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AN ANALYSIS OF BASELINE DATA TO ASSESS STRUCTURAL SHIFTS, TRENDS AND LINKAGES OF MICHIGAN'S PRODUCTION AGRICULTURE ECONOMY DURING THE 1970's AND 1980's

VOLUME I

By

John Frederick Whims

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ABSTRACT

AN ANALYSIS OF BASELINE DATA TO ASSESS STRUCTURAL SHIFTS, TRENDS, AND LINKAGES OF MICHIGAN'S PRODUCTION AGRICULTURE ECONOMY DURING THE 1970s AND 1980s

By

John F. Whims

Michigan's agriculture economy and it's participants will face many opportunities and challenges in the future. It was the purpose of this dissertation to assemble a comprehensive collection of Michigan production agriculture baseline data and to apply the statistical methods of ordinary least squares regression, shift-share analysis, and input-output modeling, to determine the ***trends***, ***shifts***, and ***linkages*** of the sector during the decades of the 1970's and 1980's. This research effort is one of the most extensive historical reviews of Michigan production agriculture ever generated. Over thirty eight different commodities from the field crop, livestock, fruit and vegetable sectors were analyzed. The analysis of baseline data will aid individuals involved in state farm organizations, farm enterprises, agribusinesses, food processing companies, governmental agencies, universities, environmental groups and input suppliers, in making their future decisions.

The following is a brief highlight of some of the findings:

Trend Highlights:

- The number of Michigan farms declined 35.7%, from 84,000 in 1970 to 54,000 in 1990.
- State soybean production expanded more than any other crop (fruit, field, food or vegetable), increasing from approximately 10 million bushels a year to over 40 million bushels a year, up 300%.
- Dry bean production fell precipitously, down approximately 33% from 6.70 million Cwt. per year to 4.45 million Cwt. per year.
- Significant growth occurred in turkey production; from 1973 to 1990, production expanded from 20 million pounds a year to over 125 million pounds a year, up 525%.

Shift-Share Highlights:

- Michigan lagged the comparative U.S. growth rates of cash receipts for livestock, fruit, and vegetable crops from 1970 to 1990. Only state field crop cash receipts expanded at a faster rate than U.S. receipts.
- The commodities with the largest competitive gains in cash receipts were; hogs, turkeys, corn, soybeans, blueberries, snap beans and asparagus. Most Michigan fruit and vegetable commodities cash receipt rates lagged the U.S. rates.

Economic (Linkages) Highlights:

- On average, for each job in production agriculture,[1] there are 1.31 additional jobs linked to the industry in other sectors of the economy.
- On average, for each dollar increase in final demand for production agricultural commodities (output), an additional $1.06 of output is created in other sectors of the economy.

[1] Includes the crop and livestock sectors.

ACKNOWLEDGMENTS

Many individuals have encouraged me during my doctoral program endeavors. Without their help and insights this dissertation would not have become a reality.

I would like to especially thank Lester Manderscheid, committee chairman, for his guidance and encouragement throughout my academic career at Michigan State University. It was an honor and privilege to mature both intellectually and as a person while under his tutelage. To John Ferris, one of the reasons for coming to Michigan State, thank you for the opportunity to learn from you both as a student and an associate in the field of agricultural economics. I also thank Larry Connor for his brief but seminal role as my dissertation advisor. To the other members of my guidance committee including James Bonnen and MaryLee Davis, your comments concerning the dissertation and open door policies were greatly appreciated. To my parents Fred and Annette, thank you for your prayers and counsel. And to Winston, a best friend, who has given so generously and asked so little in return.

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I. INTRODUCTION

Purpose of the Study

The purpose of this dissertation was to assemble a comprehensive collection of Michigan production agriculture baseline data and to apply the statistical methods of ordinary least squares regression, shift-share analysis, and input-output modeling, to determine the trends, shifts, and linkages of the sector during the decades of the 70's and 80's. This research effort is one of the most extensive historical reviews of Michigan production agriculture generated to date. The study was designed to assist decision makers in Michigan farm organizations, farm enterprises, agribusinesses, food processing companies, governmental agencies, universities, environmental groups, and input suppliers.

Evolution of the Study

The impetus for this dissertation evolved from the author's participation in two strategic planning processes concerning Michigan's food and agriculture industry; as the staff economist for the Michigan Department of Agriculture "Futures Team 2020" project, and as a research associate for the Michigan State University (MSU), Agricultural Experiment Station (AES) "SAPMA "(Status and Potential of Michigan Agriculture) project. The conceptualization of this research endeavor was greatly influenced by the research techniques used in the SAPMA project. Although the SAPMA

project generated a sizeable amount of production data, there were still missing pieces. However, since the author played an important role in the executions of both efforts it seemed meaningful to investigate thoroughly both of these efforts as well as several others, for purposes of creating a more comprehensive framework that could be used for ongoing planning efforts. Since the "Futures Team 2020" and the SAPMA project concepts contributed in a significant way to this research effort, the special nature of their contribution deserves consideration.

Futures Team 2020

In 1989 the Governor of the State of Michigan and the Michigan Department of Agriculture organized a task force of approximately 40 academic, corporate, entrepreneurial, and governmental leaders to develop a strategic plan for Michigan's food and agriculture system.[1] For two years, the Future's Team convened eleven major group meetings and many subcommittee meetings. At the conclusion of the deliberations, a final report was produced "Reaching 2020: Michigan's Food and Agriculture Industry in the 21st Century." This report analyzed and recommended policy actions (specifically for the State of Michigan) in such areas as: increasing international trade, marketing strategies aimed at U.S. consumers,

[1] As staff economist it was my responsibility to prepare briefing papers, make presentations, facilitate discussions and advise the Futures Team members about the status of the food and agriculture industry in Michigan the U.S. and abroad, and to help write the final report.

developing rural Michigan, assuring environmental quality, achieving excellence in education and research, and expanding food and agriculture production and processing.

Status and Potential of Michigan Agriculture (SAPMA)

The SAPMA project was funded by the MSU AES. The purpose was to review and assess experiment station research needs and priorities, identify key trends and future scenarios of Michigan agriculture and evaluate the potential for growth. From mid-1990 to late 1991, some 70 faculty members and graduate students prepared special reports that were reviewed by 100 other faculty members. These individuals were joined by nearly 150 industry representatives at a two-day conference during MSU's Agriculture and Natural Resources Week in March 1992.[2]

The SAPMA project was organized into three stages. The first stage,

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[2] My participation in the project was two fold: first, as a contributing author in phase I, and second, as a member of the project advisory committee. The phase I special reports were as follows:

Whims, John F. A Review of Michigan's Past and Forecasted Trends for the Food and Agriculture Industry. Michigan State University, Agricultural Experiment Station, East Lansing, Michigan , Special Report 36, December 1992.

Whims, John F.; Connor, Larry J. Michigan Agriculture in the Eighties - A Decade in Review. Michigan State University, Agricultural Experiment Station, East Lansing, Michigan , Special Report 33, November 1992.

Whims, John F.; McVeigh, Paul C.; Connor, Larry J. A Comparative Trend Analysis of Funding Sources for Michigan State University's Agricultural Experiment Station and Cooperative Extension Service. Michigan State University, Agricultural Experiment Station, East Lansing, Michigan , Special Report 41, December 1992.

phase I, produced approximately 10 special reports that assessed Michigan's food and agriculture industry from a macro point of view (analyzing such aspects as agricultural inputs, food processing and marketing, and community resources and restraints). Phase II of the SAPMA project focused on issues and concerns related to specific commodities (e.g., potatoes, poultry, and dairy). The first two stages of SAPMA have been completed. The third phase of SAPMA builds on the special reports generated in the first two stages. Phase III was designed to be a continual process where research allocation and funding priorities are developed by the AES director and his staff.

The first special report entitled "Michigan Agriculture in the Eighties - A Decade in Review," was coauthored with professor Larry Connor.[3] Connor reviewed the final publication and provided editorial advice. This publication was a comprehensive time series and cross sectional assessment of Michigan production agriculture from 1980 to 1989. The report examined such state data as farm financial characteristics (balance sheet and net income statement), the trend review of crops and livestock, and the identification of statewide agricultural activity by commodity for each county (displayed in graphical density maps).

The final AES special report was entitled "A Review of Michigan's Past and Forecasted Employment Trends for the Food and Agriculture

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[3] Currently the Dean of the College of Agriculture, The University of Florida.

Industry." Michigan food and agriculture employment trends by industry sector were analyzed over the last twenty years. Each industry sector (e.g., agricultural services, meat processors, and food stores) was evaluated by calculating annual employment growth rates and linear shift-share rates compared to the U.S. sectoral trends. Forecasted annual employment growth rates generated by the Bureau of Labor Statistics for each U.S. industry sector, were then applied to each Michigan sector to provide a possible view of the state's food and agriculture economy in the year 2000. It is the culmination of these research activities and other interests that has led to the identification of the need for this research.

Research Identification and Research Approach

Research Identification

Michigan production agriculture has faced many forces of change throughout the decades of the seventies and eighties, some that had never been experienced before. These challenges occurred in the form of drought, floods, competition from domestic and foreign markets, environmental regulations, macro economic fluctuations, trade polices, and technological advancements, among others. Michigan's agricultural decision makers and influencers (academic, private and governmental, etc.) were required to break old paradigms and develop new models for the future. Several task forces (e.g., "Futures Team," "Enriching Michigan's Future," "Project 80 and

5," and "SAPMA") were convened to generate strategies and blueprints for the food and agriculture industry.

Michigan's economic base is typically associated with industries that are heavily invested in fixed capital (durable assets with relatively long useful lives). A prime example is the automotive industry and its many linked suppliers. These firms generally require the fixed capital (the inputs of land, buildings and machinery) to produce durable goods and products. A durable good is a piece of equipment for either consumers or producers, which in normal use will last more than three years. Historically, the general economy of Michigan has been significantly influenced by the cyclical fluctuations of the durable goods industries like furniture manufactures (e.g., Steel Case and Herman Miller) appliance manufacture Whirlpool, and the big three auto companies of Ford, Chrysler, and General Motors. Durable goods are usually large ticket items and are interest rate sensitive. Often in a climate of falling interest rates consumers and producers will expand their purchases of durable goods. The falling interest rates reduces cost of doing business. Conversely, in periods of rising interest rates consumers and producers usually contract their purchases of durable goods. It has been said that when the rest of the country catches a cold (an economic recession or contraction) Michigan catches pneumonia. The saying highlights Michigan's substantial exposure to the durable goods industries and the greater variation in the level of economic activity (e.g., unemployment) compared with the

rest of the country.

A major buffer to the state's economic gyrations has been the food and agriculture industry.[4] The food and agriculture industry provides a stabilizing effect to the economy because it is closely linked with the production of nondurable goods (sometimes called soft goods). Nondurable goods are those consumer or producer items that last for only a short while and are typically purchased as needed, like food for human consumption. Consumers must make food purchases on a consistent basis for either home or away from home consumption because of its perishable nature. Aggregate food consumption remains fairly constant over time even during periods of economic contraction. In a recession consumers continue to purchase food but as incomes decline, substitution effects occur. The substitution effect means that some consumers would shift their purchases of expensive items (such as steak) to more economical items (such as ground chuck). Ultimately, a region's expenditures on food positively correlates with its population base and income level.[5]

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[4] In this case the food and agriculture industry is a comprehensive definition which includes; the input sector, production agriculture, wholesale operations, retail operations, manufacturing, food processing, forestry, agricultural services, and agribusiness.

[5] In 1992 Michigan's resident population was approximately 9.4 million placing the state 8th in the country in size. Also in 1992, Michigan ranked 20th in the country for disposable personal income per capita in current dollars at $17,154.

Research by Professor John Ferris[6] and the author has been conducted to discern the economic impact of the food and agriculture industry on the state's economy. It was estimated that in 1992 Michigan's food and agriculture industry employed approximately 600,000 workers (over 15% of the total work force) and generated gross sales of approximately 30 to 35 billion dollars. The food and agriculture industry is clearly positioned as one of the state's most important industries.

A vital link in the food and agriculture industry chain is production agriculture. Michigan production agriculture is one of the most diverse in the country - ranging from the Western counties where the moderating weather influences of Lake Michigan and sandy loam soils are ideal for growing fruit, to the Saginaw Bay and Thumb region with it's high organic soil content are ideal for growing field crops like soybeans and sugar beets. In terms of production by commodity, Michigan ranked tenth or higher in the country in 1992 for 56 commodities, with nine of those commodities ranked first.[7] Very few states, with the exception of California, produce as many diverse commodities. In 1990 cash receipts totaling over 3.1 billion dollars was

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[6] Agricultural economics professor, Michigan State University, and doctoral committee member.

[7] The commodities ranked first were; Cranberry Beans, Black Turtle Beans, Tart Cherries, Navy Beans, Blueberries, Cucumbers for Pickles, Potted Geraniums, Potted Easter Lilies, and Flowering Hanging Baskets.

generated from the sales of crops,[8] and livestock products placing it 22nd in the nation. Production agriculture also employed approximately 85,000 workers in 1990.

Since production agriculture is critical to the State of Michigan's economy, decision makers in government, professors in universities, entrepreneurs, and corporate leaders are involved in numerous projects and committees to assess its role and potential. Typically, the publications and reports have asked the following questions; where have we been, what changes are likely to occur in the future, and how should Michigan try to influence and position production agriculture going into the new millennium? A comprehensive and systematic review of many key reports and their recommendations has led to the identification of several research opportunities that would enrich future production agriculture projects. These opportunities and observations for research are as follows:

1. Evaluations about the linkages and economic contribution (e.g., employment impacts) of production agriculture to the state's economy were often limited because of sparse data and the need for complex computational requirements. Now many of these questions can be addressed in more definitive and interactive ways with the aid of such

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[8] Crops included; Field crops, vegetables, fruit, and greenhouse and nursery ornamentals.

powerful personal computer software as Micro IMPLAN (an input-output model).

2. Often the data (concerning yields, prices, acres harvested, etc.) used to analyze production agriculture focused only on "major" commodities such as corn, hogs, and soybeans. Many so-called "minor" commodities, especially fruits and vegetables,[9] were not included. With the aid of computers, data retrieval and analyses have become more robust. Researchers[10] have moved massive amounts of hard copy data[11] to the personal computer level. These databases are now being shared by the researchers, and are being expanded to include many of the minor commodities.

3. Not only have the databases and spreadsheets been expanded to include more commodities, but time series data is also more exhaustive. Two often asked questions are "how did we get here" and "where have we been?" Many of these questions are now being addressed with greater speed and detail because of the extensive

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[9] Some of these commodities may not be as significant in terms of their proportion of total state cash receipts, but they are quite significant in their national ranking.

[10] Especially in the College of Agriculture and Natural Resources.

[11] For example, the Michigan Agriculture Statistics Annual Report.

collection databases and spreadsheets. Research can be conducted quickly and with minimal cost using such statistical methods as shift-share analysis to look at the changing structure of Michigan's production agriculture economy.

4. New personal computer software provides easier access to complex statistical and graphical techniques. Many sophisticated analyses and presentations can be used that might have been overlooked because of limited time, or budget constraints in past research endeavors.

Decision makers now have better access to information bases from which to draw more accurate inferences about the status and potential of Michigan production agriculture. The use of personal computers has strengthened this analytical process. This research endeavor is an attempt to utilize many of the computer's powerful capabilities to facilitate an expanded and comprehensive review of the trends, shifts, and linkages in Michigan production agriculture. Using the proposed analytical techniques the research results should serve as a useful foundation for future decision making activities.

Research Approach

In this study an analysis of baseline data is performed during the decades of the 70's and 80's. The research addresses such production agriculture[12] categories as farm cash receipts, prices, yields and quantity produced. The data is analyzed using the statistical methods of time series graphing, cross sectional mapping, ordinary least squares regression, shift-share analysis, and input-output analysis. Each of these analytical methods has been specifically selected to produce a comprehensive body of knowledge concerning Michigan production agriculture trends, shifts and linkages. The research approach and the methods used in the study are described as follows:

1. The research includes a comprehensive graphical presentation of time series data[13] for many of the state's commodities and their production characteristics from 1970 to 1990.

2. Ordinary least squares regression is used to address the long-term secular trends of the different production related categories. Estimated trend functions are fitted to the actual time series data and are displayed in graphs to highlight the direction of change for each category.

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[12]Note: select data is also included from other states and the U.S. for comparative purposes.

[13] Such as; price, yield, output, and number of head animal livestock.

3. Ordinary least squares regression is also used to estimate annual rates of change coefficients for each of the categories. The estimated average annual rate of change yields the magnitude of change for each category's trend.

4. Shift-share analysis is used to identify structural changes in the production agriculture economy from 1970 to 1990. Michigan commodity cash receipts and United States commodity cash receipts are the basis of the comparative analysis. The data is cross sectional, taken from the years of 1970, 1980, and 1990. A three year centered average, [e.g., (1969 + 1970 + 1970)/3] is used for each of the cross sectional time periods. The three-year average reduces the variance of agricultural cash receipts usually associated with shifts in weather patterns (e.g., floods and drought). This approach should capture the appropriate long term trends for analysis.

5. The method of input-output (I-O) analysis is used to ascertain the linkages (e.g., employment multipliers and output multipliers) of Michigan production agriculture. The agricultural multipliers are then compared to the other major sectors (e.g., manufacturing and construction) state's economy. Also, generated in the I-O analysis are trade flow data and consumption patterns of Michigan agricultural

commodities. Note to the reader: the input-output analysis generated in this study uses a software package called Micro IMPLAN. Micro IMPLAN is an analytical instrument specifically developed for the policy/decision maker, ("I" stands for input, "M" stands for output, and PLAN denotes planning). This study is the first known application of Micro IMPLAN to analyze Michigan's production agriculture sector.

The collection of appropriate baseline data and the application of suitable statistical methods should uncover meaningful trends, shifts and linkages concerning Michigan's production economy during the decades of the 70' and 80's. The study's results will benefit decision makers in Michigan farm organizations, farm enterprises, agribusinesses, food processing companies, governmental agencies, universities, environmental groups, and input suppliers.

