	40.00	50.00	14.50	14.00	126.00	88.00	75.00	10.80	11.30	11.40	92.00	80.00	100.00	980.00	24.00	45.00	50.00	140.00	12.00	1130.00	170.00	150.00	150.00	525.00	6.00	7.00	4.20	54.00	52.00	500.00	2615.00	240.00	55.00	8110.20	.
1983	.	13.50	460.00	84.00	40.00	19.00	19.00	128.00	90.00	53.40	11.50	11.30	13.00	85.00	70.00	97.00	750.00	21.00	45.00	55.00	100.00	6.00	1100.00	415.00	100.00	155.00	500.00	5.00	16.00	8.20	58.00	48.00	455.00	3055.00	216.00	55.00	8357.90	.
1984	.	7.00	520.00	65.00	47.00	23.50	45.00	134.00	90.00	64.00	4.80	4.80	16.50	70.00	80.00	97.00	770.00	15.00	40.00	50.00	110.00	8.00	1020.00	360.00	135.00	130.00	575.00	5.00	43.00	11.50	45.00	41.00	465.00	2950.00	225.00	51.00	8318.10	.
1985	.	15.00	620.00	110.00	40.00	19.00	19.00	131.00	102.00	75.00	12.00	12.80	15.00	82.00	76.00	85.00	1070.00	21.00	62.00	55.00	103.00	10.00	1079.00	275.00	145.00	160.00	585.00	4.00	15.00	10.00	55.00	47.00	388.00	2050.00	230.00	58.00	7835.80	.
1986	.	9.50	515.00	17.60	46.00	27.00	29.00	94.00	90.00	37.00	5.40	2.90	3.90	86.00	85.00	92.00	700.00	18.00	37.00	50.00	100.00	6.00	900.00	120.00	90.00	105.00	620.00	5.50	30.00	8.50	34.00	48.00	450.00	3160.00	230.00	55.00	7907.30	.
1987	.	4.00	650.00	118.00	38.00	26.00	40.00	150.00	96.00	70.00	9.30	10.40	16.50	74.00	38.00	84.00	1050.00	23.00	50.00	44.00	77.00	12.60	880.00	390.00	150.00	205.00	500.00	5.50	39.00	14.00	63.00	42.00	441.00	4800.00	180.00	61.00	10451.30	.
1988	.	10.00	630.00	65.00	38.00	19.00	32.00	135.00	82.00	51.00	8.90	9.50	9.50	90.00	52.00	85.00	830.00	12.50	54.00	55.00	60.00	10.00	910.00	350.00	95.00	155.00	520.00	6.00	36.00	11.00	39.00	43.00	417.00	3900.00	215.00	43.00	9078.40	.
1989	34.00	9.00	675.00	68.00	23.00	15.00	24.00	158.00	87.00	63.00	10.80	11.30	12.00	68.00	37.00	74.00	950.00	27.50	54.00	41.00	43.00	5.30	960.00	220.00	125.00	160.00	320.00	5.50	33.00	10.00	54.00	43.00	320.00	5000.00	115.00	62.00	9917.40	.
1990	61.00	12.00	780.00	33.00	31.00	17.00	21.00	165.00	58.00	56.00	8.70	6.80	8.00	84.00	33.00	81.00	750.00	19.20	41.00	48.00	59.00	6.80	990.00	230.00	120.00	180.00	450.00	6.00	33.00	7.70	22.00	41.00	203.00	4800.00	150.00	46.00	9658.20	.
1991	56.00	10.00	800.00	70.00	24.00	25.00	30.00	120.00	68.00	56.50	7.90	5.50	16.00	63.00	42.00	55.00	880.00	22.00	40.00	36.00	87.00	2.30	1050.00	260.00	120.00	120.00	470.00	4.90	37.00	11.70	54.00	47.00	416.00	4300.00	195.00	57.00	9658.80	.
1992	73.00	8.00	840.00	88.00	35.00	27.00	24.00	75.00	88.00	66.00	12.80	5.00	15.00	78.00	50.00	79.00	1050.00	24.00	37.00	52.00	54.00	15.00	1170.00	240.00	100.00	175.00	500.00	6.10	73.00	12.40	53.00	42.00	366.00	4650.00	220.00	60.00	10463.30	.
1993	55.00	11.00	880.00	90.00	24.00	28.00	31.00	193.80	85.00	74.00	8.30	4.00	18.00	53.00	42.00	55.00	1020.00	19.70	47.00	36.00	73.00	7.00	870.00	300.00	105.00	160.00	530.00	5.00	52.00	15.10	50.00	35.00	363.00	5000.00	175.00	59.00	10573.90	.
1994	59.00	7.50	1050.00	83.00	24.00	20.00	22.00	158.00	41.00	47.50	10.80	4.50	6.50	52.00	35.00	58.00	1020.00	20.80	33.00	40.00	68.00	8.00	1100.00	250.00	90.00	200.00	400.00	4.80	57.00	9.00	43.00	38.00	299.00	5750.00	145.00	77.00	11331.40	.
1995	11.00	9.50	850.00	51.00	20.00	15.00	26.00	80.00	71.00	70.00	9.00	5.00	12.50	62.00	34.00	60.00	1220.00	18.80	37.00	42.00	72.00	3.00	1110.00	270.00	120.00	140.00	493.00	4.00	55.00	12.60	19.00	49.00	392.00	4750.00	155.00	49.50	10389.90	.
1996	100.00	5.80	950.00	24.00	20.00	15.00	14.00	190.00	51.00	46.00	10.00	1.80	9.60	63.00	27.50	53.00	700.00	18.80	32.00	38.00	58.00	5.00	1030.00	200.00	90.00	156.00	391.00	3.20	28.00	9.80	44.00	44.00	260.00	5500.00	100.00	41.50	10330.00	.
1997	44.10	7.10	962.00	34.00	23.00	.	14.00	110.00	67.00	48.00	7.50	6.40	5.80	62.00	44.50	58.50	1000.00	17.50	50.50	40.00	55.00	7.00	1120.00	150.00	60.00	160.00	525.00	3.40	56.00	8.50	41.00	49.00	262.00	5000.00	110.00	45.50	10254.30	.
1998	45.00	3.60	860.00	59.00	17.00	.	8.00	115.00	35.00	50.00	8.10	0.90	9.00	43.00	34.00	29.50	960.00	18.70	29.00	19.00	54.00	8.00	960.00	135.00	75.00	143.00	388.00	2.20	42.00	9.00	31.00	33.50	269.00	6100.00	107.00	62.00	10762.50	.
1999	32.00	4.20	896.00	8.00	22.00	.	11.00	70.00	42.50	54.80	11.00	5.20	7.00	61.00	38.00	57.00	1180.00	18.30	46.00	42.00	50.00	2.00	1230.00	170.00	91.00	145.00	505.00	2.90	30.00	8.00	9.00	52.00	350.00	5000.00	135.00	60.60	10446.50	.
2000	94.50	3.40	510.00	27.00	20.00	.	13.00	140.00	36.00	43.80	7.50	1.30	5.60	35.00	33.00	43.00	795.00	17.40	34.00	32.50	46.00	8.00	935.00	145.00	96.00	162.00	475.00	2.20	16.00	8.50	43.00	38.50	314.00	6000.00	83.00	58.00	10322.20	.
2001	5.30	3.40	490.00	23.00	20.00	.	8.90	79.00	40.60	46.00	7.70	2.20	7.00	40.00	40.70	34.00	900.00	15.50	41.00	28.50	50.00	6.00	940.00	107.00	84.00	141.00	480.00	1.40	2.00	8.00	19.00	38.00	306.00	5050.00	95.00	49.00	9209.20	.
2002	26.00	2.50	460.00	20.00	11.50	.	9.90	79.00	35.30	36.00	5.20	2.10	4.00	44.00	31.90	28.00	515.00	17.70	36.00	24.50	32.00	1.80	630.00	155.00	70.00	187.00	369.00	2.10	7.00	6.10	6.50	28.00	247.00	5100.00	92.00	52.00	8374.10	.
2003	7.00	2.30	440.00	21.00	20.00	.	12.90	70.00	45.90	48.00	4.70	2.60	7.10	40.00	38.40	37.00	890.00	19.80	40.00	24.50	40.00	1.80	1060.00	130.00	88.00	132.00	442.00	2.00	4.50	11.50	27.50	37.50	262.00	4550.00	85.00	58.00	8703.00	.
2004	37.00	1.10	355.00	27.00	18.50	.	12.00	80.00	51.30	58.00	4.80	2.20	7.00	43.00	33.00	37.00	730.00	19.90	47.00	28.00	38.00	2.50	1280.00	132.00	90.00	160.00	400.00	2.10	3.00	10.50	31.40	38.00	297.00	6150.00	80.00	55.00	10361.30	.
2005	22.00	.	355.00	27.00	15.00	.	14.00	70.00	38.50	40.00	1.90	.	4.70	29.00	40.80	26.00	755.00	16.00	47.00	19.50	44.00	.	1035.00	118.00	98.00	135.00	495.00	1.40	2.50	7.50	35.70	29.50	247.00	5700.00	83.00	49.50	9602.50	.
2006	30.00	.	355.00	14.00	16.50	.	12.00	55.00	44.80	32.00	5.80	.	6.30	23.50	32.70	30.50	855.00	17.00	30.50	27.50	44.00	.	1250.00	170.00	101.00	150.00	467.00	1.80	2.40	9.00	9.90	32.00	214.00	5550.00	88.00	53.00	9730.20	.
2007	23.00	.	345.00	13.00	22.00	.	2.00	35.00	4.90	18.00	1.70	.	0.40	36.00	29.00	36.50	770.00	20.10	1.40	33.00	42.00	.	1300.00	60.00	55.60	135.00	467.00	2.40	0.30	0.10	18.00	33.00	215.00	5200.00	77.00	49.00	9045.40	.
2008	18.00	.	360.00	17.00	19.00	.	12.00	85.00	39.60	21.50	3.60	.	6.90	35.00	41.00	38.50	590.00	24.30	30.00	35.00	39.00	.	1240.00	165.00	88.90	119.00	430.00	2.30	6.30	8.70	11.60	41.00	226.00	5650.00	81.00	54.50	9539.70	.
2009	5.50	.	265.00	15.00	18.00	.	.	45.00	39.60	27.00	4.10	.	.	32.00	46.00	41.00	995.00	20.30	18.00	28.00	42.00	.	1360.00	105.00	110.00	130.00	483.00	2.30	.	7.80	16.00	37.00	245.00	5200.00	79.00	36.50	9453.10	.
2010	17.00	.	280.00	14.00	22.00	.	.	60.00	43.00	24.00	3.10	.	.	29.00	42.00	34.00	570.00	15.80	32.00	19.50	42.00	.	1270.00	134.00	71.70	120.00	473.00	2.50	.	6.80	11.70	33.00	200.00	5550.00	61.00	31.90	9213.00	.
2011	11.00	.	270.00	8.00	19.50	.	.	60.00	33.00	18.00	3.30	.	.	22.50	39.00	36.00	975.00	19.40	14.00	17.00	35.00	.	1210.00	140.00	59.40	90.00	439.00	2.20	.	8.20	18.30	26.50	220.00	5420.00	65.00	38.70	9318.00	.
2012	8.00		270.00	16.00	15.50	.	.	75.00	25.00	4.50	0.20	.	.	27.50	34.70	27.50	115.00	11.30	33.00	13.50	34.00	.	710.00	32.00	26.00	128.00	475.00	1.60	.	6.00	13.80	24.00	230.00	6450.00	90.00	29.40	8926.50	.
2013	16.30	.	270.00	5.30	26.50	.	.	70.00	15.00	27.00	6.80	.	.	25.50	32.60	40.50	1250.00	22.00	15.00	24.50	28.50	.	1390.00	145.00	51.00	137.00	455.00	2.30	.	6.30	15.80	31.00	190.00	5900.00	95.00	46.00	10339.90	.
2014	7.10	.	240.00	8.20	19.60	.	.	60.00	20.20	16.00	3.80	.	.	36.80	45.20	40.30	1025.00	23.00	19.80	16.50	36.00	.	1250.00	125.00	43.00	155.00	523.00	1.70	.	5.00	22.40	28.20	205.00	7050.00	94.00	51.00	11170.80	.
2015	.	.	145.00	.	24.30	.	.	46.00	19.90	20.50	4.00	.	.	35.10	40.90	42.40	990.00	21.90	28.10	20.00	36.00	.	1350.00	103.00	49.00	125.00	515.00	2.20	.	4.50	14.90	35.90	195.00	5910.00	90.00	48.10	9924.40	7.70