Organization of the Study

The dissertation is laid out in the following format;

I. INTRODUCTION

II. REVIEW OF THE LITERATURE

III. METHODS

IV. MICHIGAN PRODUCTION AGRICULTURE TREND ANALYSIS

V. THE APPLICATION OF SHIFT-SHARE ANALYSIS TO FARM CASH RECEIPTS, TO ASSESS THE SHIFTS IN MICHIGAN'S COMPETITIVE POSITION IN PRODUCTION AGRICULTURE RELATIVE TO THE UNITED STATES

VI. THE APPLICATION OF INPUT-OUTPUT MODELING TO ASSESS THE LINKAGES AND IMPACT OF PRODUCTION AGRICULTURE ON THE STATE OF MICHIGAN'S ECONOMY

VII. SYNTHESIS AND IMPLICATIONS

II. REVIEW OF THE LITERATURE

A Review of Recent Michigan State University and Department of Agricultural Economics, Production Agriculture Assessment Publications

The analysis of Michigan agricultural baseline data has been a critical task for numerous faculty members in the Department of Agricultural Economics at Michigan State University through the years. Many documents, reports, and publications have been produced for the Cooperative Extension Services, Agricultural Experiment Station, and the Department of Agricultural Economics concerning the status of production agriculture in the state. Two Professors, Karl T. Wright and John N. Ferris, have played critical roles in the generation of many of these publications. The publications[14] reviewed in this chapter include numerous works related to the descriptive analysis of Michigan production agriculture baseline data during the 50's, 60's, 70's, and early 80's.

The Changing Scene in Michigan Agriculture:

This was the title of a Cooperative Extension bulletin that was authored by Wright in October 1978. The bulletin relies heavily on graphical presentations and tables to convey to the reader many of the long-term Michigan production agricultural trends. The graphs used in the publication

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[14] Note: the publications reviewed in this section are identified in the bibliographic section at the end of the thesis.

are bar, line, area, and maps.[15]

The bulletin consists of two primary sections (excluding the introduction). The first section analyzes long-term state trends[16] for four major categories: crops, livestock, economic factors and general. Time series data starting in 1950 and ending in the late 1970's is used to describe the long-term trends. For some Michigan commodities their long-term trend is compared against the national commodity trend. Two primary data sources are used in this section, the first is the Michigan Statistical Service and the second is the United States Department of Agriculture: Economic Research Service.

The second section looks at the state's nine crop reporting districts[17] and changes in county specific data. This section uses cross sectional data for the years of 1964, 1969, 1974, and 1977. Maps are used to show the concentration of different types of farming activity in the counties and tables accompany the maps to show the percent changes in the crop reporting districts. Two data sources are used in this section. The first is the

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[15] Note: the generation of these figures and graphs occurred before the proliferation of powerful micro computer software packages. A graduate student (Daniel A. Dueweke) in the department of geography assisted Dr. Wright by producing the figures and graphs as part of his graduate program.

[16] Some of the trends covered are livestock numbers, field crops acres harvested and yields, farm real estate values and cash from farm marketings.

[17] The nine crop reporting districts in the state are: 1. Upper Peninsula, 2. Northwest, 3. Northeast, 4. West Central, 5. Central, 6. East Central, 7. Southwest, 8. Southern, 9. Southeast.

Michigan Statistical Reporting Service and their Crop Reporting Board data and their data estimations and the second source are the United States Department of Commerce and the Census of Agriculture for Michigan.

Michigan Agriculture - Going Into the Eighties:

This publication was jointly authored by Wright and Ferris for the Cooperative Extension Service in March 1981. The publication is similar to the publication above, the difference however, is the analysis of long-term trends is not as extensive. "Going Into the Eights," thoroughly examines the linkages of Michigan production agriculture with the state's economy and evaluates various commodities and their potential economic impact. As with "The Changing Scene in Michigan Agriculture," "Going into the Eighties" makes extensive use of figures and tables to describe Michigan's production agricultural economy.

The publication begins by giving a brief overview of the many contributions that production agriculture makes to the state's economy. The contribution section flows into a general analysis of the "current" data for the 1978 Census of Michigan Agriculture. Topics such as the percentage breakdown of the type of farm enterprises (e.g., family or partnership) and the percent of farms by the sales per farm are discussed. The next section presents an analysis of the long-run trends for livestock production, crop production, production efficiency, financial factors, and number and

characteristics of farms. The trend review covers the time period from 1960 to 1980. The previous sections form the foundation for looking at the potential growth for various Michigan commodities. To address the issue of potential growth, the authors ask and answer the following six questions:

1) What are the prospects for domestic and export demands for U.S. farm products?

2) What are the comparative advantages and disadvantages for Michigan agriculture compared with other producing areas?

3) How will our comparative advantage (disadvantage change in the future?

4) What changes will take place in the infrastructure for agriculture?

5) What is Michigan's physical potential to expand production?

6) How much can be accomplished by leadership and organized efforts within the state to enhance our production capabilities?

All of the key trends, status, and prospects for Michigan agriculture are then highlighted in a summary section with brief bullet statements.

A Decade of Changes in Michigan Agriculture:

"A Decade of Changes in Michigan Agriculture" was authored by Wright in response to the 1981 Governor's[18] Conference on Agriculture.

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[18] William G. Milliken.

The publication was developed[19] to serve as a "data book" to assist the Governor's task force members as they met for the next few years. The publication reviewed Michigan production agriculture during the decade of the 70's. Two primary sources of data are utilized (1) the Michigan Census of Agriculture Reports from 1969, 1974, 1978 for select county and district data and, (2) annual county data and district from the Michigan Agricultural Reporting Service. The presentation of data in this publication is exclusively tabular,[20] with text that highlights the analysis of the various data series.

The report is laid out into five sections. The first section is an introductory overview of the report. The second section is a general summation of the highlights for state data totals for such categories as number of farms, percentage by type of organization, and sales per farm. The third section goes to the next level of data disaggregation by summarizing the highlights of the key trends by state district. The fourth section is a continuation of section three regarding district data, however, more extensive detail is provided concerning the different categories in each district. The final section is a compilation of Census data displayed in 12 tables describing the changes and concentration of key agricultural activities at the county level.

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[19] Per the suggestion of the screening committee members. Note: the publication was released via the Cooperative Extension Service at Michigan State University.

[20] There were no figures as in the other publications.

Comparing Michigan's Agriculture with that of Nearby States, 1960-1982:

Of the publications discussed in the review of the literature, this is the only one that compares Michigan production agricultural trends verses other states and their production agricultural trends. Wright authored this publication in 1984 as a Cooperative Extension Service bulletin, comparing data for Michigan verses the five states of Minnesota, Wisconsin, Illinois, Indiana, and Ohio.

The publication is segmented into two major sections plus a brief summary and a bibliographic appendix. The first section analyzes time series data from 1960 to 1980 for all of the states (six in total). Section one includes figures that describe linear trends for the headings of crop production, livestock production, farm income and land in farms. Each of these headings is divided into detail about specific commodities and economic classifications. For example, on page 8, is the category of harvested acreage of principal crops that falls under the heading of crop production. This category is accompanied by figure number four entitled, "Harvested Acreage of Principal Crops: Michigan and Five Nearby States, by 5-year Averages, 1960-82," and text that reviews the trends and percent changes of all six states. The second section analyzes the changes in farm enterprise size distribution for the periods of 1968 and 1978.[21] Farm data

[21] Note: most of the data used in this section comes from the Census of Agriculture (state reports) which were conducted in the years of 1969 and 1978.

for each state are segmented into size classifications based on acreage, number of head, or cash receipts. Numerous tables are employed to compare and contrast the data for the headings of crops, livestock and farm characteristics. The tables include numbers of farms, proportions, percent changes and five state average for the commodity and farm characteristics. Most of the data used in the publication comes either from the Census of Agriculture or state reporting services such as Michigan's Agricultural Statistic Service.

A Look at Michigan's Changing Agriculture 1974-1982:

This Cooperative Extension bulletin was published in 1985 in response to the release of the Census of Agriculture for 1982.[22] Wright analyzed data for the census periods of 1974, 1978, and 1982. The publication also uses other data provided by the Michigan Statistical Service, but not as extensively as the census data.

The publication follows a similar pattern to the other "Wright" reports. The first section is highlight and summary[23] of the changes in Michigan Agriculture at the state level from 1974-1982, complete with bullet statements, tables, and figures. The second section reviews the changes in

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[22] Note: there is usually a delay of three years from the time the Census is taken and when it is released.

[23] This could be considered to be an executive summary of the publication.

production agriculture from district level[24] perspective. The district analysis focuses on the changes in crop acreage, livestock numbers, and a general (e.g., total cash sales) category. The third section, and largest section, uses 36 different maps of Michigan with county boundaries coupled with county data to display changes in production agriculture from 1974 to 1982. Each map has text to highlight the findings of the analysis and summary tables to point out leading, lagging, and top county activity. The county review analysis looks at many of the same categories as in the second section's district level of analysis (e.g., livestock numbers).

Selected Charts on Trends in Agriculture in Michigan and Share of U.S. Total:

This is a report produced by author Ferris, which is reviewed in an unpublished format. The report is a collection of twenty figures that display time-series data for different Michigan commodities.[25] All of the commodities have various data series ranging from 1960 to 1988. Each figure is a line graph of two variables. The first variable is the Michigan commodity for example, head of dairy cows and the second variable is the Michigan proportion (or share) of total U.S. dairy cows. The line graphs show the trends for each Michigan commodity and their relative change in

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[24] Note: see the review of "The Changing Scene in Michigan Agriculture" above for an explanation of Michigan crop reporting districts.

[25] Note: the paper reviews trends for such categories as acres harvested, livestock numbers, and cash receipts.

position to the respective U.S. commodity. This report provided an important foundation for using the method of shift-share analysis in this dissertation, to investigate commodity trends between Michigan and the United States.

Michigan Agriculture in the Eighties: A Decade in Review:[26]

In 1992 I wrote this publication for the Agricultural Experiment Station (SAPMA) project. The publication was an analysis of Michigan production agriculture during the decade of the 80's. Its purpose was to serve as a "data book" to assist the various author's and participants in the SAPMA project, much in the same manner as Wright's publication "A Decade of Changes in Michigan Agriculture" did for the 70's The structure and format of the publication have many similarities to Wright's publications. The first section covers key state trends related to farm characteristics, such as farm numbers and acreage in farms. Each trend is displayed in a figure, either line graphs or bar graphs. The figures are accompanied with text and data that highlight the highs, lows, averages, and standard deviation for each category. The second section is an extensive review of the livestock, field crops, fruit crops, vegetable, and nursery and greenhouse crops. The trends of over 38 commodities plus the greenhouse and nursery products are

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[26] Note: this publication was produced for the Michigan State University Agricultural Experiment Station project "Status and Potential of Michigan Agriculture" (SAPMA). For a detailed explanation of the project see the section in Chapter I of this dissertation entitled "Evolution of the Study."

all analyzed by density maps, line trend figures, bar charts, and tables. Text is also integrated with the figures highlighting the changes in the 80's. The third section reviews the economic aspects of Michigan production agriculture. The economic review has four parts of trend analysis for state totals of: (1) farm household income, (2) balance sheet, (3) cash receipts, and (4) employment. As with the other sections, figures and text are used to identify and describe the different trends. The last section is a data appendix that reviews changes in county data, and lists data sets for cash receipts, farm household incomes, and farm balance sheets. The data used in the publication comes from several sources. The most critical data was the time-series data that the Michigan Agricultural Statistical Service publishes annually, this provided the basis for all line trend figures and the county data appendix tables. The second key source of data was the Census of Agriculture for the years of 1972, 1982, and 1987. Other important sources of information used, came from the U.S.D.A. Economic Research Service and the Bureau of Economic Analysis both in Washington, D.C.

Summary

As mentioned in chapter I the purpose of this dissertation is to further develop the "baseline" publications that were reviewed above. This dissertation extends these publications in numerous ways while maintaining a "Wright type" style and format. A number of the unique aspects of the dissertation are identified as follows: This is the first publication to extensively review the decades of the 70's and 80's for Michigan production agriculture.[27] Secondly, the dissertation takes advantage of powerful personal computer (PC) applications. These PC applications[28] have been used to generate all figures, tables, statistical regressions, spreadsheets, input-output analysis and word processing aspects of the dissertation. Thirdly, several analytical methods have never been applied to Michigan production agriculture data before. This is the first known research application of the shift-share method of analysis to decompose the competitive shifts and trends in Michigan production agriculture based on commodity cash receipts. This dissertation is also the first to apply the input-output model (Micro-IMPLAN) to examine the economic structure and linkages of production agriculture with Michigan's general economy. These methods and others used in the dissertation are all described in greater detail in the following "Methods" chapter III.

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[27] Note: the dissertation relies heavily on the publication the researcher authored entitled "Michigan Agriculture in the Eighties: A Decade in Review."

[28] Note: such applications used were Borland's Quattro Pro for Windows and WordPerfect for Windows.

III. METHODS

Time Series Trend Analysis

The time series method of analysis was selected because of the ability to discover and identify the direction and patterns of key baseline data for various Michigan's production agricultural commodities over time. Time series analysis when coupled with a graphical display is a powerful tool for uncovering specific trends and telling a story in a "picture is worth a thousand words," format. This time series analytical approach has been greatly facilitated by the continued development of integrated personal computer programs that can easily merge database structures, statistical calculations, word processing, and graphical output into a comprehensive package.

A time series is a set of ordered observations of a particular variable taken at different points in time. The time series can be represented by a mathematical equation listing the values of the response as a function of time or, equivalently, as a figure on a graph whose vertical coordinate gives the value of the historical data plotted against time on the horizontal axis. The historical data can also be displayed in a tabular format of rows and columns, however, the trend pattern over time can be easily obscured. It is the trend pattern generated by the time series analysis that offers the planning mechanism and not necessarily the individual values themselves.

The time series is often assumed to have three different components. The McGraw Hill Dictionary of Modern Economics defines a time series as being composed of three mutually exclusive and exhaustive components: "(1) The trend cycle consists of cumulative and reversible movements characterized by recurrent and aperiodic intervals of expansion and contraction (the cycle) and by ***longer-run drifts*** underlying the economy (***the trend***). The trend is usually characterized by longer movements than those of the cycle. (2) The seasonal trend represents the composite effect of climatic and institutional factors and is represented by fluctuations that are repeated almost regularly each year. (3) The irregular, the residual that is left when the trend cycle and the seasonal have both been removed from the original economic time series, consists of erratic real-world occurrences and measurement errors and is characterized generally by movements of less than six months' duration."[29] The time series ***trend*** component can be further elucidated by introducing and defining the term "***secular trend.***" A secular trend denotes the regular long-term movement of a series of economic data. The secular trend of most economic series is positive, or upward showing growth, however, in a few cases,[30] the secular trend is negative. The slope of the calculated trend indicates the tendency (up or

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[29] Greenwald, Douglas, and Associates, The McGraw-Hill Dictionary of Modern Economics: A Handbook of Terms and Organizations. (New York: McGraw-Hill, 1984), pp.355-6.

[30] Note: in a number of cases the calculated trends are negative for different variables.

down) of the trend and how fast or how slow the growth (positive, negative, or flat) rate is. The growth or decline of the trend is an indication of changes or shifts that have taken place in either supply-side factors or demand-side determinants from a theoretical perspective. A suggestive list of the factors affecting Michigan (applicable to other states) production agriculture is as follows:

- The adoption of new production technology
- Restrictive or slackened environmental legislation
- Changes in consumer tastes and preferences
- Changes in tax policies
- Shifts in foreign and domestic trade policies
- Changes in commodity price support programs
- Changes in set aside programs.

There are three primary reasons for analyzing trend patterns in the time series data. "First, a study of trend allows us to describe a historical pattern in the data."[31] Often this information is a useful benchmark when evaluating the success or failure of previously implemented public or administrative policies. "Second, a study of trend patterns permits us to project past patterns or trends into the future."[32] When the secular trend is

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[31] Bails, Dale G., and Peppers, Larry C. Business Fluctuations: Forecasting Techniques and Applications, (Englewood Cliffs, New Jersey: Prentice Hall, 1993), p. 75.

[32] Ibid.

identified, the growth rate can be utilized to extrapolate a forecasted trend, which enhances the decision makers' point of reference for formulating policies. The third reason is, "by studying the trend pattern of a time series data, we can isolate or remove the trend component from the actual (Y_t) data."[33] By removing the trend component it is easier to isolate and analyze the residual components of a time series, which is the seasonal, cyclical and residual effects. In chapter IV, the analytical goal is to graphically display the time series data of numerous Michigan agricultural commodities and their prices, value of production, yields, and acres harvested, etc., and their long-run secular trends, during the 1970's and 80's.

Explanation of the Time Series Method of Analysis:

Numerous trend patterns can be identified from time series data. From a mathematical perspective, many of these trends are described in terms of linear, quadratic, exponential, logarithmic, polynomial, square root, or parabolic functions, to name a few. The researcher must identify the function that best describes the trend pattern for the specific time series.[34]

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[33] Ibid.

[34] Note: The methods and processes used by the econometrician to practice his or her trade is often an eclectic combination of both art and science. The researchers' selection of a specific function used to describe a trend pattern, can range on the continuum from highly subjective to highly objective measures. The econometrician, must therefore, rely heavily on experience when performing the analysis and on his or her ability to judge the reasonableness of their assumptions in

When selected, the mathematical function becomes an approximation of the general tendency[35] or the trend pattern of the time series data. In this study I have confined the analysis to calculating only two trend patterns; the linear and exponential function. These two functional forms have been selected for four primary reasons:

(1) The ease of interpreting the statistical output, i.e., the coefficients, and the ability to calculate annual rates of change from the functions.

(2) The ability to compare the two functions to each other based on their statistical goodness of fit (R^2) and, therefore, select the "best fitting trend" function.[36]

(3) The limitation of time to explore other trend functions. The specification of the two functions will generate close to 400 least squares regression runs, for all the different commodity variables.

(4) Other more complex functions (e.g., functions which incorporate sin or cos properties and change signs) could be used to maximize the goodness of fit of the trend, however, the long-run secular trend

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light of all surrounding circumstances related to the time series under investigation.

[35] The general tendency is the direction of the trend pattern up or down, and the rate of change or steepness of the function. It should be noted, for example, that complex functions such as third degree-polynomials are not as clearly analyzed, and are the exception rather than the rule.

[36] Note: the properties of goodness of fit and it's limitations (comparability between different functions) will be discussed forth coming.

would be less clear because of the gyrations of the estimated pattern.

The mathematical function that describes the linear trend pattern is as follows:

$$Y_t = a + bT \quad (1)$$

The variables are defined as follows:

- Y_t = the value of the dependent variable in time period (t) of the time series being analyzed.
- T = the time variable (independent variable) which is incremented annually from 0, 1, 2, ..., T. For most of the time series analyzed in the study, the time variable (T) goes from (0, 1, ..., 20), representing the 21 years from 1970 to 1990.[37]
- a = the y intercept, and a derived coefficient.
- b = the slope of the line, and the amount by which Y_t changes for a unit increase in T, it is also a derived coefficient.

The mathematical function that describes the exponential trend pattern is as follows:

$$Y_t = ab^T \quad (2)$$

The variables are defined as follows:

- Y_t = is the value of the dependent variable in time period (t) of the time series being analyzed.
- T = the time variable, incremented annually from 0, 1, 2, ..., T.[38]
- a = constant multiple
- b = the positive compound rate of growth raised to the power T.