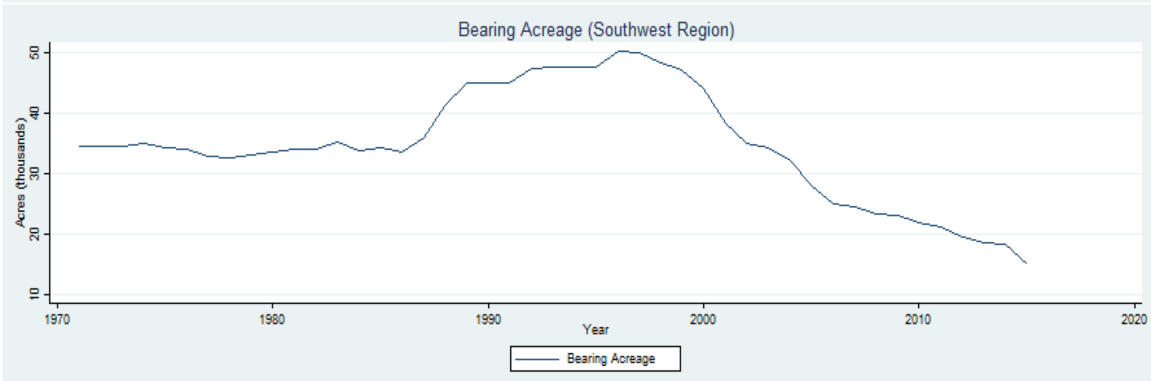
Data Sources

Variables	Data Source
Bearing Acreage by State	(1971-1980) - Johnson, Doyle. C., USDA/NASS. (1987). Fruit and Nuts Bearing Acreage, 1947-1983. (1981-2010) - USDA/ERS. Apple Statistics Tables. URL: http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1825 (2011) - USDA/NASS. (2014). Noncitrus Fruits and Nuts 2013 Summary. (2012) - USDA/NASS. (2015). Noncitrus Fruits and Nuts 2014 Summary. (2013) - USDA/NASS. (2016). Noncitrus Fruits and Nuts 2015 Summary. (2014) - USDA/NASS. (2016). Noncitrus Fruits and Nuts 2015 Summary. (2015) -USDA/NASS. (2016). Noncitrus Fruits and Nuts 2015 Summary.
Total Production by State Total Utilized Production by State Fresh Utilization by State Processed Utilization by State Total Average Price by State Fresh Utilization Price by State Processed Utilization Price by State	(1971) - USDA/NASS. (1974). Noncitrus Fruits and Nuts 1973 Summary (1972) - USDA/NASS. (1975). Noncitrus Fruits and Nuts 1974 Summary (1973) - USDA/NASS. (1976). Noncitrus Fruits and Nuts 1975 Summary (1974) - USDA/NASS. (1977). Noncitrus Fruits and Nuts 1976 Summary (1975) - USDA/NASS. (1978). Noncitrus Fruits and Nuts 1977 Summary (1976) - USDA/NASS. (1979). Noncitrus Fruits and Nuts 1978 Summary (1977) - USDA/NASS. (1980). Noncitrus Fruits and Nuts 1979 Summary (1978) - USDA/NASS. (1981). Noncitrus Fruits and Nuts 1980 Summary (1979) - USDA/NASS. (1982). Noncitrus Fruits and Nuts 1981 Summary (1980) - USDA/NASS. (1983). Noncitrus Fruits and Nuts 1982 Summary (1981) - USDA/NASS. (1984). Noncitrus Fruits and Nuts 1983 Summary (1982) - USDA/NASS. (1985). Noncitrus Fruits and Nuts 1984 Summary (1983) - USDA/NASS. (1986). Noncitrus Fruits and Nuts 1985 Summary (1984) - USDA/NASS. (1987). Noncitrus Fruits and Nuts 1986 Summary (1985) - USDA/NASS. (1988). Noncitrus Fruits and Nuts 1987 Summary (1986) - USDA/NASS. (1989). Noncitrus Fruits and Nuts 1987 Summary (1987) - USDA/NASS. (1990). Noncitrus Fruits and Nuts 1989 Summary (1988) - USDA/NASS. (1991). Noncitrus Fruits and Nuts 1990 Summary (1989) - USDA/NASS. (1992). Noncitrus Fruits and Nuts 1991 Summary (1990) - USDA/NASS. (1993). Noncitrus Fruits and Nuts 1992 Summary (1991) - USDA/NASS. (1994). Noncitrus Fruits and Nuts 1993 Summary (1992) - USDA/NASS. (1995). Noncitrus Fruits and Nuts 1994 Summary (1993) - USDA/NASS. (1996). Noncitrus Fruits and Nuts 1995 Summary (1994) - USDA/NASS. (1997). Noncitrus Fruits and Nuts 1996 Summary (1995) - USDA/NASS. (1998). Noncitrus Fruits and Nuts 1997 Summary (1996) - USDA/NASS. (1999). Noncitrus Fruits and Nuts 1998 Summary (1997) - USDA/NASS. (2000). Noncitrus Fruits and Nuts 1999 Summary (1998) - USDA/NASS. (2001). Noncitrus Fruits and Nuts 2000 Summary (1999) - USDA/NASS. (2002). Noncitrus Fruits and Nuts 2001 Summary (2000) - USDA/NASS. (2003). Noncitrus Fruits and Nuts 2002 Summary (2001) - USDA/NASS. (2004). Noncitrus Fruits and Nuts 2003 Summary (2002) - USDA/NASS. (2005). Noncitrus Fruits and Nuts 2004 Summary (2003) - USDA/NASS. (2006). Noncitrus Fruits and Nuts 2005 Summary (2004) - USDA/NASS. (2007). Noncitrus Fruits and Nuts 2006 Summary (2005) - USDA/NASS. (2008). Noncitrus Fruits and Nuts 2007 Summary (2006) - USDA/NASS. (2009). Noncitrus Fruits and Nuts 2008 Summary (2007) - USDA/NASS. (2010). Noncitrus Fruits and Nuts 2009 Summary (2008) - USDA/NASS. (2011). Noncitrus Fruits and Nuts 2010 Summary (2009) - USDA/NASS. (2012). Noncitrus Fruits and Nuts 2011 Summary (2010) - USDA/NASS. (2013). Noncitrus Fruits and Nuts 2012 Summary (2011) - USDA/NASS. (2014). Noncitrus Fruits and Nuts 2013 Summary (2012) - USDA/NASS. (2015). Noncitrus Fruits and Nuts 2014 Summary (2013) - USDA/NASS. (2016). Noncitrus Fruits and Nuts 2015 Summary (2014) - USDA/NASS. (2016). Noncitrus Fruits and Nuts 2015 Summary (2015) -USDA/NASS. (2016). Noncitrus Fruits and Nuts 2015 Summary
Per capita Consumption of : Apples, Fresh Apples, Processed Apples, Fresh Bananas, Fresh Oranges, Canned Peaches, Canned Pear, Orange Juice. United States Population	(1971-1979) - Putnam, Judith.J., Allshouse, J.E., USDA/ERS/FRED. (1999). Food Consumption, Price, and Expenditures, 1970-1997. (1980-2015) - (May be Authors) USDA/ERS. (2016). Fruit and Tree Nuts Situation and Outlook Yearbook 2016.
Personal Consumption Expenditure: Food	(1971-2015) - United States Department of Commerce: Bureau of Economic Analysis. (Provide Link)
Index of Prices Paid by Farmers	(1947-1951) - USDA/NASS. (1963). Agricultural Statistics 1962. United States Government Printing Office. Washington. (1952-1956) - USDA/NASS. (1967). Agricultural Statistics 1967. United States Government Printing Office. Washington. (1957-1961) - USDA/NASS. (1971). Agricultural Statistics 1972. United States Government Printing Office. Washington. (1962-1966) - USDA/NASS. (1974). Agricultural Statistics 1974. United States Government Printing Office. Washington. (1967-1971) - USDA/NASS. (1977). Agricultural Statistics 1977. United States Government Printing Office. Washington. (1972-1976) - USDA/NASS. (1985). Agricultural Statistics 1985. United States Government Printing Office. Washington. (1977-1981) - USDA/NASS. (1990). Agricultural Statistics 1990. United States Government Printing Office. Washington. (1982-1985) - USDA/NASS. (1992). Agricultural Statistics 1992. United States Government Printing Office. Washington. (1986-1989) - USDA/NASS. (1997). Agricultural Statistics 1997. United States Government Printing Office. Washington. (1990-1994) - USDA/NASS. (2001). Agricultural Statistics 2001. United States Government Printing Office. Washington. (1995-1999) - USDA/NASS. (2005). Agricultural Statistics 2005. United States Government Printing Office. Washington. (2000-2004) - USDA/NASS. (2010). Agricultural Statistics 2010. United States Government Printing Office. Washington. (2005-2014) - USDA/NASS. (2015). Agricultural Statistics 2015. United States Government Printing Office. Washington.
Gross National Product Deflator	Federal Reserve Bank of St. Louis, Economic Data (FRED). URL: https://fred.stlouisfed.org/series/GNPDEF

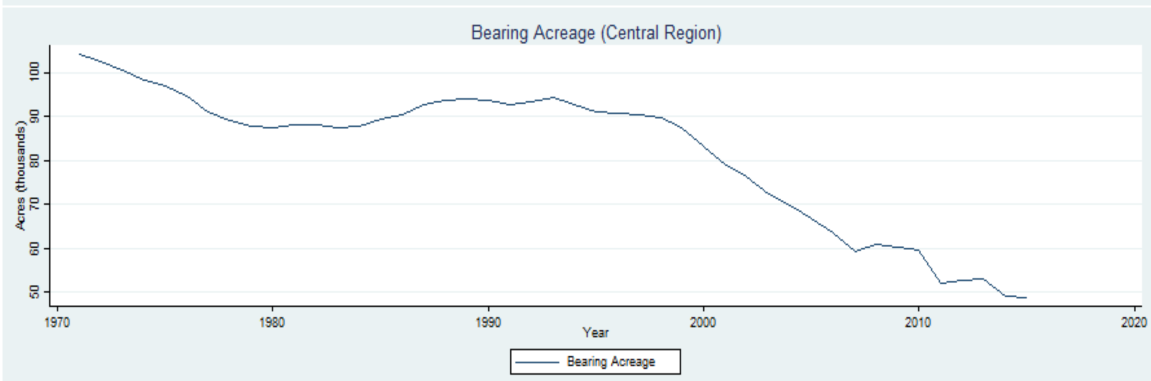
Appendix B



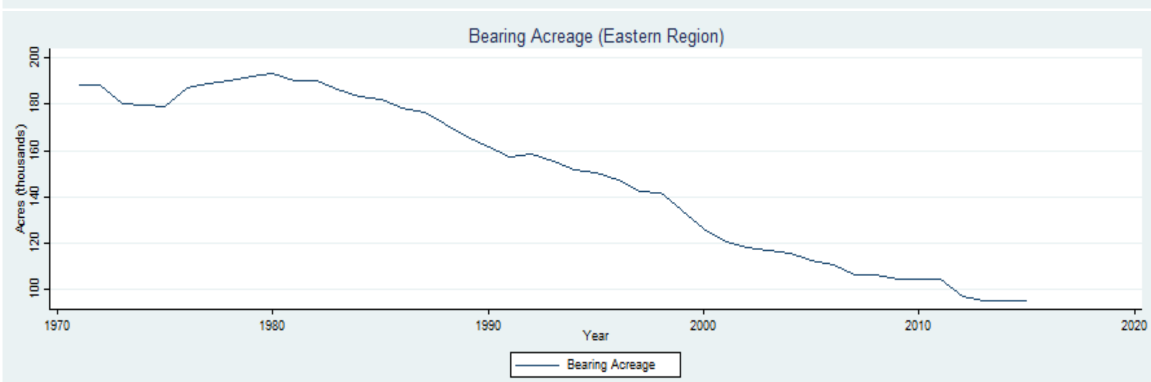
Bearing Acreage (Northwest Region)
Acres (thousands)
80
100
120
140
160
180
1970
1980
1990
2000
2010
2020
Year
Bearing Acreage



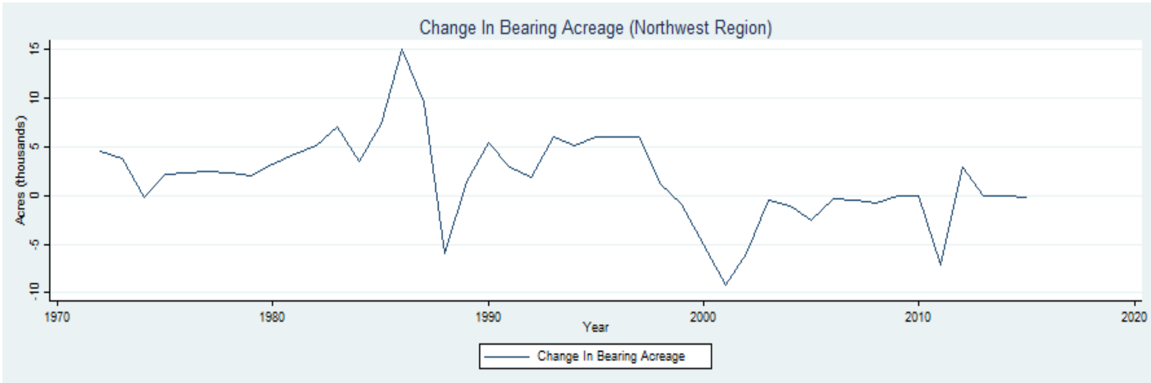
Bearing Acreage (Southwest Region)
Acres (thousands)
10
20
30
40
50
1970
1980
1990
2000
2010
2020
Year
Bearing Acreage

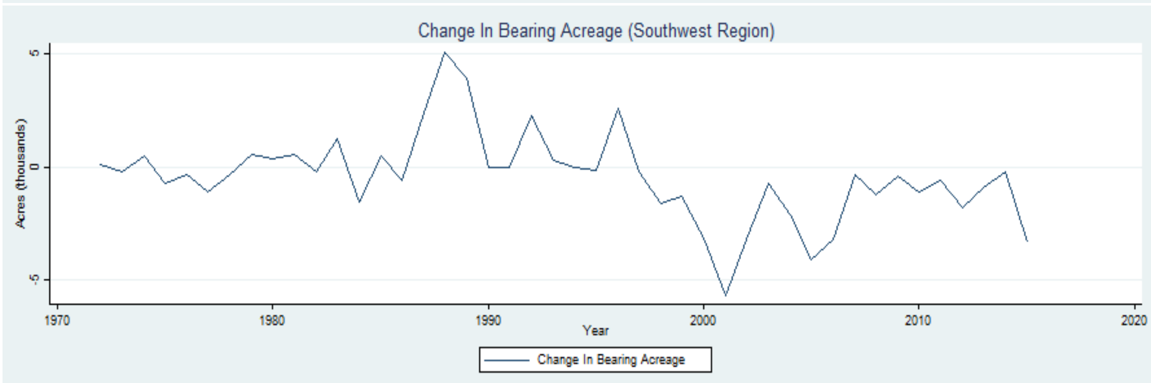


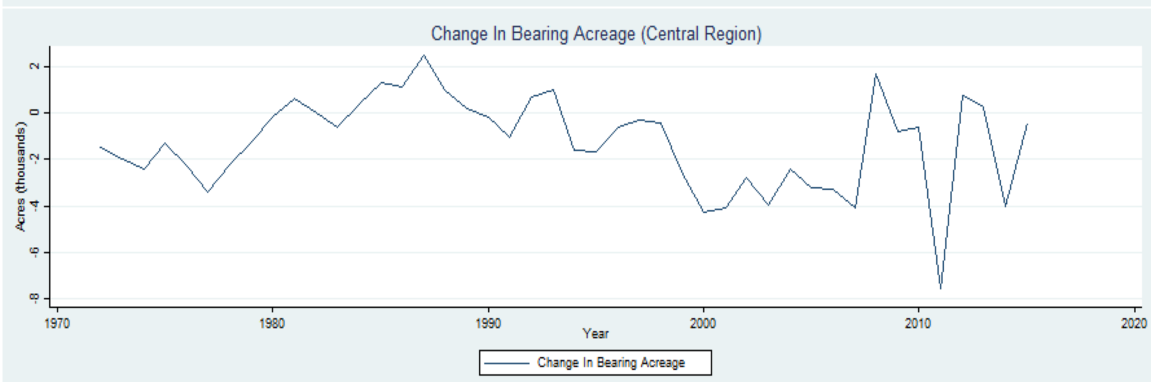
Bearing Acreage (Central Region)
Acres (thousands)
50
60
70
80
90
100
1970
1980
1990
2000
2010
2020
Year
Bearing Acreage

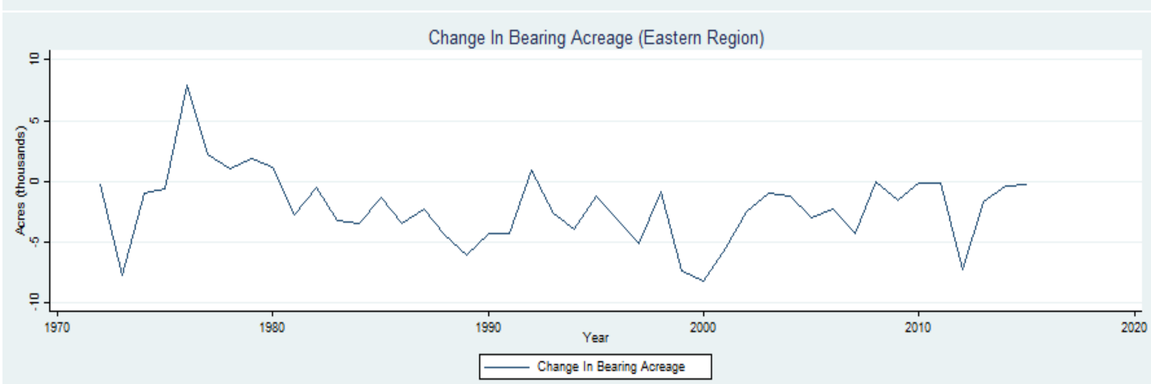


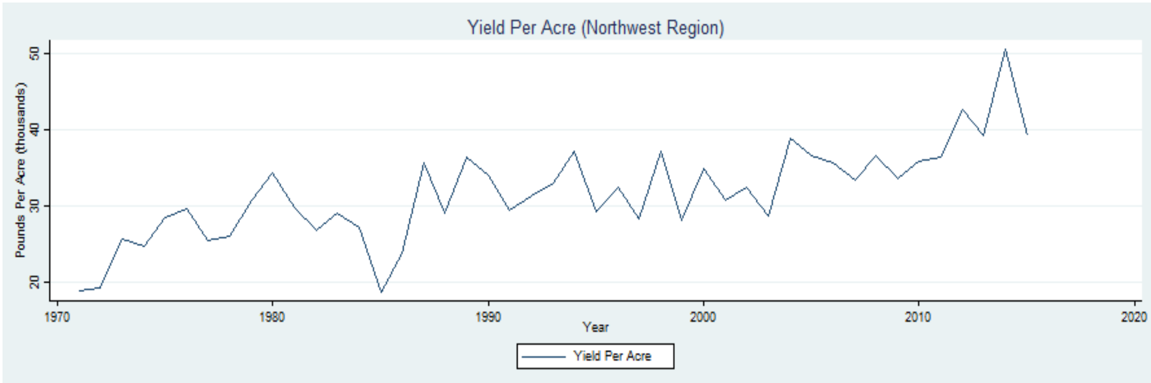
Bearing Acreage (Eastern Region)
Acres (thousands)
100
120
140
160
180
200
1970
1980
1990
2000
2010
2020
Year
Bearing Acreage