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[37] Note: some time series are broken or shortened because of missing data.

[38] Note: the sign of variable T is positive when (Y_t) is increasing over time, or the sign is negative when (Y_t) is decreasing over time.

The statistical method of least squares regression is used to determine the goodness of fit and the coefficients of the estimated trend equations.[39] This is what is often called the curve fitting process. Equations three through six explain mathematically how the linear and exponential equations were estimated. All of the statistical analyses were performed in the spreadsheet Quattro Pro for Windows.[40] The estimated functions were then merged with the actual data into a graphical format.

The estimated coefficients for the linear function are calculated as follows:

$$a = \overline{Y}_t - bT \tag{3}$$

$$b = \frac{\sum T Y_t - n\overline{T}\,\overline{Y}_t}{\sum T^2 - n T^2} \tag{4}$$

The estimated coefficients for the exponential function[41] are calculated as follows:

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[39] Note: In order to perform least squares regression on the exponential function, the function (the data) must be transformed logarithmically. This procedure turns the function into a line equation which is estimable using least squares regression.

$$\log Y_t = \log a + T \log b$$

[40] Note: Quattro Pro has the capability to calculate least squares regression.

[41] Note: the equations used to estimate the exponential coefficients reflect the line logarithmic transformation, mentioned in the previous footnote.

$$\log a = (\Sigma \log Y_t / n) - \overline{T} \log b \qquad (5)$$

$$\log b = \frac{\Sigma T \log Y_t - \overline{T} \Sigma \log Y_t}{\Sigma T^2 - n T^2} \qquad (6)$$

The regression output of Quattro Pro contains all the needed coefficients to construct the linear and exponential trend pattern functions for each time series. These calculated functions are located in appendix B. It is of particular importance to know that the exponential functions located in appendix B are the estimated logarithmic[42] coefficients, translated back to base 10 by taking the antilog of each coefficient. The conversion makes the exponential coefficients more easily understood and comparable to the linear coefficients. The estimated coefficients serve two important purposes. The first, is the construction of the historic trend pattern for each of the time series. By overlaying the estimated trend pattern on the historical data set, a long-run secular trend can be identified.

The other important purpose is the utilization of the slope coefficient to calculate an average annual rate of change[43] of the trend pattern. The rate of change highlights the degree of growth or decline of the long-run trend,

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[42] Remember that the exponential function requires the translation into a logarithmic format in order to utilize the technique of least squares regression.

[43] Note: an average annual change can also be calculated in absolute numerical terms.

and the rates of change can also be compared between commodity variables.

The econometrics text by Pindyck and Rubinfeld defines R^2 as the proportion of the total variation in Y explained by the regression of Y on X.[44] In this study the independent variable X is actually the independent time variable *(T)*. The calculated R^2 statistic is used as the goodness of fit proxy to identify which trend had the closet match to the actual time series data. The higher the R^2 value[45] of the estimated function the better the fit. In order to select the best fitting function for the trend analysis some modifications for the exponential function was necessary to calculate R^2. The modifications centered around the previously mentioned translation of the estimated logarithmic coefficients back to base 10 (the actual data scale) by taking the antilog. In the same manner the trend line must also be converted into base 10 units. The least squares components of equation seven (TSS, RSS, ESS) are then recalculated. With the decomposition of Y_t complete, a new R^2 is calculated for the exponential function. Then the best fitting trend function (linear or exponential) is selected based on the highest R^2 for Y_t. The best fitting trend pattern is then ready to be fitted with the actual data series Y_t.

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[44] Pindyck, Robert S., and Rubinfeld, Daniel L., Econometric Models and Economic Forecasts, (McGraw-Hill Book Company: New York, 1981), p 62.

[45] Note: the R^2 value ranges from 0 to 1, with 1 being a perfect fit of the estimated trend to actual data, and 0 no correlation between the estimated function and actual data.

The following is a brief description of the process of calculating R^2. The equation is the decomposition of Y_t when least squares regression is applied. This decomposition of Y_t leads to the next step of calculating the goodness of fit (R^2):

$$\Sigma(Y_i - \bar{Y})^2 = \Sigma(Y_i - \hat{Y}_i)^2 + \Sigma(\hat{Y}_i - \bar{Y})^2 \qquad (7)$$
$$TSS = ESS + RSS$$

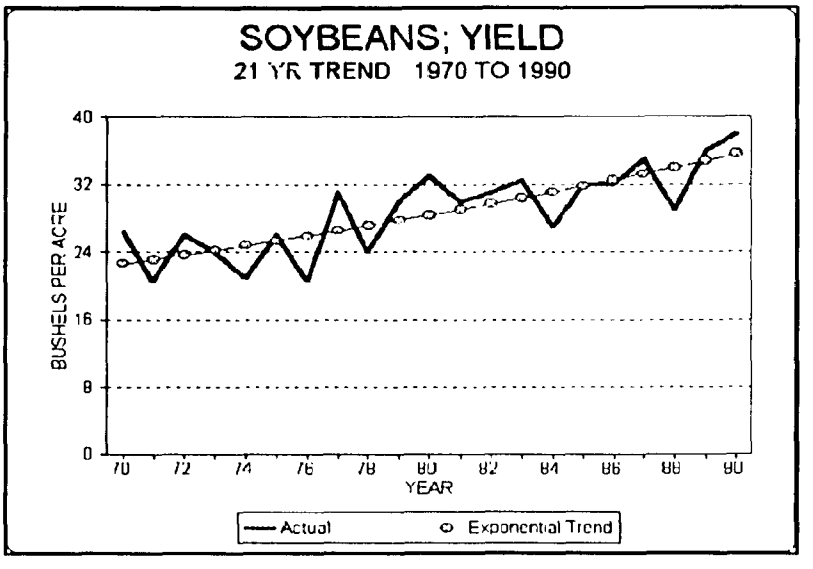
TSS = the total variation of Y (or total sum of squares).
ESS = the residual variation of Y (or error sum of squares).
RSS = the explained variation of Y (or regression sum of squares).
$\bar{Y}$ = the average observed value or mean value of Y_t
$\hat{Y}_t$ = the predicted value
Y_t = the actual or observed value

Equation eight is the definition of (R^2), derived from equation seven above:

$$R^2 = 1 - \frac{ESS}{TSS} = \frac{RSS}{TSS} \qquad (8)$$

Below is an example of the type of graphical integration of the actual time series data (Y_t) and the fitted trend pattern ($\hat{Y}_t$), in this case exponential trend, found in chapter IV. Also, included with the graph is a summary table of statistical highlights of the time series data: average, high,

low, and the average annual rate of change.[46]



YIELD	
21 - YEAR	
Average:	29
High:	38
Low:	21
Avg. Anl. Chg:	2.30%

[46] Note: the method used to calculate the average annual rate of change is mentioned above.

Shift Share Method of Analysis

Explanation of Shift-Share Method[47] of Analysis:

This section is a general overview of the shift-share method of analysis. A short historical explanation of shift-share and the justifications for its research application is developed here. A comprehensive description of the shift-share technique and the models' results and an interpretation of the results is located in chapter V of the thesis.

The disciplines of regional economics and labor economics developed the statistical method of shift-share analysis approximately thirty-five years ago to address differences (what was called "locational shifts") in regional employment patterns over time. Later the method was incorporated into studies that focused on regional income levels and their shifts and changes. Since its inception, the original shift-share technique has been significantly modified and extended. In chapter V the basic shift-share model is reviewed and then adjusted into the more robust and newer Arcelus (I) shift-share technique.

The shift-share method is a descriptive statistical technique that ***does not explain*** the reasons for the shifts and changes in employment or income, but is a tool that ***identifies*** the shifts and changes. The regional analysis

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[47] For reference to a comprehensive review of the shift-share literature see the bibliographic notation for the authors Selting and Loveridge. The University of Minnesota staff paper covers the academic contributions, criticisms, defenses and the extension of the original shift-share technique.

approach to the shift-share method allows the researcher to select a base region and local region for comparative purposes. Various regions such as states, counties, rural areas, urban areas, ethnic backgrounds, etc., can be selected for the analysis. Growth rates (percent changes) for a base region and a local region are calculated[48] and then decomposed into various components such as expected national growth effects and differential national growth effects. The decomposed elements form the basis for identifying the types of "shifts" (employment or income) in a particular region. The shift-share technique allows the researcher to ask such questions as: "are we gaining or losing jobs in an industry," "what industries in our region are considered fast growth employment industries," "what industries are we specializing in," and "what industries do we have a competitive advantage in?"

For purposes of this study the Arcelus (I) model has been selected to analyze production agriculture shifts[49] between the base U.S. region and the local Michigan region. Farm cash receipts are used as the basis for the shift-share analysis instead of the usual employment or income proxies. By using commodity cash receipts as the basis, the Arcelus method is able to

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[48] Typically the employment (or income) data is grouped into respective industrial classifications, (e.g. Standard Industrial Classification codes) to compare the local region against the base region.

[49] Shifts in economic activity that are predicated on changes in the cash marketings of Michigan production agriculture commodities compared to the U.S. cash receipts for the same commodities.

decompose all commodities into comparative growth patterns. Now the questions that were asked above may be rephrased: over time is Michigan gaining or losing in the value of production for a specific commodity, what commodities in our region are considered "fast growth" commodities, what commodities are we specializing in, and what commodities do we have a competitive advantage in? Upon reviewing the literature, there was no evidence that the shift-share technique has ever been used to examine agricultural cash receipts in this manner. This method should provide a solid analytical approach to help baseline the direction of Michigan production agriculture during the decades of the 70's and 80's.

Input-Output Analysis (Linkages)

Explanation of Input-Output Method of Analysis:

Input-output (I-O) analysis is considered part of the field of econometrics. Most I-O approaches integrate economic theory, mathematics, and statistical analysis into an analytical model of a well defined economy (e.g., county, state, or country). In the 1930's, The Russian economist Wassily Leontief was credited with the development of a general theory of production that concentrated on the interdependence (linkages) of industries in an economy. His first American empirical model was constructed in 1936 of the United States economy. Over time, the I-O method gained momentum in the U.S. The growth in I-O modeling was

greatly enhanced by the aggregative national accounting influence of the National Bureau of Economic Research (NBER). The development of comprehensive macro economic data (National Accounts) by the U.S. government fit ideally within the I-O modeling framework.

For purposes of this study an I-O personal computer software package named "Micro IMPLAN" is used to better understand the structure and linkages of Michigan's production agriculture economy. The IMPLAN software uses Michigan specific data[50] to generate the statistical results. The final I-O results[51] include economic multipliers (employment, output, and personal income) and patterns of trade and consumption tables with special attention being paid to Michigan production agriculture. This section is a brief overview of the "mechanics" of the I-O method of analysis.[52]

The model starts with the simplifying assumptions of linear production functions within industries, equilibrium in the economy and homogeneous output that is produced by each industry. The important variables are the outputs that each industry (industrial categories) is divided into in the representative economy. Each industry's output is a product of the summation of sales to all other industries and to final demand. The economy

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[50] Note: latter in this section is a description of the data elements used in the IMPLAN model.

[51] The I-O model results are found in chapter IV.

[52] It should be noted that at the beginning of chapter IV key variables and terms are defined to assist the reader with the interpretation of the I-O results.

is in equilibrium when each industry's output equals its total purchases (from other industries) which are determined by the output of all the other industries.

The basic theoretical structure of the I-O model used in IMPLAN is shown in table I, this is called the "transactions" table. Table I consists of four matrix quadrants that reflect the transactions between the purchasing and producing sectors of a representative economy. The first quadrant I, is the intermediate transactions matrix. This is the flow of goods and services that are both consumed and produced in the current production process. Quadrant II is the final demand sector and reflects the "ultimate consumers'" purchases from the producing industries. Final demand contains four major purchasing institutions (1) household consumption, (2) government expenditures, (3) gross domestic capital formation and (4) exports. Quadrant III represents the primary inputs to production. This includes the labor supplied by households, depreciation, imports, and the government. The final quadrant IV is the economy in equilibrium, where the primary inputs equal final demands. Below is the mathematical representation of the IMPLAN I-O model structure corresponding to Table I:

Table I Structure of Input-Output Transactions Table

			Purchasing Sectors				
			Intermediate Demand	Final Demand			Total Gross Output
			Agriculture, Mining, Manufacturing, Trade, Services, Finance 1 ..... j ..... n	Household Cons.	Govt. Expenditures	Gross Domestic Capital Formation	Exports	
			I Intermediate Production & Consumption	II Final Outputs of Producing Sectors				
Producing Sectors	Intermediate Inputs	Agriculture 1	$X_{11} \cdots X_{1j} \cdots X_{1n}$	C_1	G_1	I_1	E_1	X_1
		Mining :	: :	:	:	:	:	:
		Manufacturing :	: :	:	:	:	:	:
		Trade i	$X_{i1} \cdots X_{ij} \cdots X_{in}$	C_i	G_i	I_i	E_i	X_i
		Services :	: :	:	:	:	:	:
		Finance n	$X_{n1} \cdots X_{nj} \cdots X_{nn}$	C_n	G_n	I_n	E_n	X_n
			III Primary Inputs to Production	IV Primary Inputs to Final Demand				
	Primary Inputs	Payments to Households	$H_1 \cdots H_j \cdots H_n$	H_C	H_G	H_I	H_E	H
		Government	$T_1 \cdots T_j \cdots T_n$	T_C	T_G	T_I	T_E	T
		Depreciation	$D_1 \cdots D_j \cdots D_n$	D_C	D_G	D_I	D_E	D
		Imports	$M_1 \cdots M_j \cdots M_n$	M_C	M_G	M_I	M_E	M
	Total Gross Outlays		$X_1 \cdots X_j \cdots X_n$	C	G	I	E	X

By summing across a row, in quadrant I (table I) intermediate demand plus final demand equals the Total Gross Output for industry "i" the combining of intermediate demand plus final demand in an "n" - industry model:

$$X_i = \sum_{j=1}^{n} X_{ij} + (C_i + G_i + I_i + E_i)$$

Where: X_i = Total Gross Output of Industry i

Σ_{ij} = ***Intermediate Demand*** for the output of Industry i

$(C_i + G_i + I_i + E_i)$ = ***Final Demand*** for the output of industry i

The variables of ***Final Demand*** are as follows:

C_i = Personal Consumption Expenditures

G_i = State and Local and Government Expenditures and Commodity Credit

I_i = Gross Domestic Capital Formation Plus Inventory Purchases

E_i = Foreign Exports

By summing down a column, intermediate inputs (quadrant I) plus primary inputs (quadrant III) produces the Total Gross Outlays of industry j. As follows:

$$X_j = \sum_{i=1}^{n} X_{ij} + (H_j + T_j + D_j + M_j)$$

Where: X_j = Total Gross Outlays of Industry j

Σ_{ij} = ***Intermediate Inputs*** for Industry j

$(H_j + T_j + D_j + M_j)$ = ***Primary Inputs*** for industry j

The variables of ***Primary Inputs*** are as follows:

H_j = Personal Consumption Expenditures

T_j = State and Local and Government Expenditures and Commodity Credit

D_j = Depreciation

M_j = Foreign Imports

By summing across the totals row or down the totals column, the totals (Gross Output and Gross Outlays) for the whole economy are derived.

$$X = \sum_{I=1}^{n} X_I + (H + T + D + M)$$

$$X = \sum_{J=1}^{n} X_J + (C + G + I + E)$$

The two aggregates combined, by definition, shows that the economy is in position of equilibrium.

$$\sum_{I=1}^{n} X_I = \sum_{J=1}^{n} X_J$$

The data used in the IMPLAN model is separated into two major

database sections. The first section is a national-level technology matrix and the second section is a grouping of estimates of sectoral activity. The national technology matrix is the collection of production function coefficients for the different sectors that are applied to regional multiplier and impact analyses. It is therefore, an assumption of the IMPLAN model that Michigan's economy is representative of the U.S. in terms of the methods of production used. The second database section is separated into five major groups. The major groups are final demand, sales, value added, employment, and total industry output. Some of the major groups are further separated into more specific categories that relate to the individual commodities (i.e., the industry sectors such as dairy products and cattle and calves). The following is an outline summary of the database elements:

I. <u>Final Demand</u>: Is the final demand for the output produced by each sector. It is divided and subdivided into 11 data elements. The 12th element is Total Final Demand and is derived from the other 11 elements.

A. **Personal Consumption Expenditures** (PCE): the industry output purchased by individuals or households for personal consumption. There are three levels of expenditures included in the database that are based upon a household income level of:

1. Low < $15,000
2. Medium > $15,000 but < $40,000
3. High > $40,000

B. **State and Local Government Expenditures** (SLG PUR): The expenditures on goods and services required to provide government services. SLG purchases have been divided into the following data elements:

1. State and local government education expenditures (ED).
2. State and local government non-education expenditures (NonED).

C. **Federal Government Expenditures** (FG PUR): Expenditures for goods and services required to provide federal government services. The federal government is separated into:

1. Non-military expenditures (Non MiL)
2. Military expenditures (MiL)

D. **Commodity Credit** (CCC): Excess goods that are bought by the federal government Commodity Credit Corporation.

E. **Inventory Purchases** (INV PURCH): Goods that are not dispersed in a particular year that are stored for sale in the next period. Values in this column reflect additions to inventory amounts for the year.

F. **Gross Private Capital Formation** (CAPITAL FORM): Goods that are sold to industries who use the goods as capital equipment. The sales of these goods provides industries with their capital structure.

G. **Foreign Exports** (FE): Exports of commodities to foreign countries.

H. **Total Final Demand** (TTL Final Demand): This is a summation of all the final demand categories.

II. **Sales**

A. State and Local Government Sales (SLG Sales): Sales of goods and services that have been produced or stockpiled by state and local governments.

B. **Federal Government Sales** (FG Sales): Sales of goods and services that have been produced or stockpiled by the federal government.

C. **Inventory Sales** (INV Sales): Inventory stored in a previous year (Inventory Purchases) and sold in the current period.

III. **Value Added**: Those costs that are added to the intermediate costs of producing goods and services. There are four components of the value added category plus a fifth derived data element "total value added":

A. **Employee Compensation**: Wages and salaries paid to employees by industries plus the value of benefits, and any contributions to social

security and pension funds by the employee and employer.

B. **Property Income**: Income of sole proprietorships, which includes self-employed income.

C. **Indirect Business Taxes**: Include all sales, excise, and value added taxes.

D. **Other Property Income**: Dividend, interest, corporate, and rental income.

E. **Total Value Added** (TTL Value Added): This data element is a total of the above four value added data elements.

IV. **Employment**: The employment estimates are produced from a number of sources that include County Business Patterns and Dunn and Bradstreet.

- Total Industrial Employment (TTL Employment): This figure is expressed in thousands and represents the number of jobs of both full and part-time employment to produce total output.