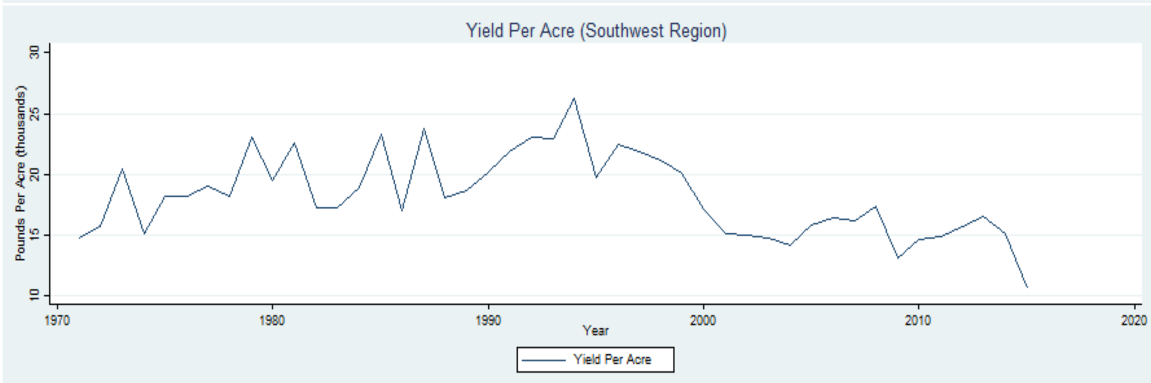

Change In Bearing Acreage (Northwest Region)
Acres (thousands)
-10
-5
0
5
10
15
1970
1980
1990
2000
2010
2020
Year
Change In Bearing Acreage

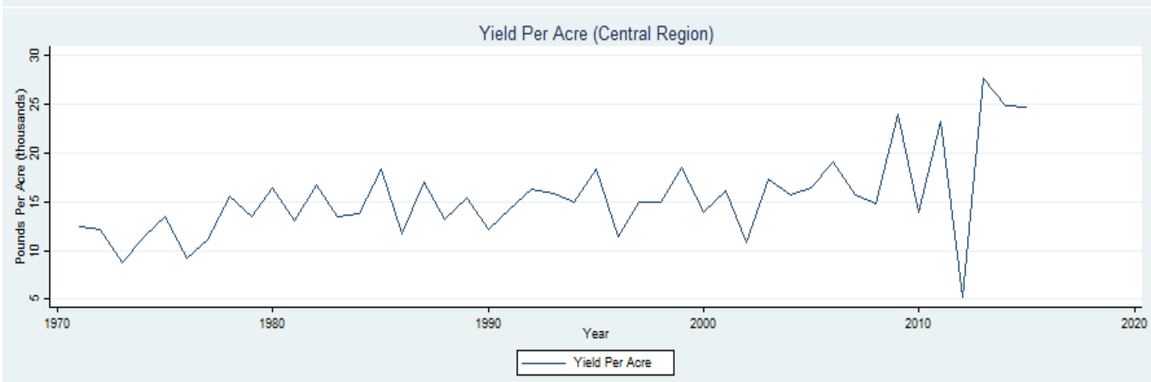

Change In Bearing Acreage (Southwest Region)
Acres (thousands)
-5
0
5
1970
1980
1990
2000
2010
2020
Year
Change In Bearing Acreage

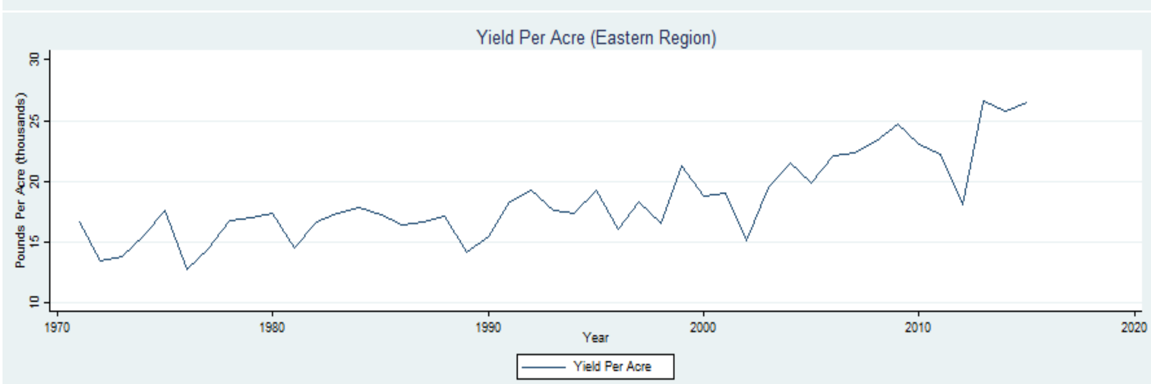

Change In Bearing Acreage (Central Region)
Acres (thousands)
-8
-6
-4
-2
0
2
1970
1980
1990
2000
2010
2020
Year
Change In Bearing Acreage

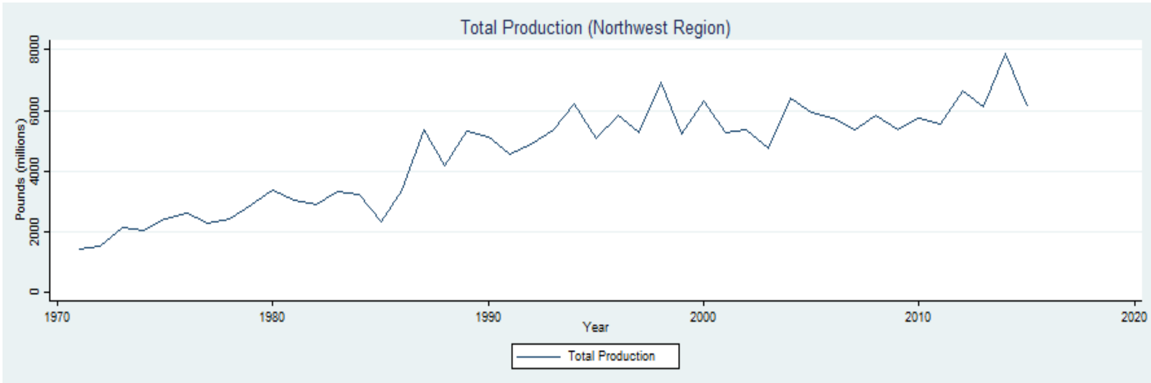

Change In Bearing Acreage (Eastern Region)
Acres (thousands)
-10
-5
0
5
10
1970
1980
1990
2000
2010
2020
Year
Change In Bearing Acreage

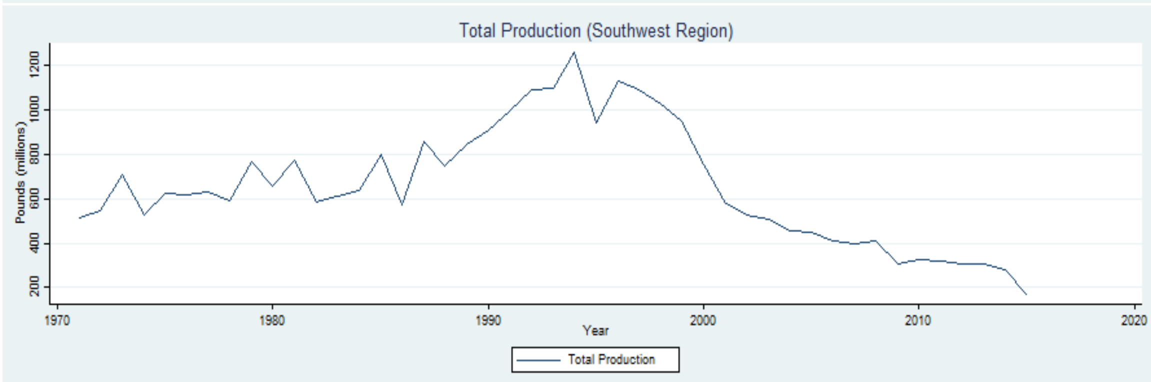

Yield Per Acre (Northwest Region)
Pounds Per Acre (thousands)
20
30
40
50
1970
1980
1990
2000
2010
2020
Year
Yield Per Acre

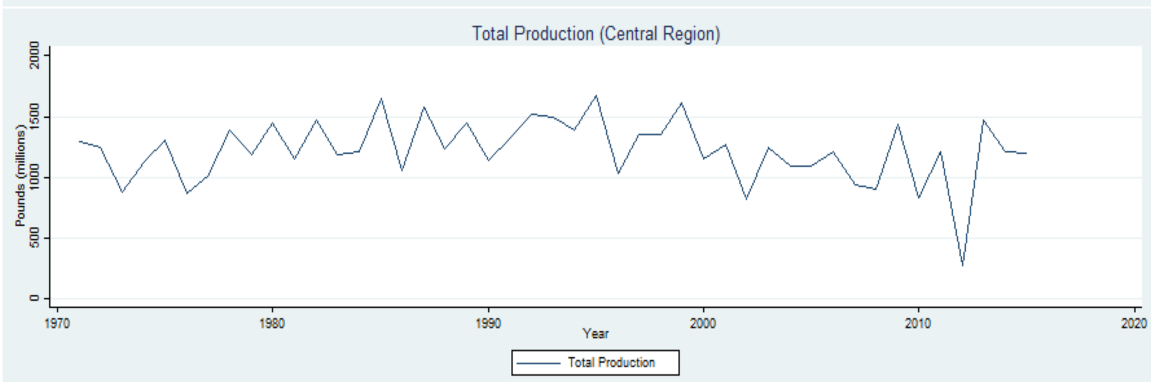

Yield Per Acre (Southwest Region)
Pounds Per Acre (thousands)
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
Yield Per Acre

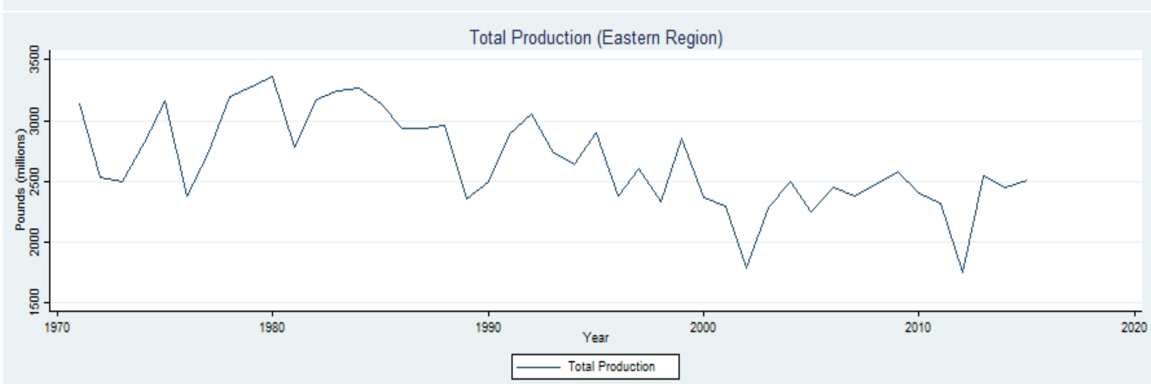

Yield Per Acre (Central Region)
Pounds Per Acre (thousands)
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
Yield Per Acre

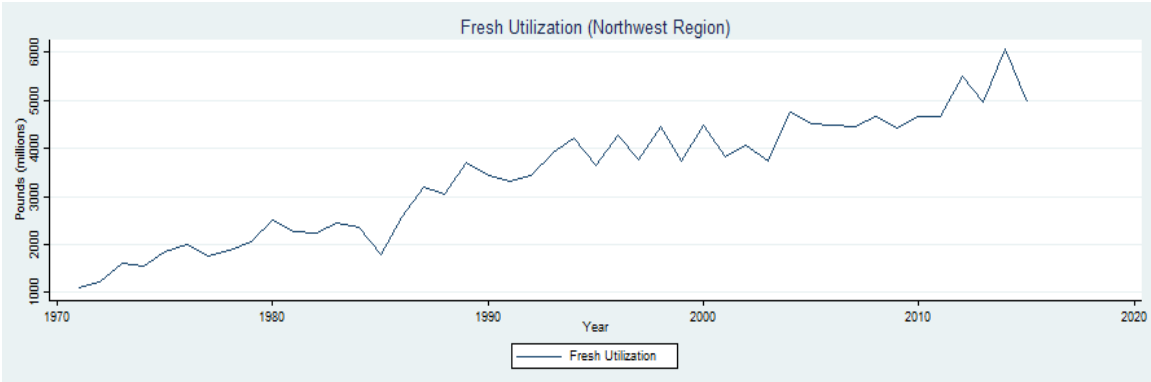

Yield Per Acre (Eastern Region)
Pounds Per Acre (thousands)
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
Yield Per Acre

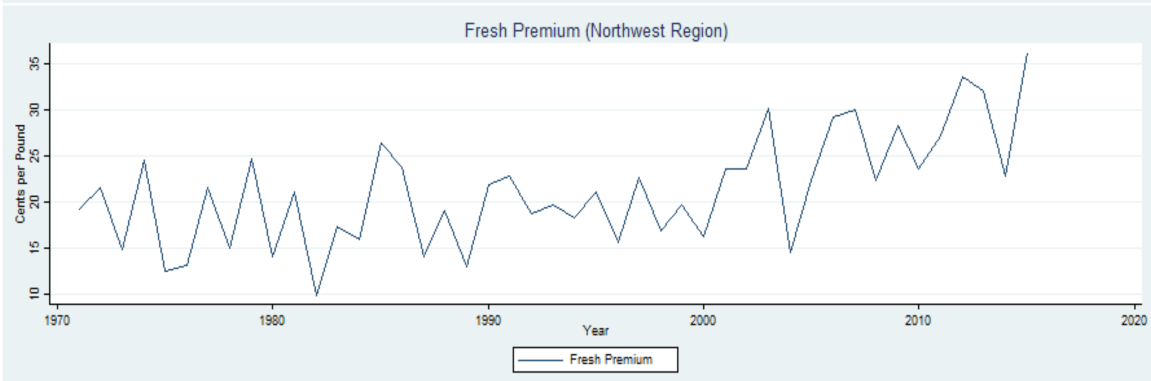

Total Production (Northwest Region)
Pounds (millions)
0
2000
4000
6000
8000
1970
1980
1990
2000
2010
2020
Year
Total Production

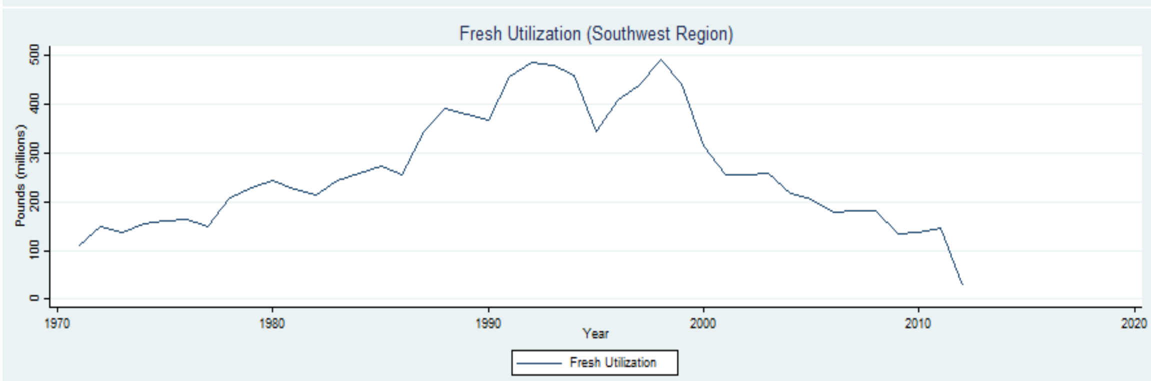

Total Production (Southwest Region)
Pounds (millions)
200
400
600
800
1000
1200
1970
1980
1990
2000
2010
2020
Year
Total Production