V. **Industrial Output**:

A. **Total Industrial Output** (TTL Industrial Output): This represents gross industry sales from production.

IV. MICHIGAN PRODUCTION AGRICULTURE TREND ANALYSIS

General Farming Overview

This section is an historical overview of three primary macro trends in Michigan production agriculture during the decades of the 70's and 80's. The three categories reviewed are the number of farms, total land in farms, and the average size per farm in acres.

Number of Farms: Michigan's farm numbers have trended gradually lower in the 70's and 80's, see Figure 1. In 1970 there were 84,000 farms in the state, by 1990 the number of farms had declined to 54,000, a loss of approximately 36%. For the 21 year period, farms fell an average annual rate of 2.07%. When the trend however, is segmented into the 70's vs. the 80's, two different patterns emerge. What appears is a very slight drop in the rate of decline in the number of farms. In the 70's, farms dropped at an average annual rate of 2.53%, for a total reduction of 19,000. During the 80's the rate slowed to an annual decline of 1.84% with only 11,000 farms leaving production.

Land in Farms: As expected, the amount of land in Michigan farms had a similar trend pattern, see Figure 2. In the 70's, land fell at an average annual rate of 1.07%, for a total reduction of 1.3 million acres. During the 80's the

average rate slowed to an annual drop of 0.54%, and a total decline of 600 thousand acres. Overall, total land in farms fell from 12.7 million acres in 1970 to 10.8 million acres in 1990, a drop of 15%.

Average Size of Farms: Many reports[53] have highlighted the nation wide trend toward consolidation and growth of farms into larger enterprises. Michigan is no different. From 1970 to 1990, the average Michigan farm grew in size from 151 to 200 acres, see Figure 3. The farm size growth trend was an average annual rate of 1.39%. This trend does not show the same kinds of strong bifurcated patterning as discussed above. The growth trend is more constant. The average farm picked up 24 acres during the 70's and another 25 acres in the 80's, no reduction in absolute terms.

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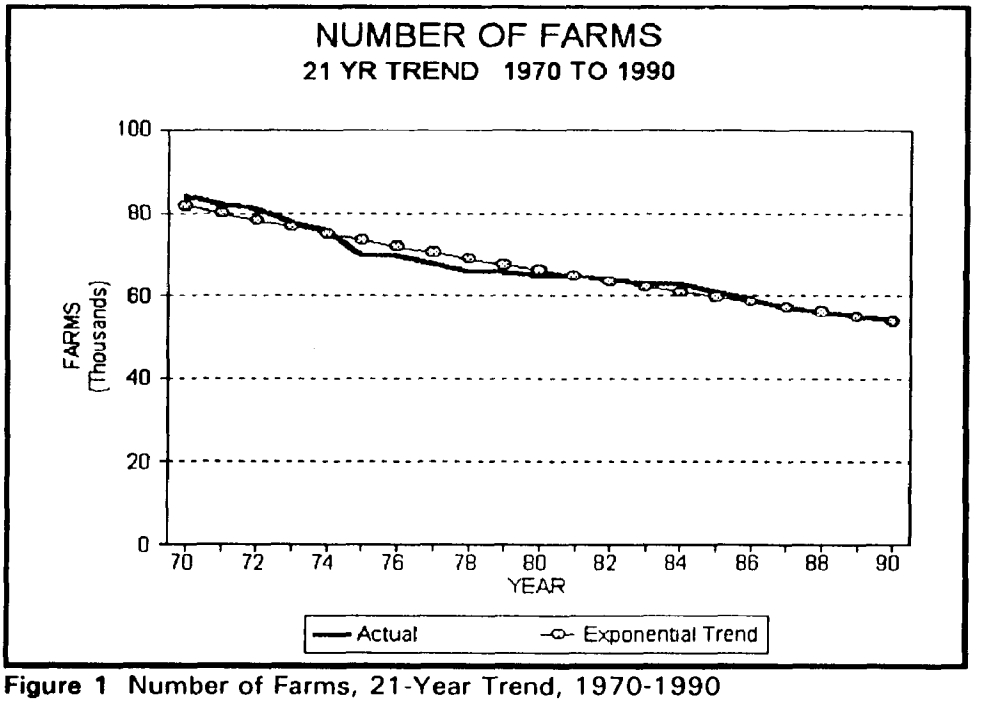
[53] An example of the types of reports that are addressing this issue is as follows: U.S. Department of Agriculture, Economic Research Service, Structural Change in U.S. Farmland, by Robert C. Reining, Agricultural Economic Report 617, (Washington D.C.: Government Printing Office, issued June 1990).



NUMBER OF FARMS

21 - YEAR

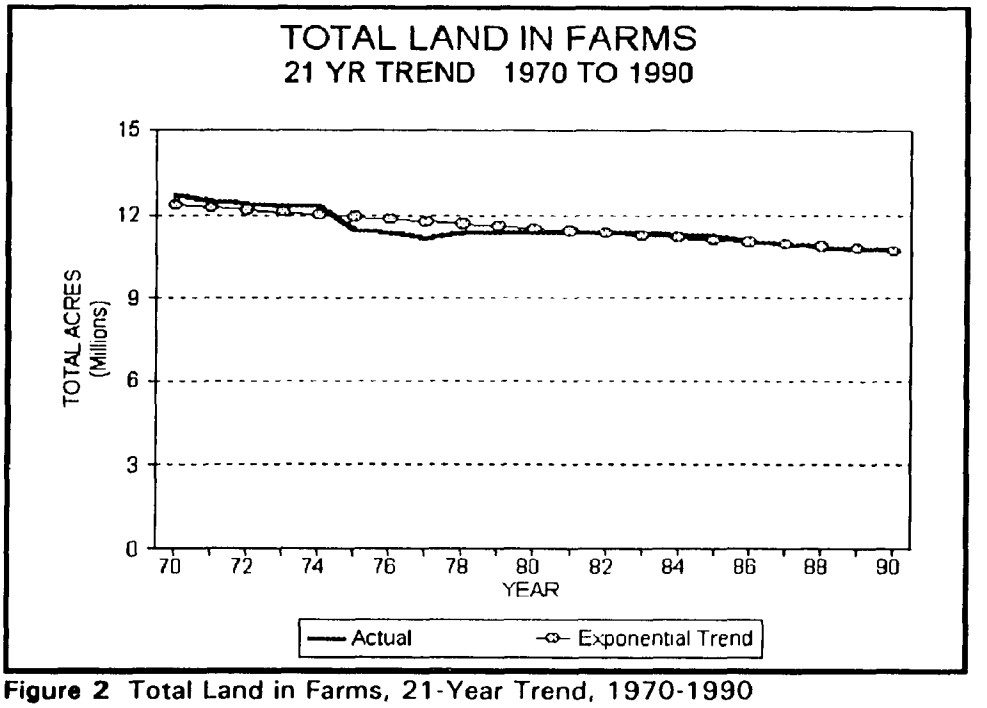
Average:
66,810

High:
84,000

Low:
54,000

Avg. Anl. Chg:
-2.07%

Figure 1 Number of Farms, 21-Year Trend, 1970-1990



TOTAL LAND IN FARMS

21 - YEAR

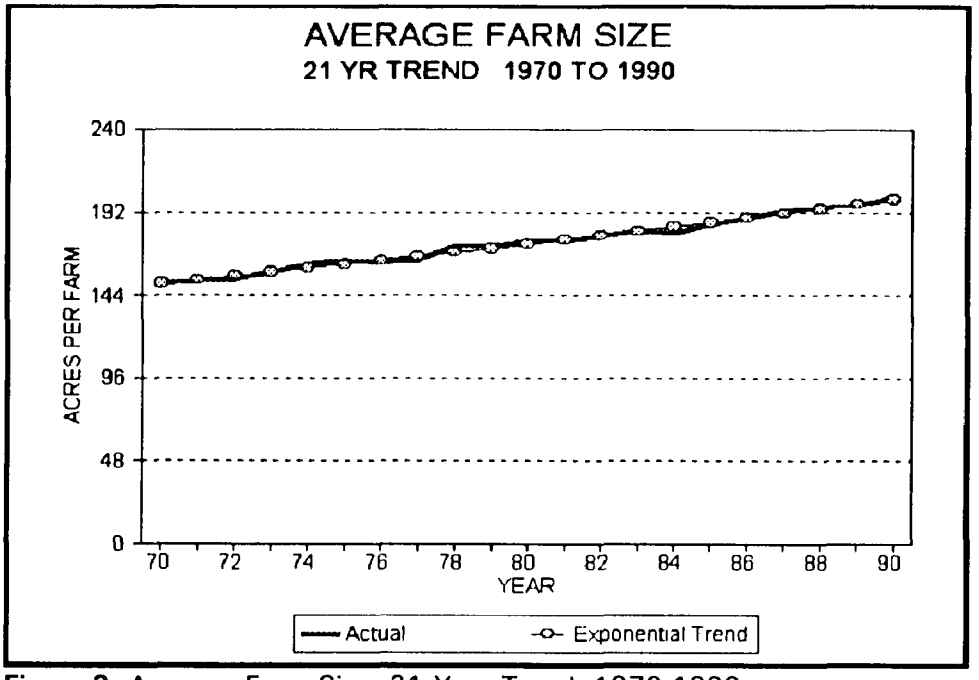
Average:
11,519,000

High:
12,700,000

Low:
10,800,000

Avg. Anl. Chg:
-0.70%

Figure 2 Total Land in Farms, 21-Year Trend, 1970-1990



AVERAGE SIZE OF FARMS

21 - YEAR

Average:
174

High:
200

Low:
151

Avg. Anl. Chg:
1.39%

Figure 3 Average Farm Size, 21-Year Trend, 1970-1990

General Field Crop Overview

This section reviews the important crop trends of price, yield, acres harvested, value of production, and quantity produced for each of Michigan's top ten field crops.[54] The section also discusses some of the economic forces and weather patterns that have significantly influenced crop production. Of special note is the weather disaster of 1988, the effects of which were similar to the 1930's drought that affected much of the U.S. During the months of May and June, numerous state weather stations recorded record low rainfall. Many of these stations registered rainfall that was half to one third below normal. This late spring and early summer moisture shortage severely hampered crop development throughout most of the state. To make matters worse, the fall was exceedingly wet, bringing yearly precipitation totals to near normal levels. The deluge of rain in such a short time period caused such wet field conditions that the abandonment rate soared and much of the harvesting was delayed until winter. Ultimately, these two weather obstacles led to lows in field crop production that had not been seen since the 1930's.

Table II is a trend summary of field crops ranked by the average annual percent changes for each category (yields, price, etc.). Figures 4 and 5 are the aggregation of all field crops for the categories of value of production and acres harvested. Field crop acres harvested have expanded at a fairly slow rate of 0.87% per year, increasing from just below 5.4 million acres to just

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[54] The Michigan field crops selected for analysis were the top ten based on value of production.

below 6.0 million acres in 1990. Value of production has increased at a faster annual rate of 4.40%. The total field crop value has expanded from approximately $400 million in 1970 to almost $1.6 billion in 1990, a four fold increase, see Figure 2.

Table II Trend Summary for Crops, Commodity Rank by Average Annual % Change for 21-Years, 1970-1990

TREND SUMMARY FOR CROPS
COMMODITY RANK BY
AVERAGE ANNUAL % CHANGE FOR
21-YearS FROM 1970 - 90

Acres Harvested

Rank	Commodity	% Chg.
1	Barley	4.74%
2	Soybeans	4.10%
3	Sugarbeets	3.05%
4	Hay	1.32%
5	Corn	0.95%
6	Potatoes	0.62%
7	Wheat	0.35%
8	Corn Silage	-0.98%
9	Oats	-1.96%
10	Dry Beans	-3.38%
	Average	0.88%

Production

Rank	Commodity	% Chg.
1	Soybeans	5.98%
2	Barley	5.68%
3	Hay	3.26%
4	Sugarbeets	3.26%
5	Corn	2.68%
6	Wheat	2.11%
7	Potatoes	1.32%
8	Corn Silage	-0.59%
9	Oats	-1.33%
10	Dry Beans	-1.99%
	Average	2.04%

Yield

Rank	Commodity	% Chg.
1	Soybeans	2.30%
2	Hay	1.98%
3	Wheat	1.96%
4	Corn	1.86%
5	Dry Beans	1.48%
6	Barley	1.05%
7	Potatoes	0.62%
8	Corn Silage	0.46%
9	Oats	0.41%
10	Sugarbeets	0.20%
	Average	1.23%

Price

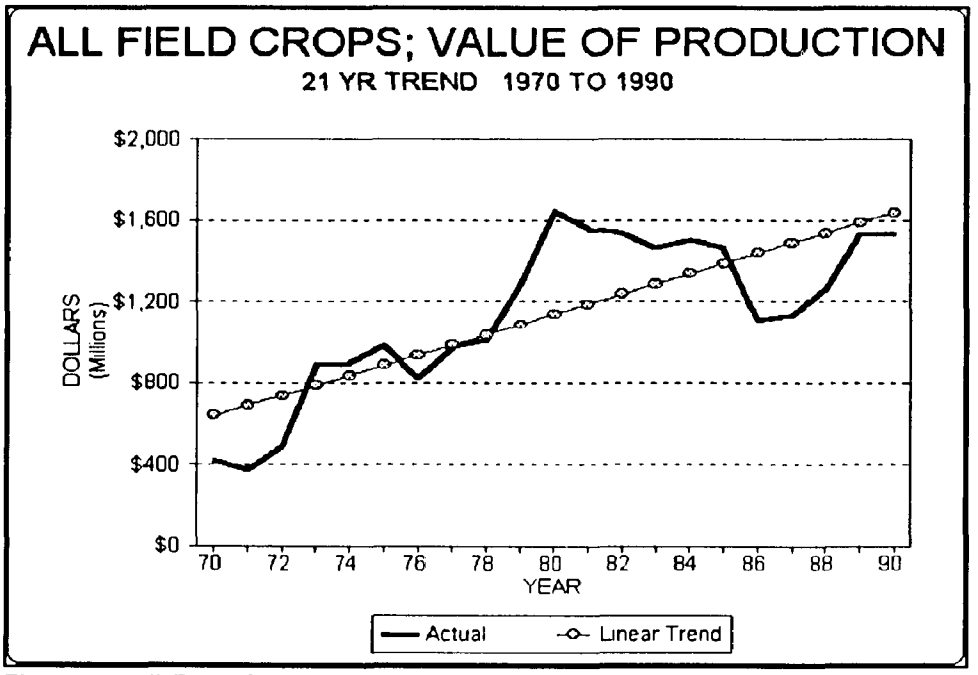
Rank	Commodity	% Chg.
1	Hay	4.63%
2	Potatoes	3.31%
3	Sugarbeets	3.21%
4	Oats	2.50%
5	Dry Beans	2.35%
6	Barley	1.97%
7	Soybeans	1.59%
8	Wheat	1.40%
9	Corn	1.32%
	Average	2.48%

Table II (Continued), Trend Summary for Crops, Commodity Rank by Average Annual % Change for 21-Years, 1970-1990

TREND SUMMARY FOR CROPS
COMMODITY RANK BY
AVERAGE ANNUAL % CHANGE FOR
21-YearS FROM 1970 - 90

Value of Production

Rank	Commodity	% Chg.
1	Sugarbeets	7.69%
2	Hay	7.36%
3	Barley	6.75%
4	Soybeans	6.72%
5	Potatoes	4.45%
6	Corn	3.38%
7	Wheat	2.87%
8	Oats	0.95%
9	Dry Beans	0.31%
	Average	4.50%



VALUE OF PRODUCTION

21 - YEAR

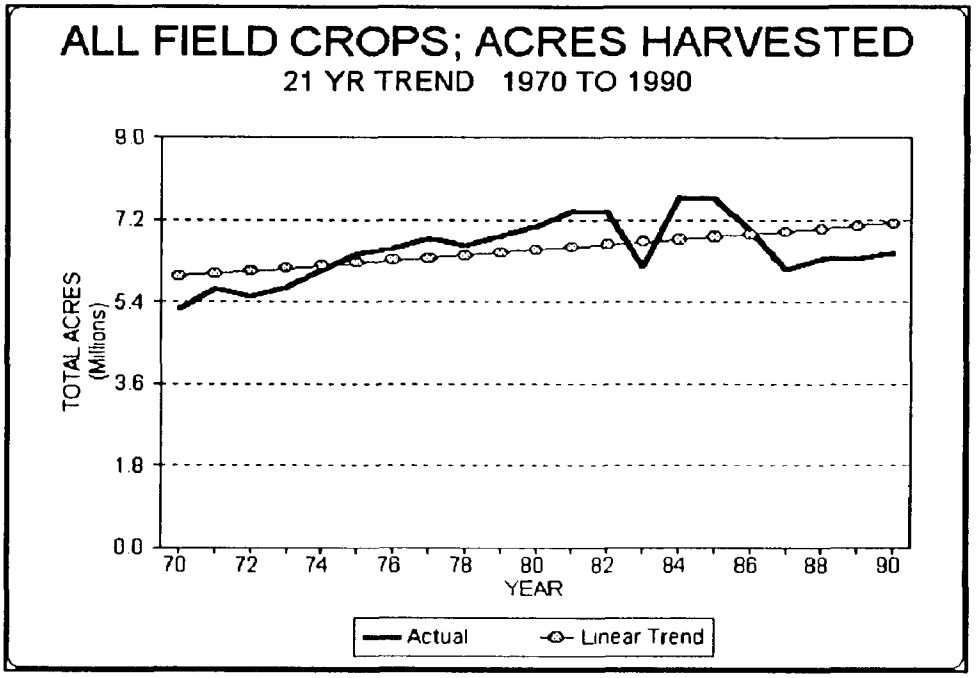
Average: $1,138,381,827

High: $1,644,995,650

Low: $376,448,500

Avg. Anl. Chg: 4.40%

Figure 4 All Field Crops Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

Average: 6,544,890

High: 7,698,800

Low: 5,241,900

Avg. Anl. Chg: 0.87%

Figure 5 All Field Crops Acres Harvested, 21-Year Trend, 1970-1990

Barley: Most barley grown in Michigan is used for feed, however, a small portion is sold for malting. Barley production is confined predominantly to the three counties of Huron, Sanilac, and Tuscola. These three counties account for approximately 40% of the state's production. Huron county alone produces 25% of the barley.