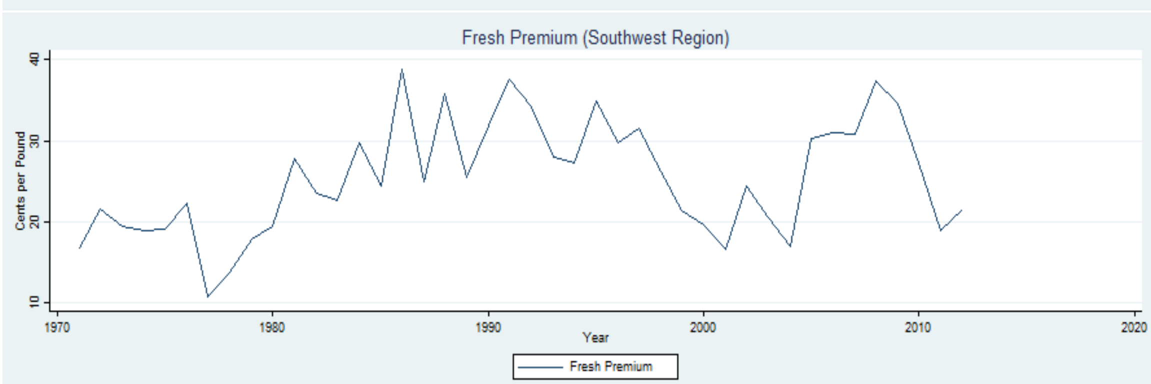

Total Production (Central Region)
Pounds (millions)
0
500
1000
1500
2000
1970
1980
1990
2000
2010
2020
Year
Total Production

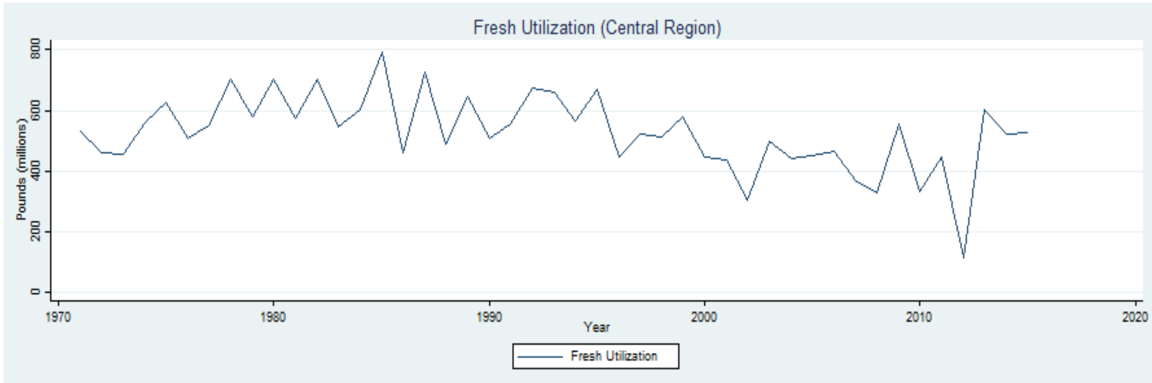

Total Production (Eastern Region)
Pounds (millions)
1500
2000
2500
3000
3500
1970
1980
1990
2000
2010
2020
Year
Total Production

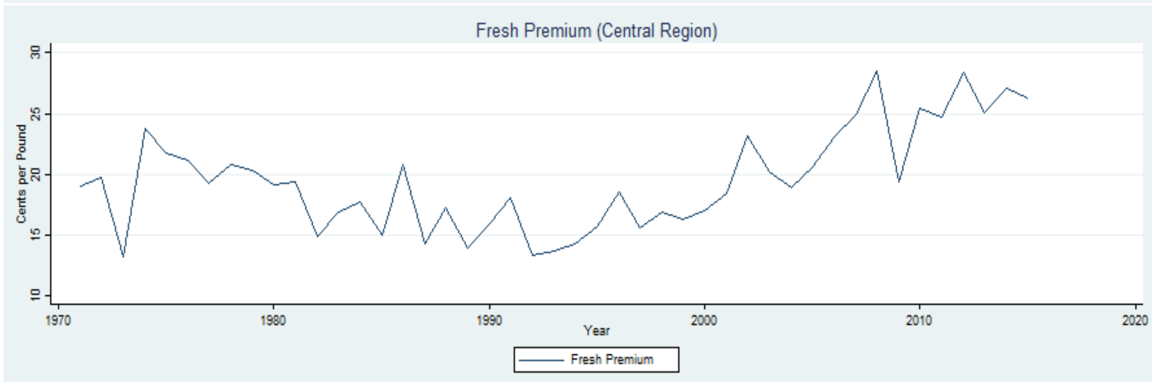

Fresh Utilization (Northwest Region)
Pounds (millions)
1000
2000
3000
4000
5000
6000
1970
1980
1990
2000
2010
2020
Year
Fresh Utilization

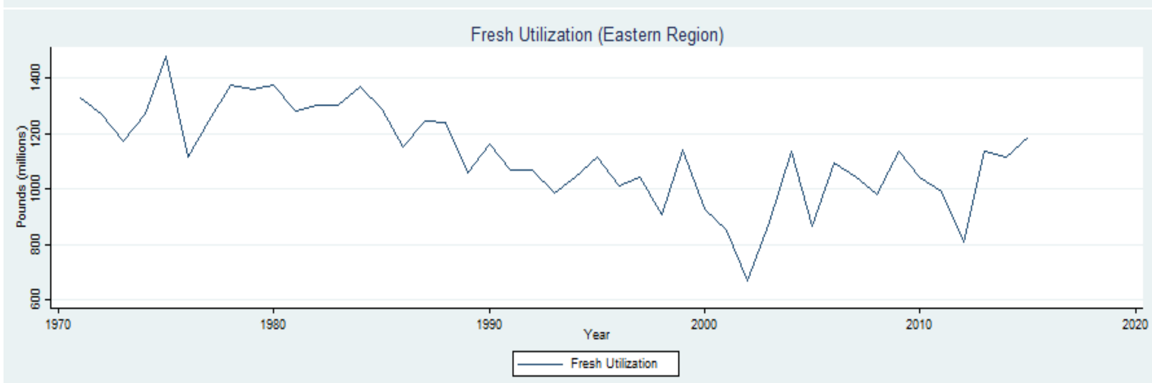

Fresh Premium (Northwest Region)
Cents per Pound
10
15
20
25
30
35
1970
1980
1990
2000
2010
2020
Year
Fresh Premium

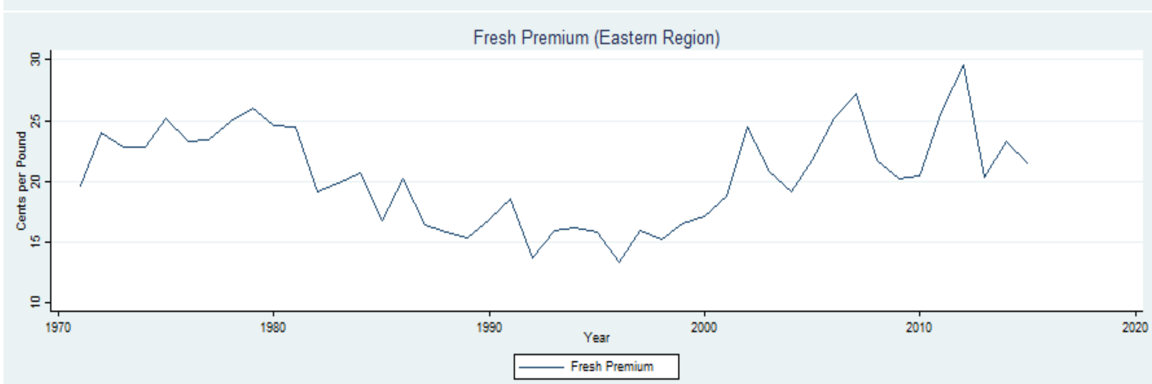

Fresh Utilization (Southwest Region)
Pounds (millions)
0
100
200
300
400
500
1970
1980
1990
2000
2010
2020
Year
Fresh Utilization