Although barley is not thought of as a major field crop in Michigan, it has quietly increased in production. Acres harvested have doubled in the 21 years of analysis, growing at an average annual rate of 4.74%,[55] first for all Michigan field crops, see summary Table II. Acres in production have expanded from 20,000 in the 70's to well over 40,000 acres in the 80's. The amount of barley acres harvested is now comparable to all the state's potatoes area harvested. Most of this growth has occurred during the decade of the eighties, see Figure 7. Yields have also improved, at an average annual rate of 1.05%. The higher yields coupled with the rise in acres harvested has provided a significant increase in the quantity of barley produced. Production of barley increased from an average of approximately one million bushels a year for much of the 70's, to consistently over 2.5 million bushels a year in the late 80's. The only field crop with a higher trend rate in terms of total quantity produced are soybeans.[56] The price per bushel trend is steadily

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[55] Note: the trend for barley is exponential rather than linear, see Figure 7, this highlights the rapid growth in acres harvested.

[56] Soybean production increased at an average annual rate of 5.98%.

upward,[57] but highly variable. Barley prices have ranged from a low of $0.79 in 1970, to a high of $3.75 in 1980. Given the rise in prices and the rapid increase in the quantity produced, it is not surprising to discover that the value of production has grown as well. Barley value of production increased at an average annual rate of 6.75%, just behind sugarbeets and hay. Total value has increased from below $1 million per year to over $5 million per year. By far the smallest value of production for the field crops studied, but the growth in percentage terms is one of the largest.

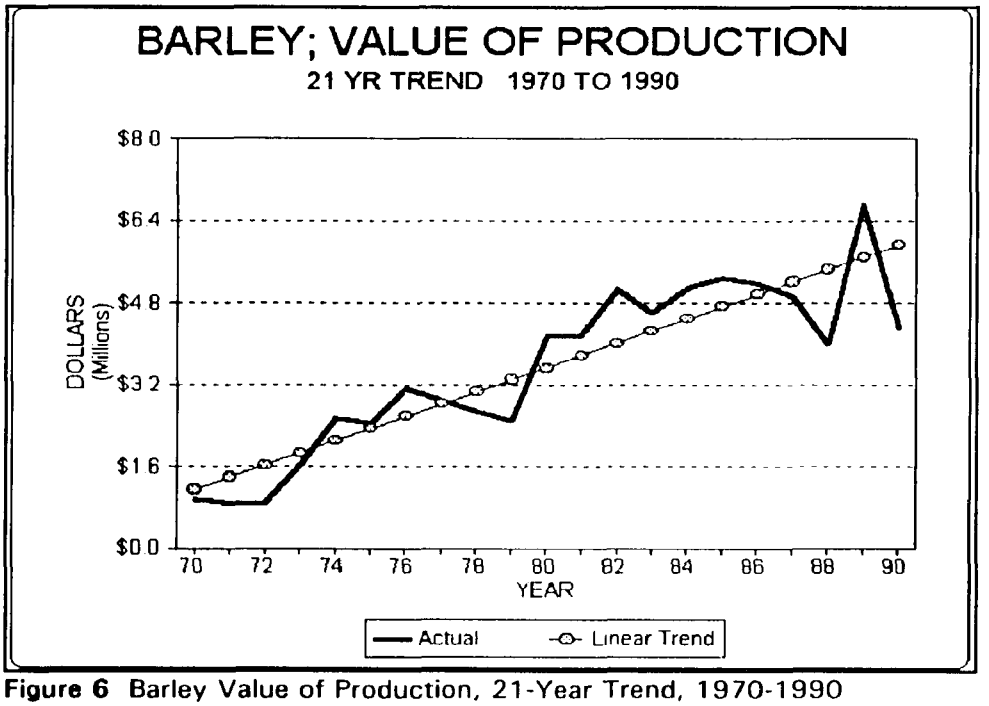
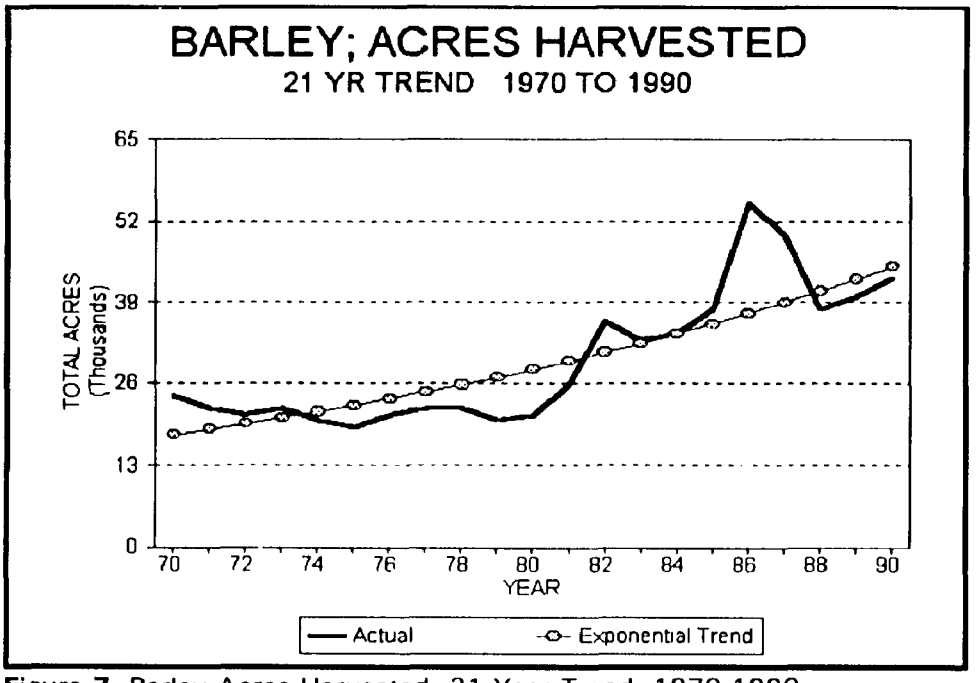


Figure 6 Barley Value of Production, 21-Year Trend, 1970-1990

[57] The average annual growth rate is 1.97% for the barley price per bushel.



ACRES HARVESTED

21 - YEAR

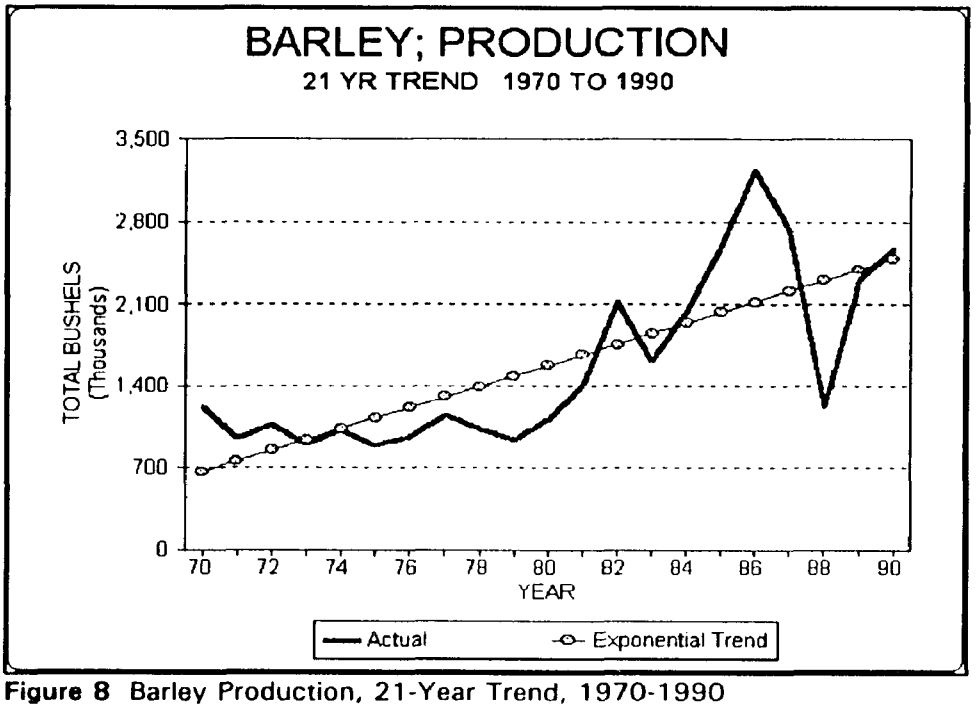
Average:
29,857

High:
55,000

Low:
19,000

Avg. Anl. Chg:
4.74%

Figure 7 Barley Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

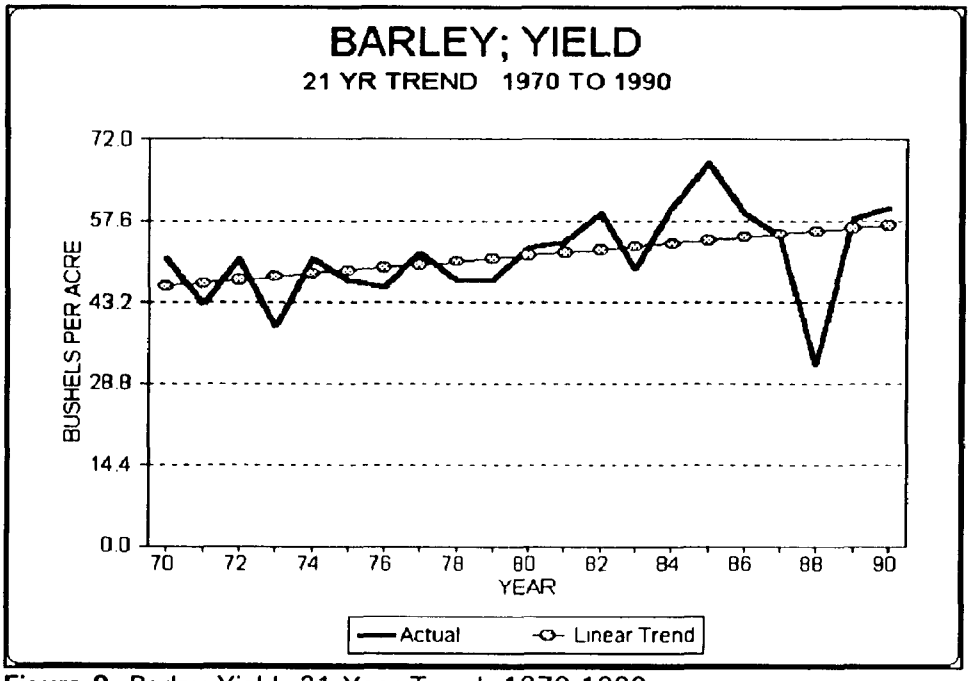
Average:
1,577,524

High:
3,245,000

Low:
893,000

Avg. Anl. Chg:
5.68%

Figure 8 Barley Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

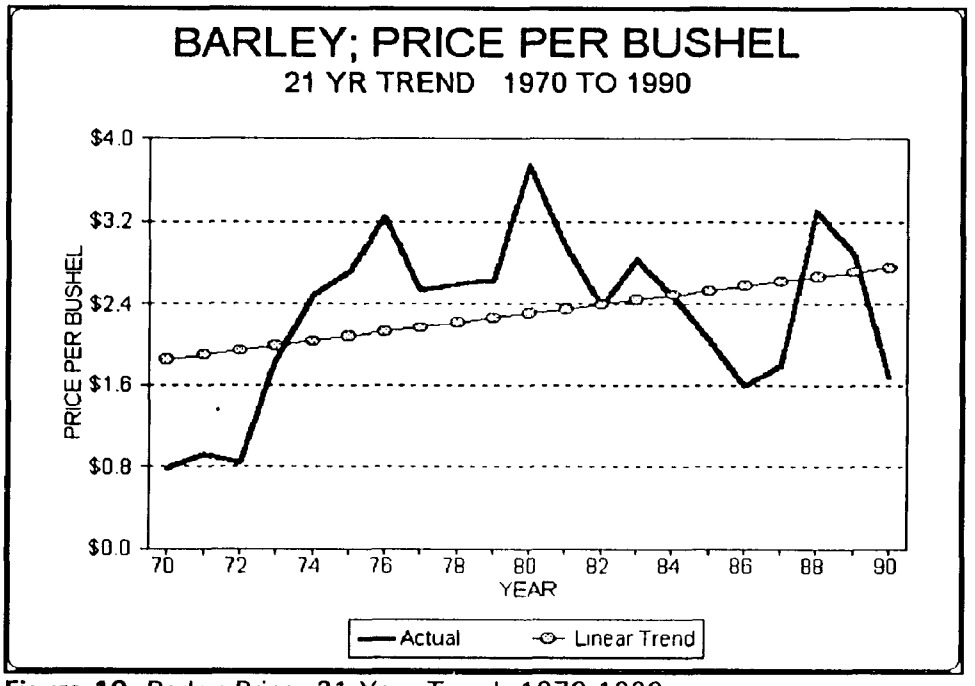
Average:
51

High:
68

Low:
32

Avg. Anl. Chg:
1.05%

Figure 9 Barley Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$2.31

High:
$3.75

Low:
$0.79

Avg. Anl. Chg:
1.97%

Figure 10 Barley Price, 21-Year Trend, 1970-1990

Corn for Grain: Corn for all purposes is one of Michigan's most abundant and important livestock feed grains.[58] The corn is used primarily in the dairy and cattle industries. The rest of the corn is either shipped to export markets, dry milled, wet milled, distilled or used as seed. It's grown in almost every county in the lower peninsula. Sixty-six of the sixty-eight counties in the lower peninsula harvest over 500 acres or more of corn a year. In 1990 the top five producing counties were Huron, Lenawee, St. Joseph, Sanilac, and Branch. These five counties account for approximately 24% of the state's total acres harvested annually.

During the 21 years of analysis, one year 1983, requires discussion. In 1983 the U.S. Department of Agriculture instituted the Payment in Kind (PIK) program. By participating in PIK farmers agreed to remove acreage from production and receive a specified amount of corn or wheat as a payment for not planting. The program was designed as a supply management tool to control a nation wide surplus of corn. Michigan's enrollment in the program reduced production acreage by 34 percent or 940,000 acres, see Figure 12. Once the program was lifted in 1984, acreage planted returned to normal preprogram levels. The other year of note is 1988 and the effects of a drought. The drought of 1988 was the worst weather conditions experienced by Michigan farmers since the 1930's. Many weather stations recorded record low rainfall during May and June, generally one half to one third below

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[58] The other major feed sources are hay and corn silage.

normal rainfall amounts throughout the state. The lack of moisture severely damaged critical plant development. To compound problems further, the fall was exceedingly wet, bringing yearly precipitation totals to near normal levels. The result was wet field conditions, abandonment, delayed harvesting until freeze-up, and plummeting yields.

The 21-year trend for Michigan corn production is gradually upward despite the significant interruptions mentioned above. Most of the growth occurred in the first decade and the early 80's. Acres harvested increased from 1.4 million acres to a record high of 2.8 million acres[59] in 1981. During the 80's harvested acres have retreated to a consistent level of 2.0 million acres. Yields have expanded an average annual rate of 1.86%, 4th for all Michigan field crops. Michigan recorded it's highest state average yield per acre of 115 bushels of corn in 1990. The increase in yields plus an expansion in acres harvested has meant that the quantity of corn produced has also grown. The corn production trend is an average annual increase of 2.68%, 5th for all field crops. In 1982 Michigan set a production record for 293 million bushels, see Figure 13. The state is currently 8th in the country in corn production, producing 3.0% of the share, Iowa is first.

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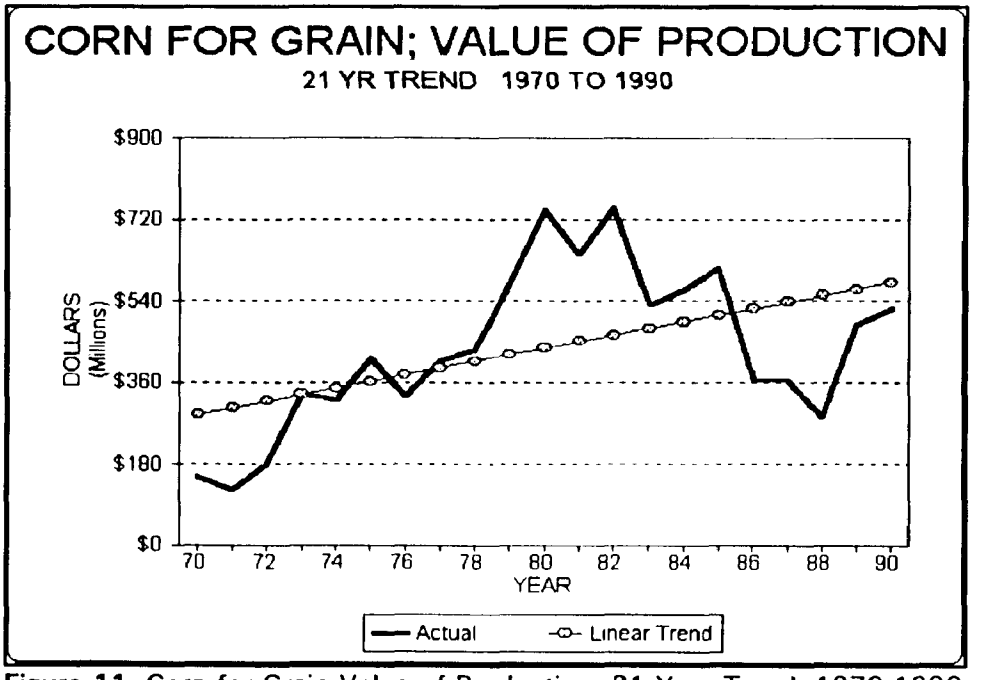
[59] The 1981 state record of 2.8 million acres was the highest amount recorded since yearly estimates began in 1924.