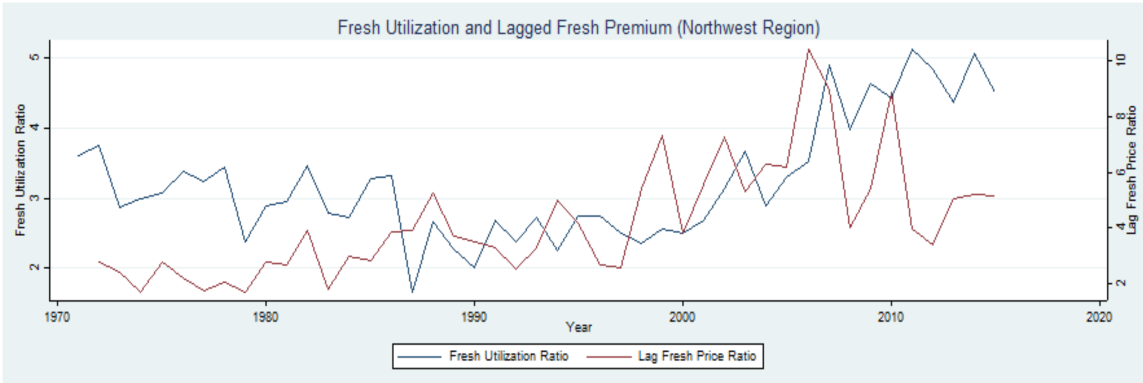

Fresh Premium (Southwest Region)
Cents per Pound
10
20
30
40
1970
1980
1990
2000
2010
2020
Year
Fresh Premium

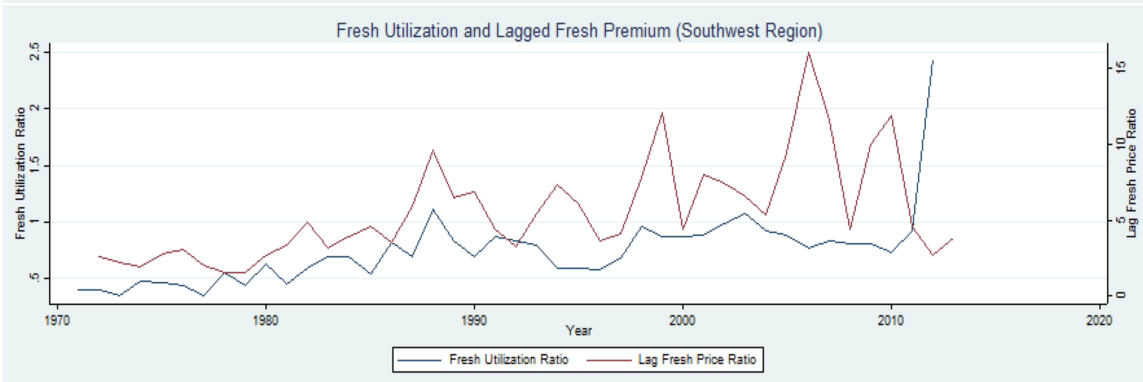

Fresh Utilization (Central Region)
Pounds (millions)
0
200
400
600
800
1970
1980
1990
2000
2010
2020
Year
Fresh Utilization

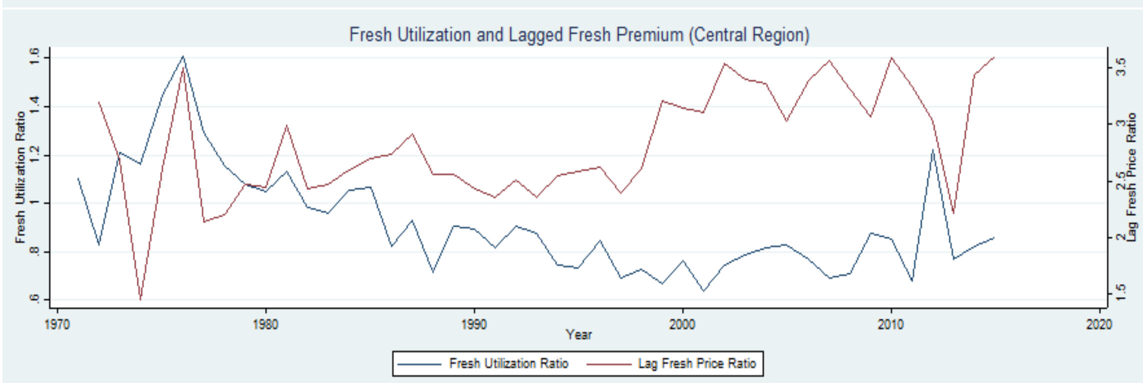

Fresh Premium (Central Region)
Cents per Pound
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
Fresh Premium

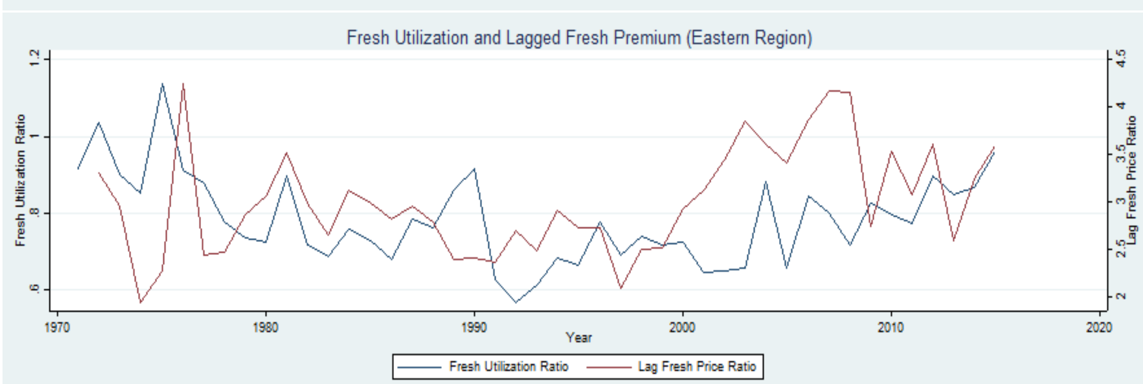

Fresh Utilization (Eastern Region)
Pounds (millions)
600
800
1000
1200
1400
1970
1980
1990
2000
2010
2020
Year
Fresh Utilization


Fresh Premium (Eastern Region)
Cents per Pound
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
Fresh Premium


Fresh Utilization and Lagged Fresh Premium (Northwest Region)
Fresh Utilization Ratio
Lag Fresh Price Ratio
2
3
4
5
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year
Fresh Utilization Ratio
Lag Fresh Price Ratio


Fresh Utilization and Lagged Fresh Premium (Southwest Region)
Fresh Utilization Ratio
Lag Fresh Price Ratio
.5
1
1.5
2
2.5
0
5
10
15
1970
1980
1990
2000
2010
2020
Year
Fresh Utilization Ratio
Lag Fresh Price Ratio


Fresh Utilization and Lagged Fresh Premium (Central Region)
Fresh Utilization Ratio
Lag Fresh Price Ratio
.6
.8
1
1.2
1.4
1.6
1.5
2
2.5
3
3.5
1970
1980
1990
2000
2010
2020
Year
Fresh Utilization Ratio
Lag Fresh Price Ratio


Fresh Utilization and Lagged Fresh Premium (Eastern Region)
Fresh Utilization Ratio
Lag Fresh Price Ratio
.6
.8
1
1.2
2
2.5
3
3.5
4
4.5
1970
1980
1990
2000
2010
2020
Year
Fresh Utilization Ratio
Lag Fresh Price Ratio