VALUE OF PRODUCTION

21 - YEAR

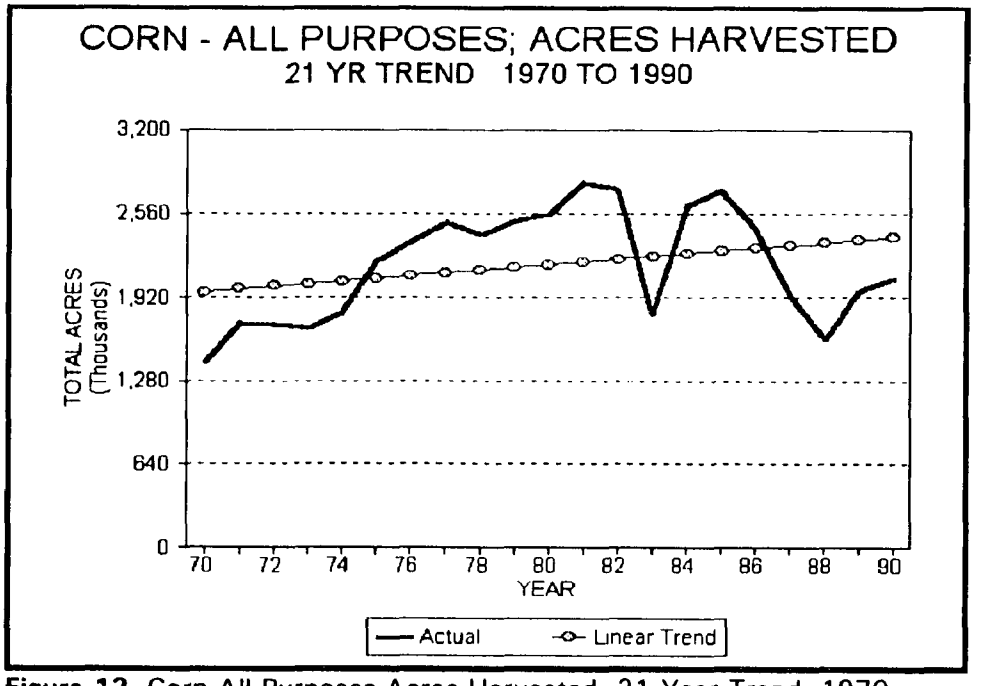
Average: $435,680,407

High: $747,609,000

Low: $122,951,100

Avg. Anl. Chg: 3.38%

Figure 11 Corn for Grain Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

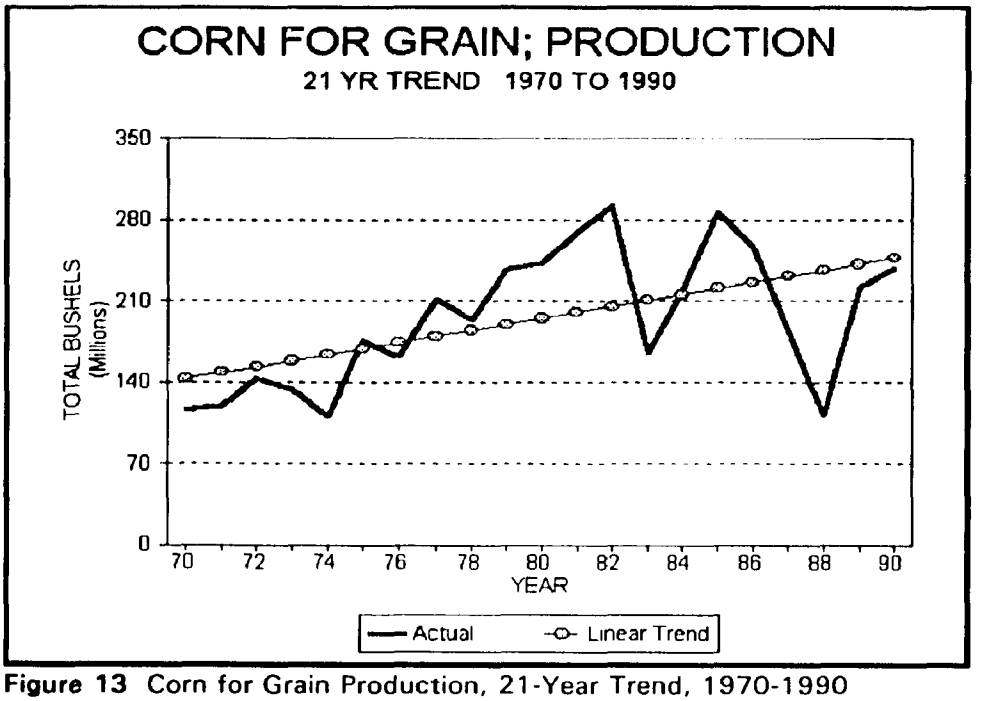
Average: 2,171,476

High: 2,800,000

Low: 1,429,000

Avg. Anl. Chg: 0.95%

Figure 12 Corn-All Purposes Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

Average:
195,030,714

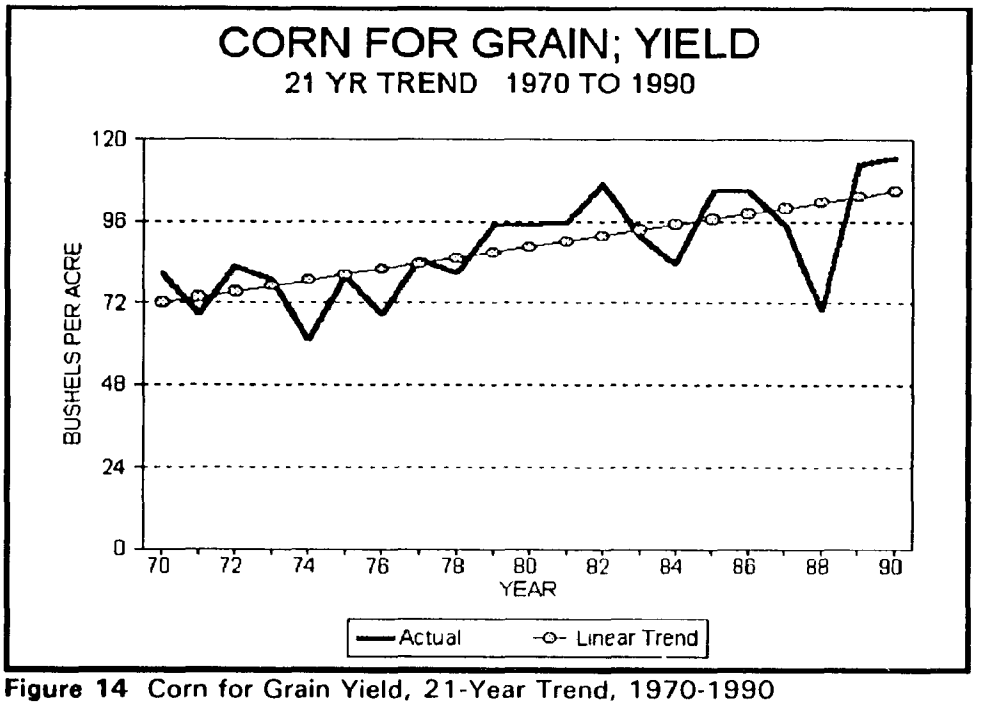
High:
293,180,000

Low:
110,410,000

Avg. Anl. Chg:

2.68%

Figure 13 Corn for Grain Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
89

High:
115

Low:
61

Avg. Anl.
Chg: 1.86%

Figure 14 Corn for Grain Yield, 21-Year Trend, 1970-1990

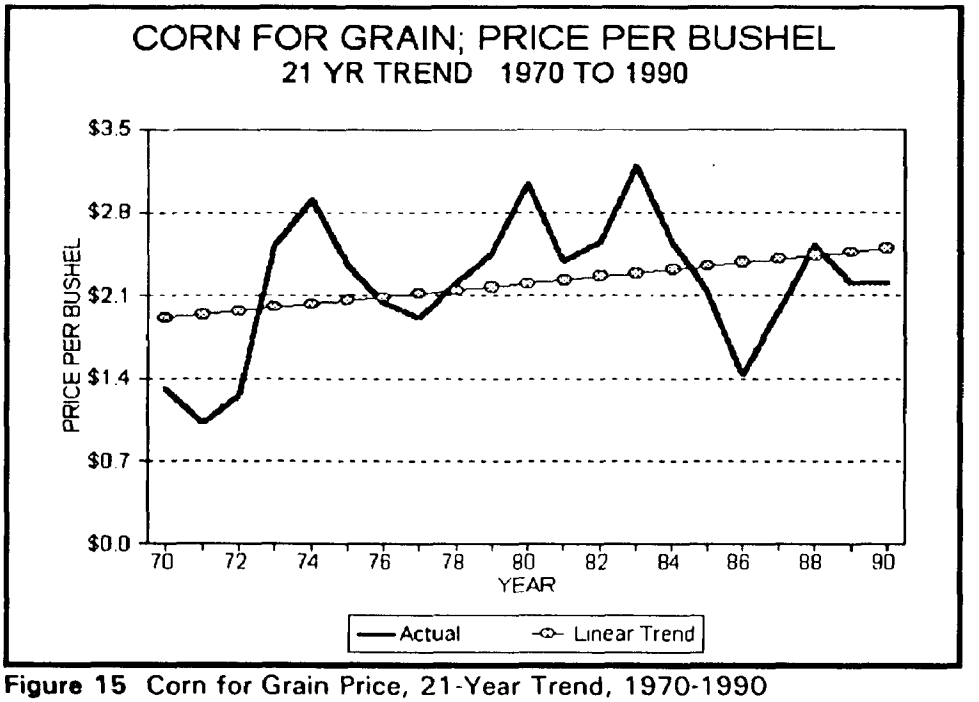


Figure 15 Corn for Grain Price, 21-Year Trend, 1970-1990

Corn Silage: Corn silage is a critical input for Michigan's dairy and cattle industries. It's not surprising that the state's leading dairy counties; Sanilac and Huron,[60] are first in the in the production of corn silage. These two counties account for over 18% of the state's total acres harvested. In 1990 Huron county harvested 26,000 acres and Sanilac harvested 25,000 acres.

Total state production of corn silage has been declining for the last two decades. Acres harvested have fallen an average annual rate of 0.98%.[61] The trend for yields shows minor improvements increasing at an average annual rate of 0.46, 8th for all field crops. In 1990 an average state

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[60] In 1990 Sanilac county had 25,700 milk cows and Huron county had 17,300 milk cows.

[61] Note: oats and dry beans were the only other crops to have a declining acreage trend.

yield record was set for 14.5 tons per acre, see Figure 18. Given the faster rate of decline for acres harvested compared to the gradual rise in yields, the quantity produced has subsequently dropped. Production has trended downward at an average annual rate of 0.59%. Production peaked in 1977 when a record of 5.6 million tons was established. Since 1977, the quantity of silage harvested has consistently fallen below 4.0 million tons. Michigan was ranked 8th in the country in production, in 1990, producing 4.7% of the share, Wisconsin is the leading state.

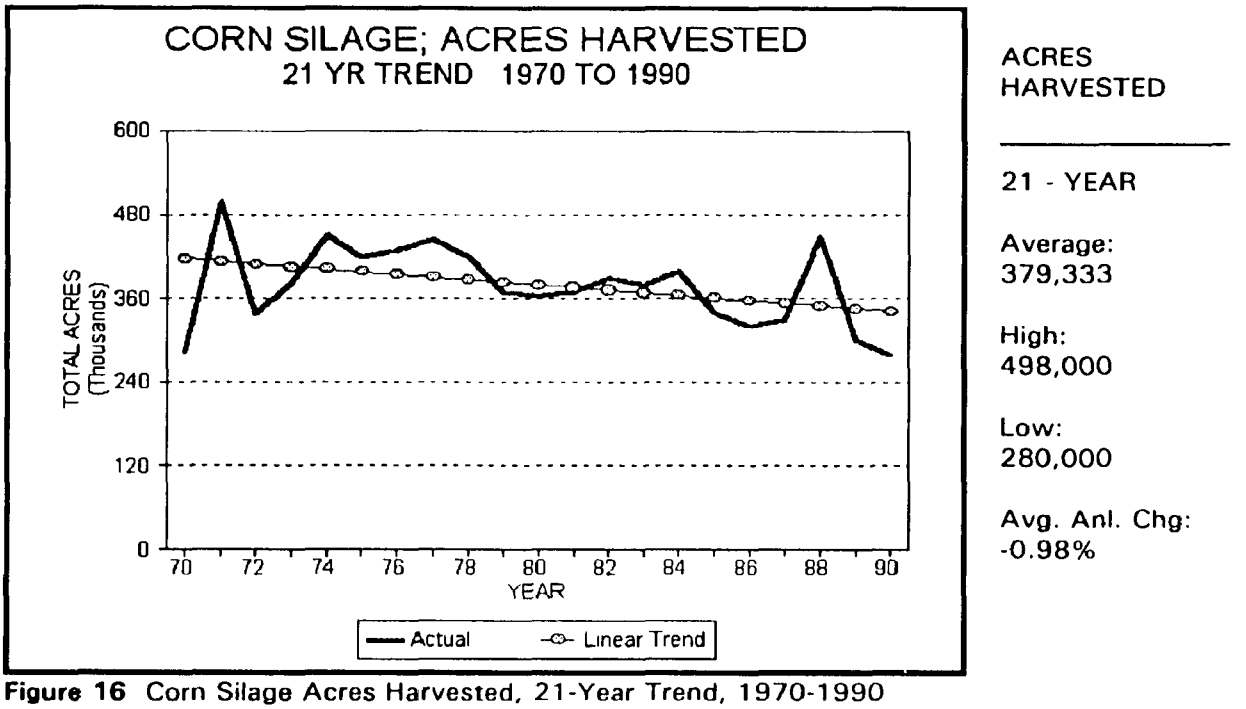
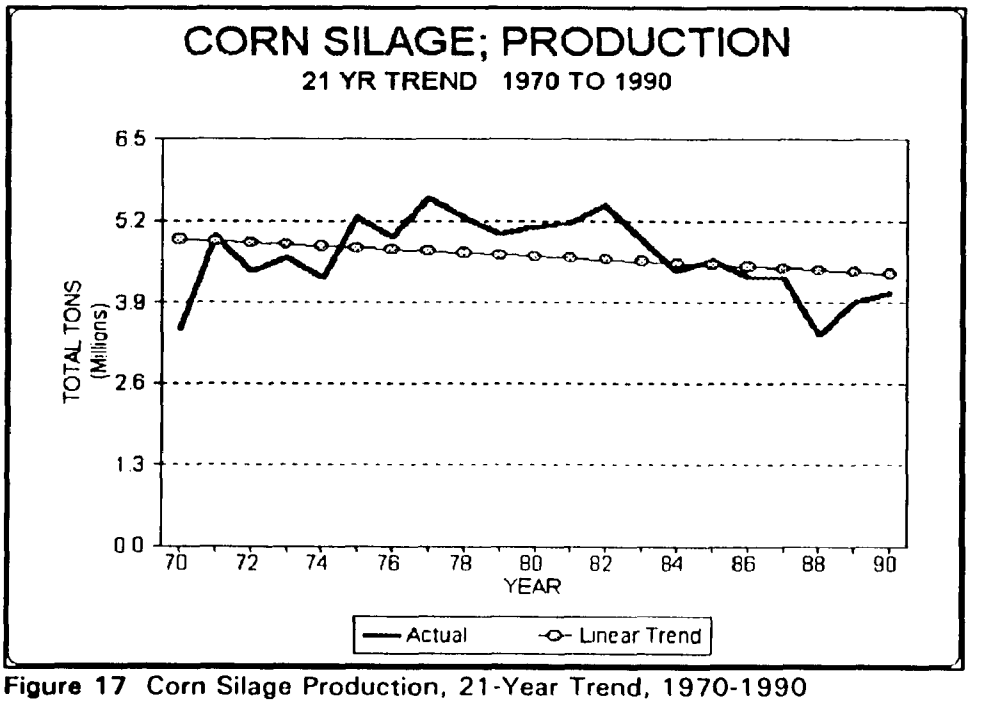


Figure 16 Corn Silage Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

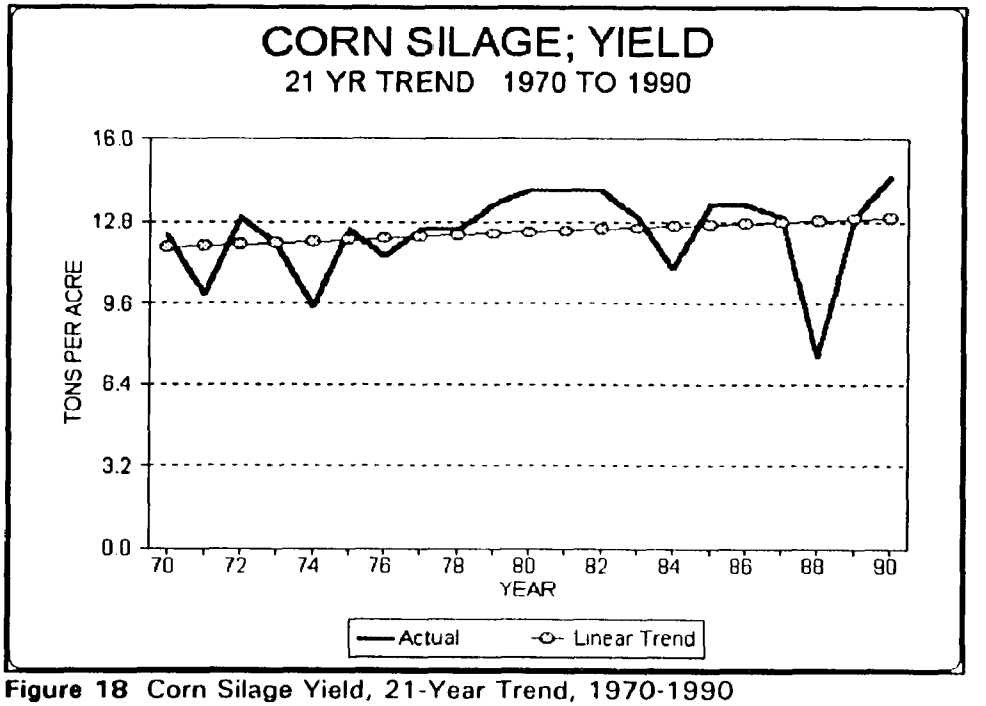
Average:
4,638,095

High:
5,565,000

Low:
3,375,000

Avg. Anl. Chg:
-0.59%

Figure 17 Corn Silage Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
12.4

High:
14.5

Low:
7.5

Avg. Anl. Chg:
0.46%

Figure 18 Corn Silage Yield, 21-Year Trend, 1970-1990

Dry Beans: Michigan has been called the dry bean capital of the World. Most of the dry bean production is located in the fertile soils of the Bay-Thumb area in the state. The two counties of Huron and Tuscola account for approximately 40% of the total production. The state's competitive position however, has been declining throughout the decades of the 70's and 80's. In the early 70's Michigan produced over 30% of the United States total dry bean production and for some varieties such as navy beans, the state produced 90% of the total. By 1990 however, Michigan's national share of total dry bean production had declined to 16.8% and 53.8% for navies. What does the trend analysis reveal?

Acres harvested of all dry beans has been on a downward trajectory for most of the 21 years of analysis. The only significant deviation from the trend occurred from 1980 to 1982. In 1980 an unexpectedly large export market for colored beans emerged with Mexico. Given the new bean market, acres harvested escalated to over 570,000 acres (up 24% in one year), production increased to over 7.75 million hundred weight (up 20% in one year), and value of production soared to $204 million (up 72% in one year), the different spikes are shown in each of the respective figures. By 1982, the Mexican export market for colored beans, primarily black turtle and pinto beans deteriorated and Michigan dry bean production had returned to pre-1980 levels. The 21-year trend for bean acres harvested shows an average annual decline of 3.38%. Dry beans are last among the ten field crops analyzed, only

oats and corn silage posted a negative acres harvested trend. The trend for the quantity of beans produced was also significantly negative. Dry beans have declined an average annual amount of 1.99%, last for all field crops, see summary Table II. The trend for the price of beans per Cwt. persisted higher. Dry bean prices rose annually at an average of 2.35%, fifth for all field crops. The increase in bean prices coupled with the declines in production has meant that the value of production trend is flat, see Figure 19. The 21-year trend for bean value of production is an average annual increase of only 0.31%, last for all field crops.

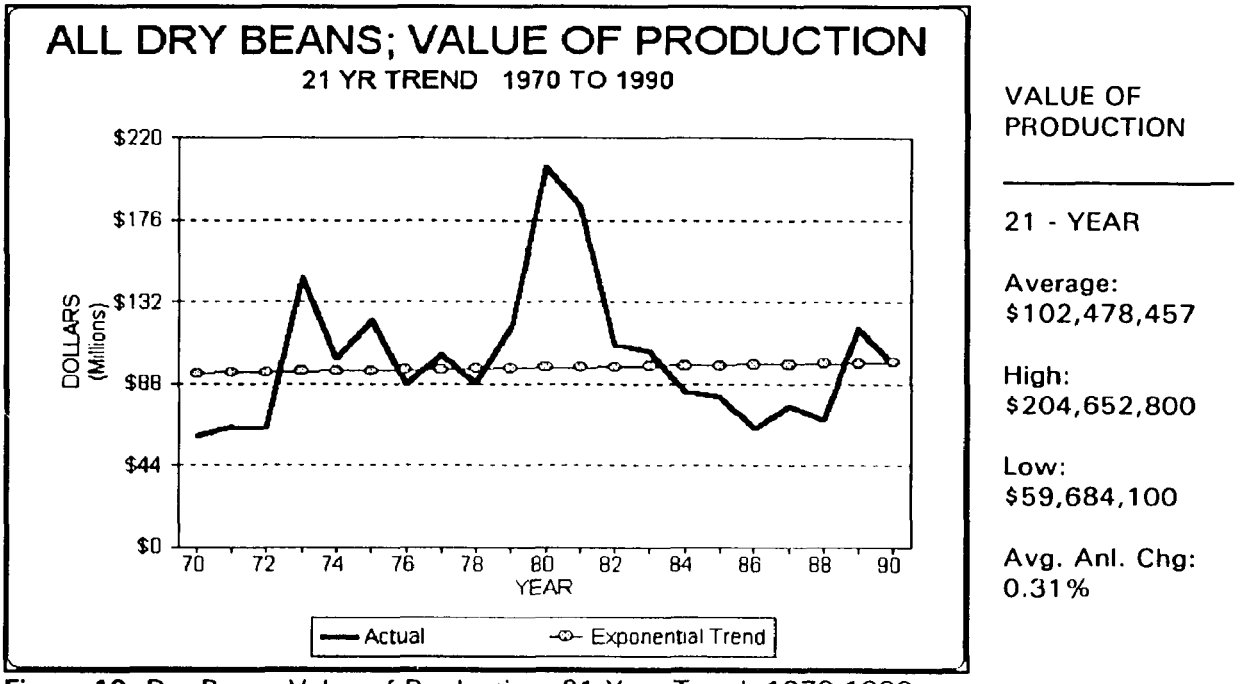
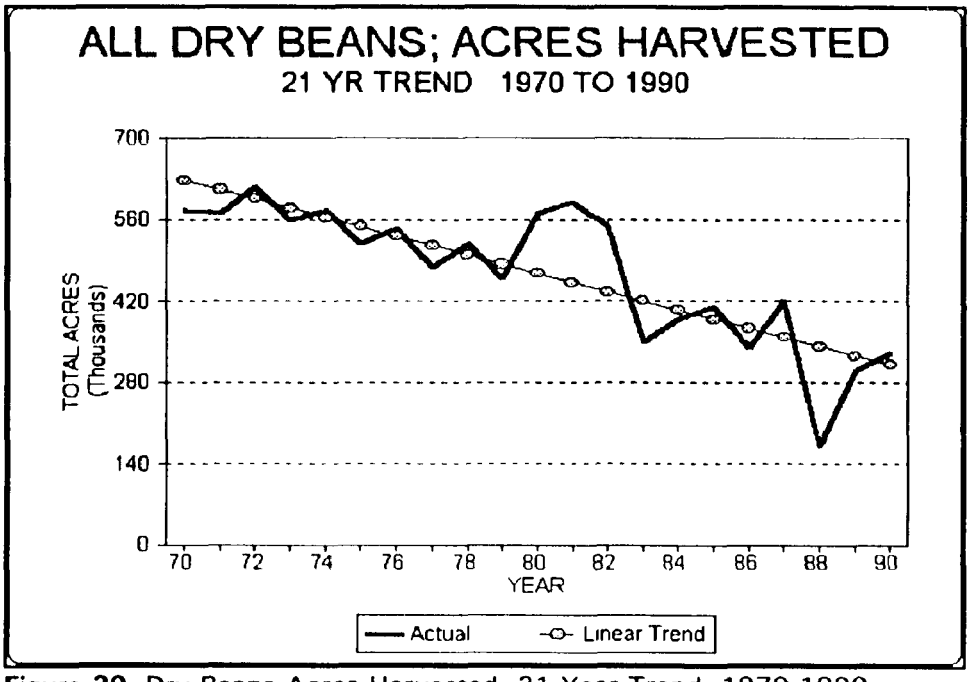


Figure 19 Dry Beans Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

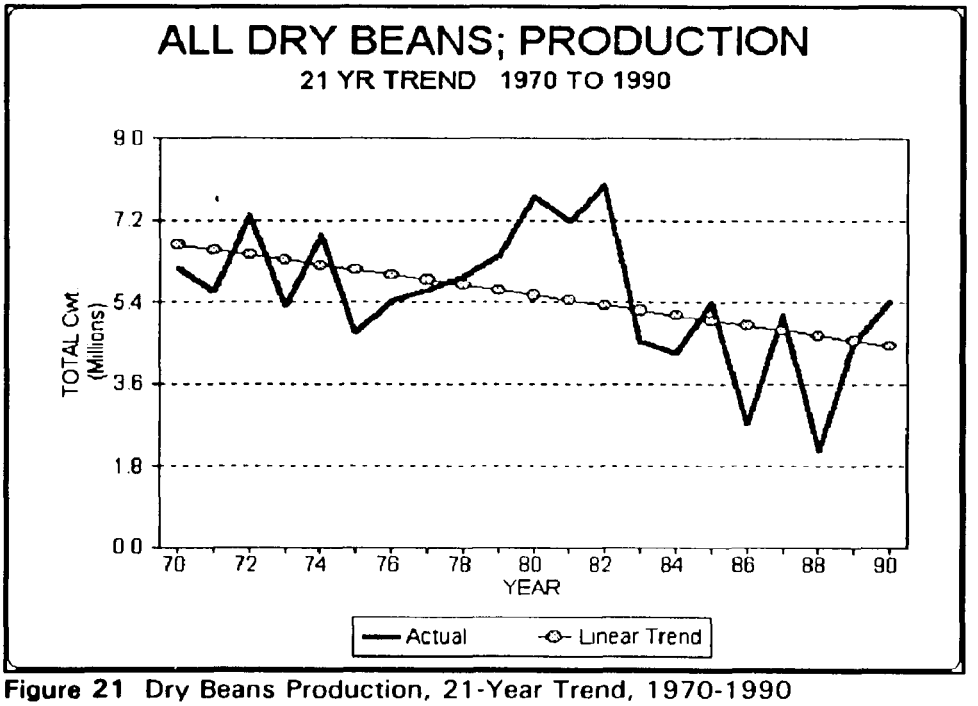
Average: 468,571

High: 615,000

Low: 170,000

Avg. Anl. Chg: -3.38%

Figure 20 Dry Beans Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

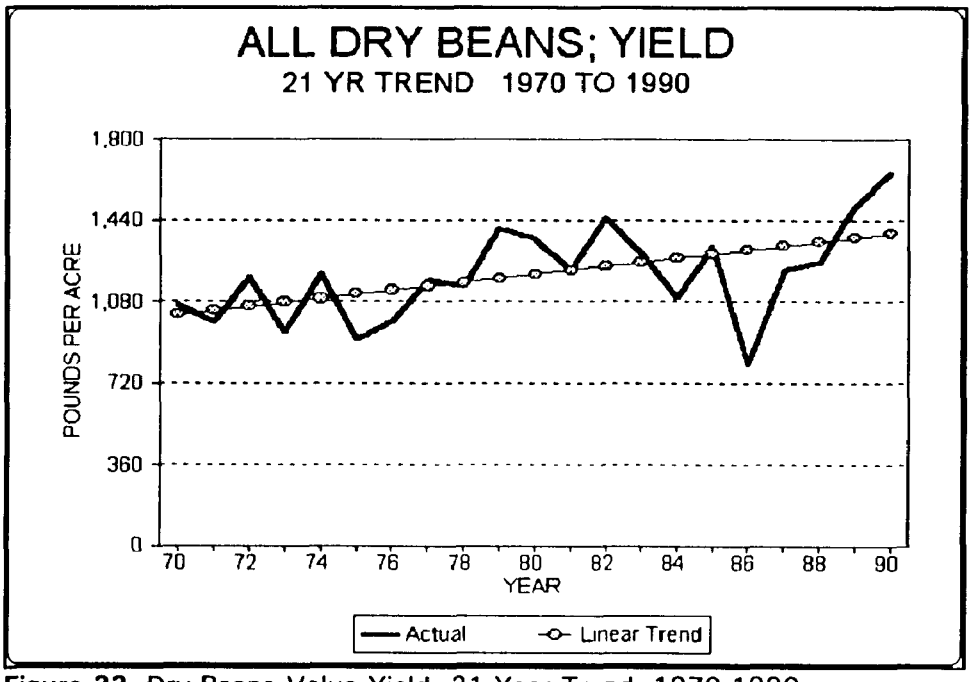
Average: 5,557,667

High: 7,975,000

Low: 2,142,000

Avg. Anl. Chg: -1.99%

Figure 21 Dry Beans Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

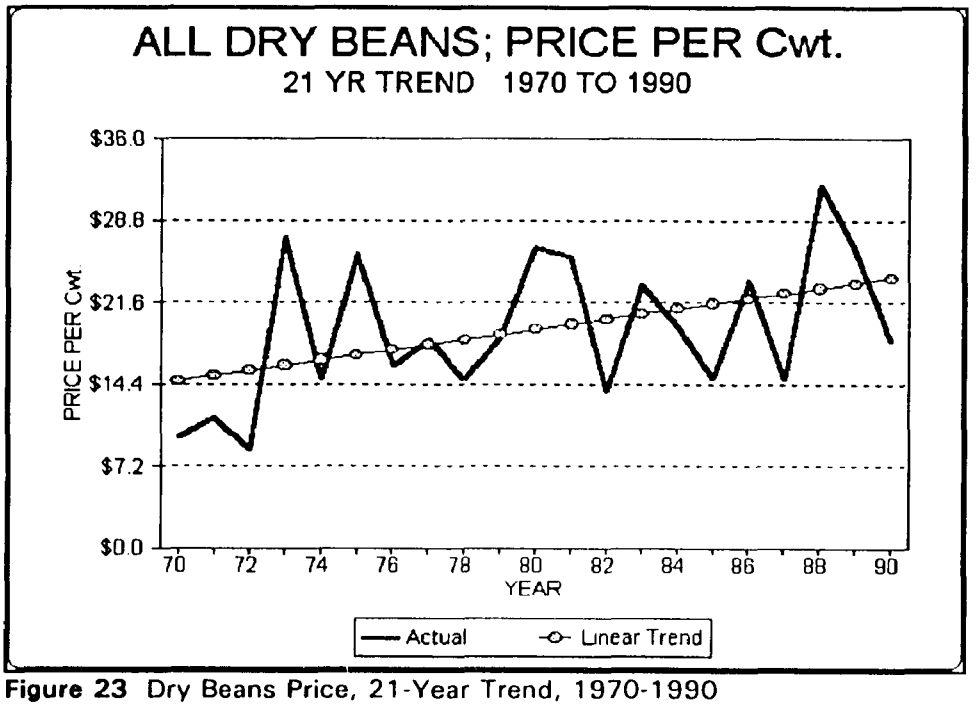
Average:
1,201

High:
1,650

Low:
800

Avg. Anl. Chg:
1.48%

Figure 22 Dry Beans Value Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$19.2

High:
$31.9

Low:
$8.7

Avg. Anl. Chg:
2.35%

Figure 23 Dry Beans Price, 21-Year Trend, 1970-1990

Hay: Michigan hay is usually cut three times a year depending on weather conditions. The Michigan Agricultural Statistics Service estimates that 85% of the state's hay is consumed on location with the remaining 15% sold as a cash crop. The number of producers growing hay as a cash crop is increasing to meet the feed needs of the state's dairy and beef cattle industries. The hay is either sold directly to livestock farmers or to hay brokers through auctions.

Hay production has increased rapidly in the 70's and 80's. This growth is a function of more acres harvested and improved yields. Hay production[62] has increased an annual average of 3.26%[63] for the last 21 years. Production has increased from just below 3.0 million tons per year to well over 5.0 million tons a year, placing Michigan 10th in the country in 1990 with a share of 3.6%. The 21-year yield per acre trend was the second largest for Michigan field crops at an average annual increase of 1.98%, see summary Table II. Acres harvested have expanded from 1.3 million acres per year to a consistent level of 1.5 million acres per year. One year of special note is 1988, when acres harvested swelled to 1.9 million up from 1.4 million acres in 1987. This large increased was a direct result of set-aside and conservation reserve acreage being released for haying and grazing because of the 1988 drought. Prices jumped dramatically in 1988 to a record high of $94 per ton, from $60 a ton in 1987, as demand greatly exceeded a limited supply. Throughout the

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[62] Only soybeans (5.98%) and barley (5.68%) had a faster annual production growth rate.

[63] Hay is tied for third with sugarbeets

two decades hay prices increased more than any other field crop increasing an average annual amount of 4.63%. Consistently higher hay prices coupled with expanded production greatly increased the value of production. Value of production has quadrupled from approximately $75 million per year to over $336 million, see Figure 24. Hay is now the state's second largest field crop based on value of production, corn is first. In 1990 Michigan was 5th in the country for the quantity produced of alfalfa hay (5.8% of the share) and 10th for all hay (3.6% of the share), Wisconsin ranked first in both categories.

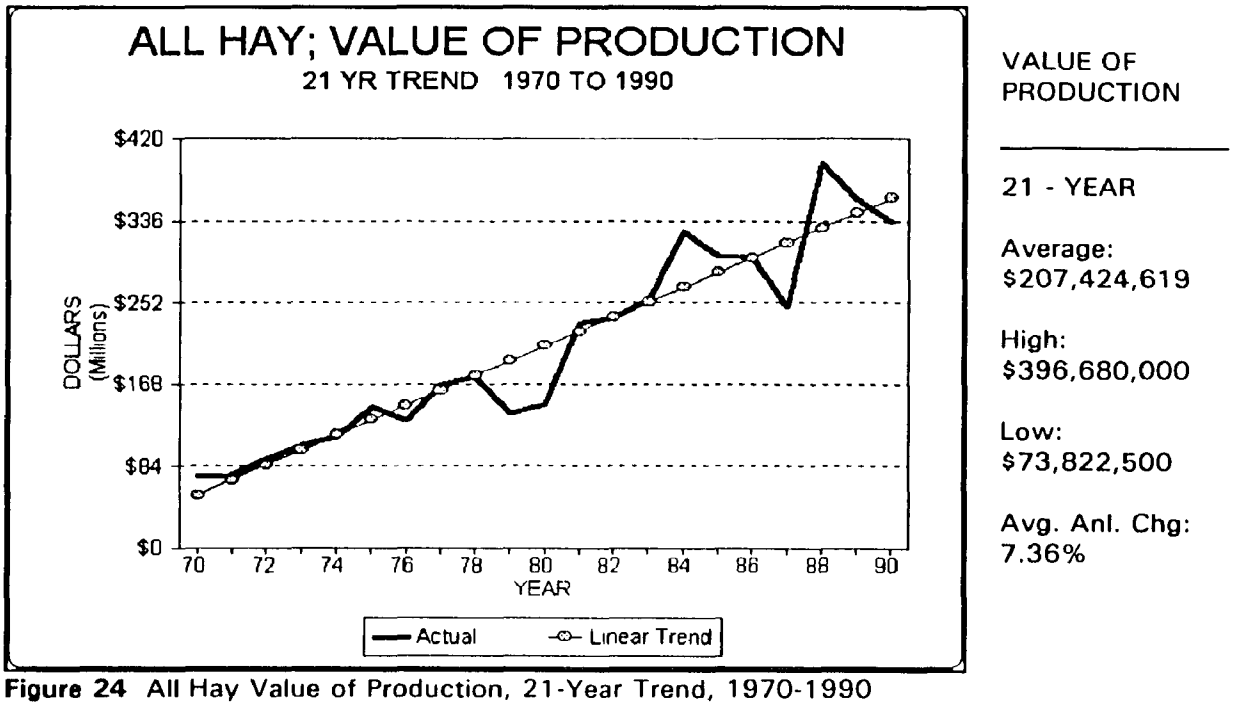
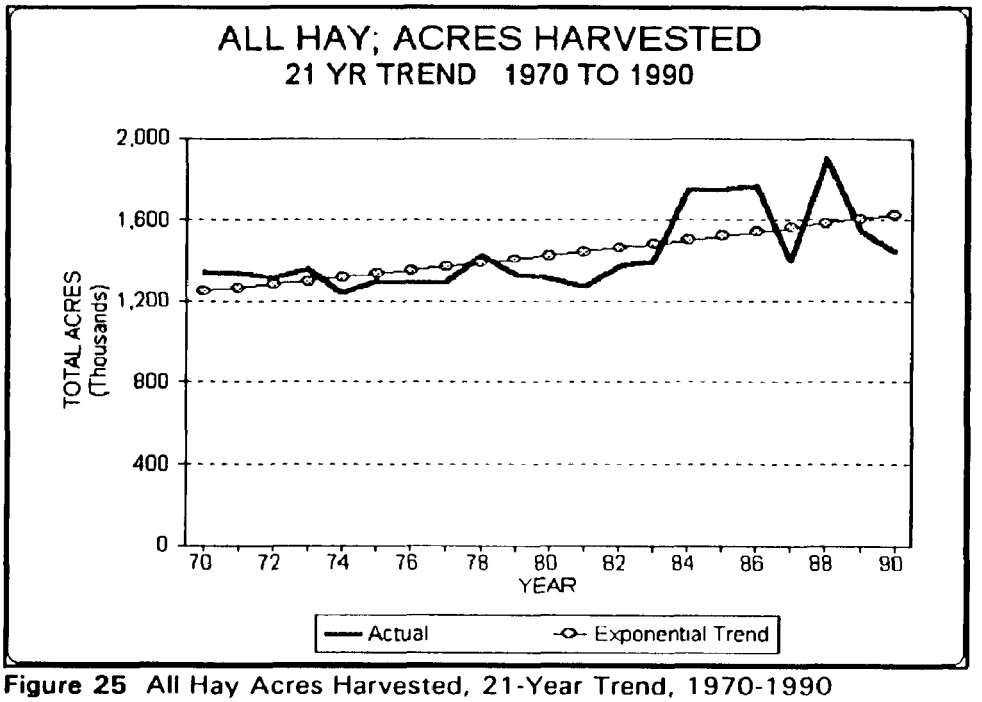


Figure 24 All Hay Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

Average: 1,436,667

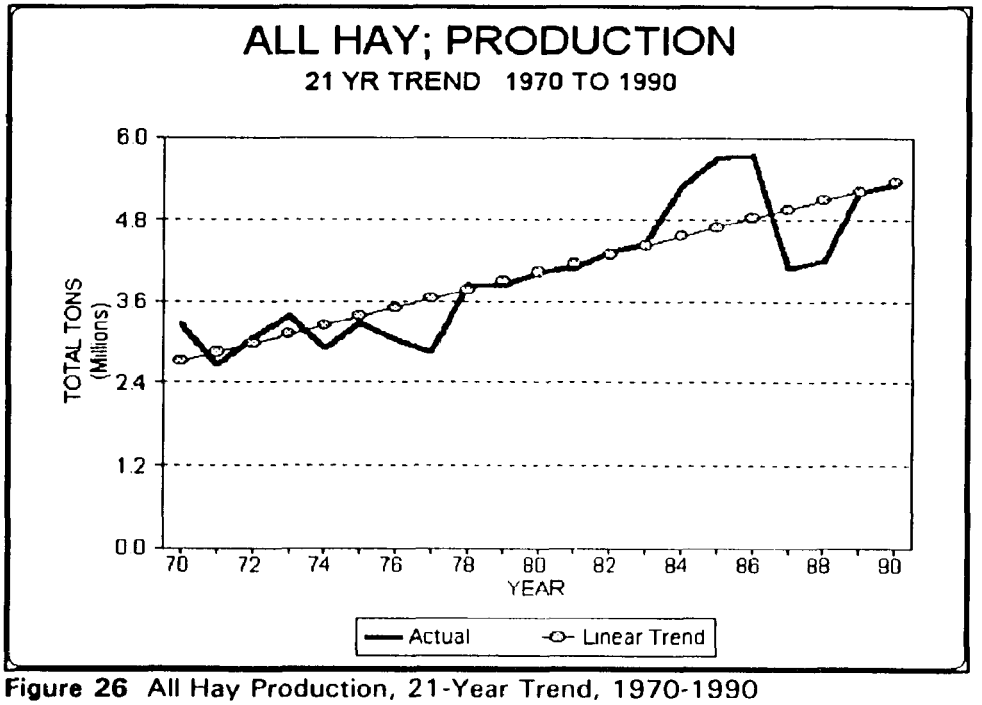
High: 1,900,000

Low: 1,240,000

Avg. Anl. Chg:

1.32%

Figure 25 All Hay Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21- YEAR

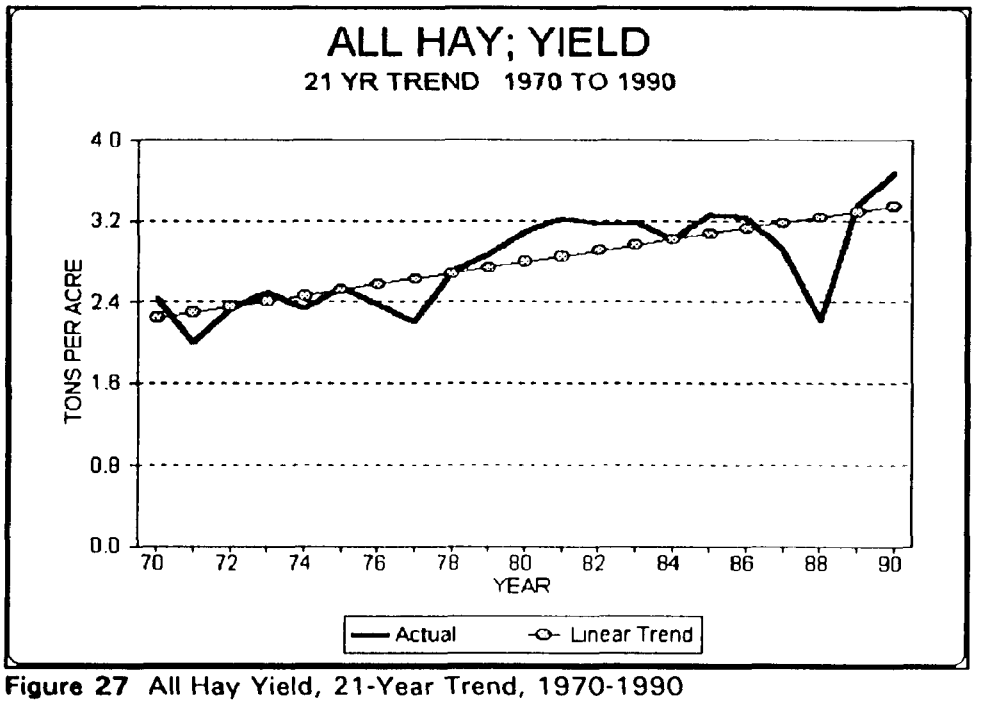
Average: 4,036,286

High: 5,743,000

Low: 2,677,000

Avg. Anl. Chg: 3.26%

Figure 26 All Hay Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

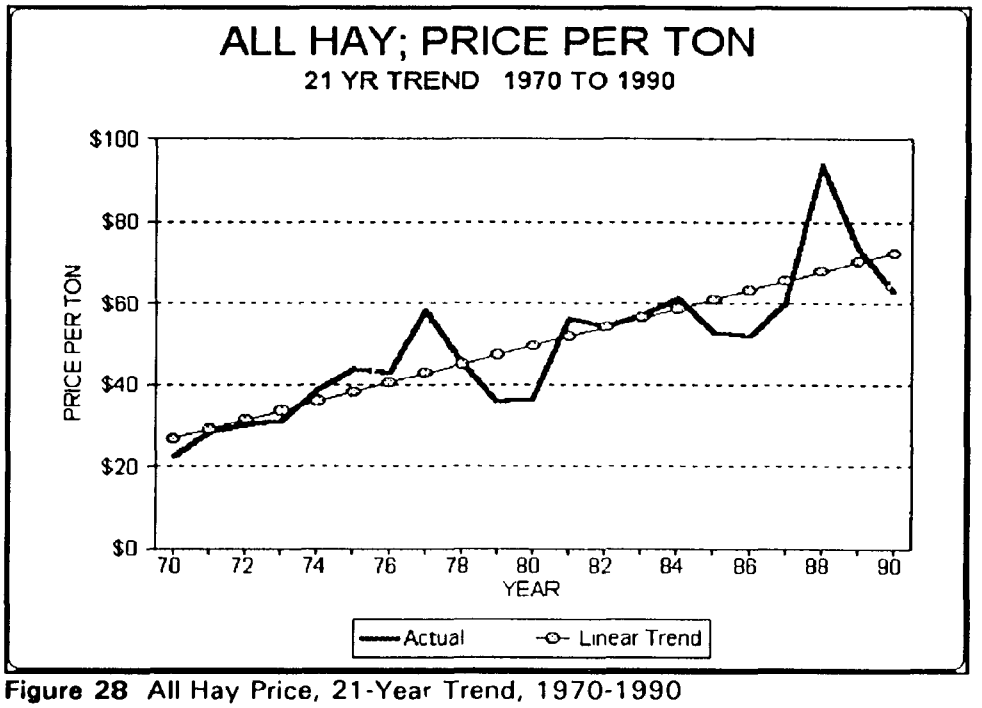
Average:
2.79

High:
3.68

Low:
2.00

Avg. Anl. Chg:
1.98%

Figure 27 All Hay Yield, 21-Year Trend, 1970-1990



PRICE

21- YEAR

Average:
$49.6

High:
$94.0

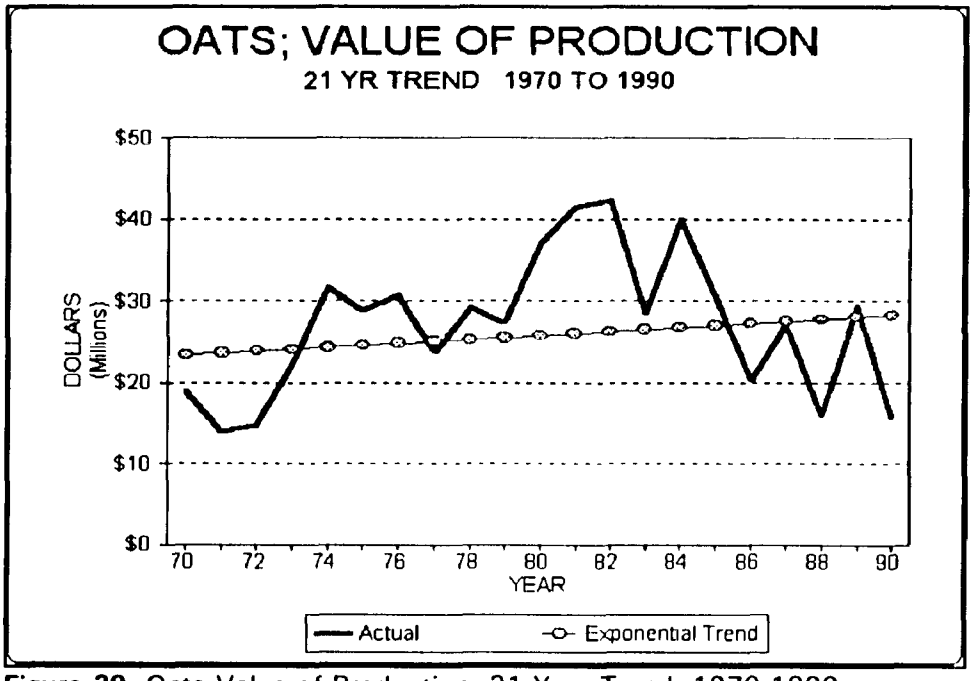
Low:
$22.5

Avg. Anl. Chg:
4.63%

Figure 28 All Hay Price, 21-Year Trend, 1970-1990

Oats: Oats are grown almost exclusively as a source of livestock feed. Typically, they are raised and consumed on site with some sold for processing. The equine industry (pleasure horses, working horses, or race horses) is one of Michigan's largest consumers of oats. Production in the state is confined primarily to the east central region, which includes the counties of Sanilac, Huron, and Tuscola. These three counties usually account for 25% of the state's total acres harvested. In 1990 Michigan ranked 9th in the country for number of bushels produced, producing 3.7% of the total.

Oat production has trended steadily downward during the decades of the 70' and 80's. The decline in the quantity of oats produced is a direct function of a reduction in acres harvested. Both acres harvested and quantity of oats produced showed negative average annual changes, the former 1.96% and the latter 1.33%. This placed oats in ninth place in each category for the ten Michigan field crops analyzed, see summary Table II. Total acres harvested reached a low of 200,000 acres during the drought of 1988 and the high in acreage harvested occurred in 1970, at a level of 467,000. Even with the decline in oat production, yields have shown small gains, increasing an annual average of 0.41%. Price per bushel has also exhibited a persistent growth of an annual average rate of 2.50%. This is fourth among all field crops. The value of production trend showed slight increases of 0.95% per year, despite the declines in the quantity of oats produced. Michigan produces oats at an average value of $27 million a year.



VALUE OF PRODUCTION

21 - YEAR

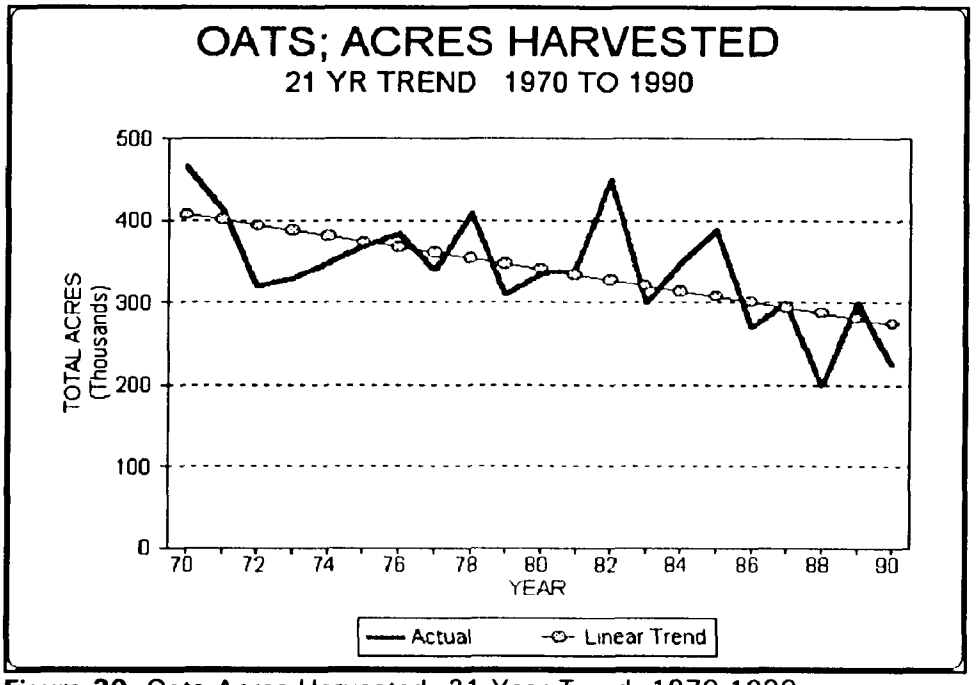
Average: $27,138,679

High: $42,241,500

Low: $13,848,550

Avg. Anl. Chg: 0.95%

Figure 29 Oats Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

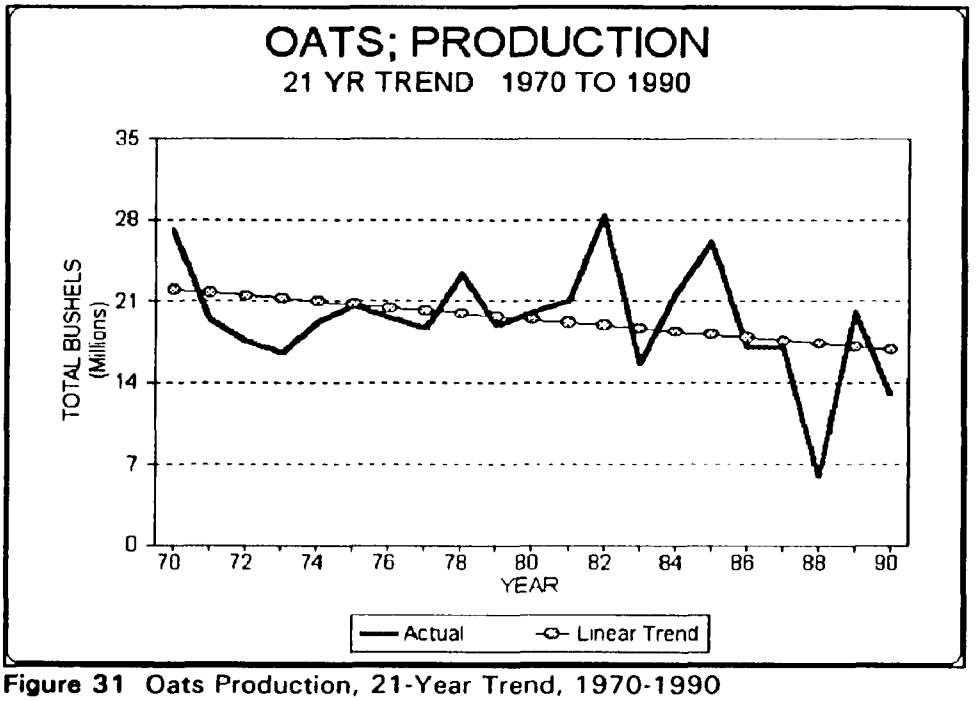
Average: 340,810

High: 467,000

Low: 200,000

Avg. Anl. Chg: -1.96%

Figure 30 Oats Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

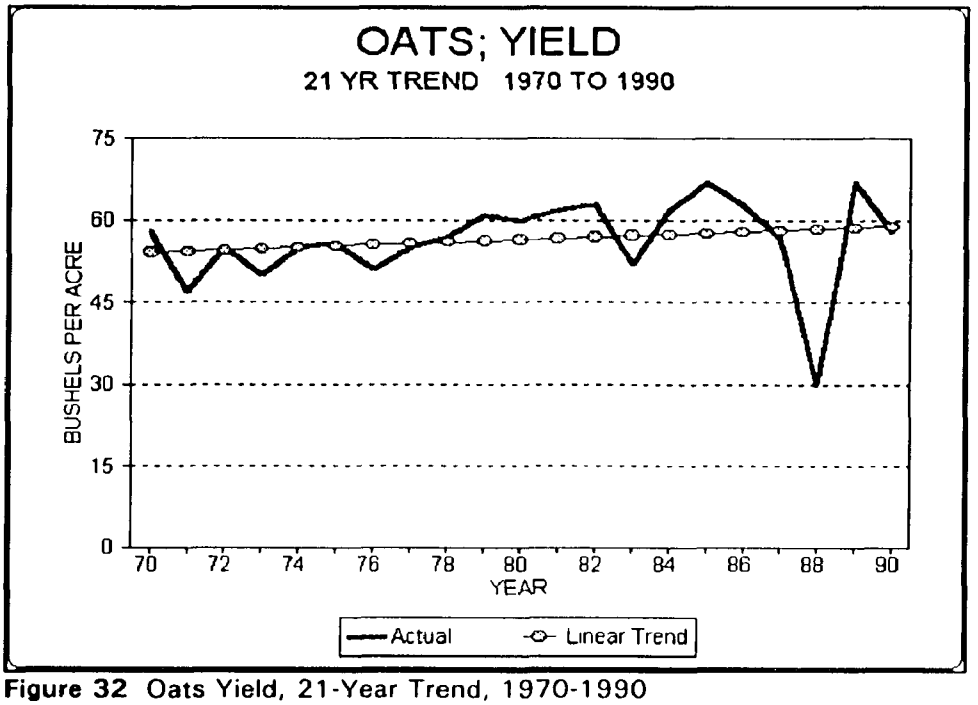
Average:
19,404,571

High:
28,350,000

Low:
6,000,000

Avg. Anl. Chg:
-1.33%

Figure 31 Oats Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
56

High:
67

Low:
30

Avg. Anl. Chg:
0.41%

Figure 32 Oats Yield, 21-Year Trend, 1970-1990

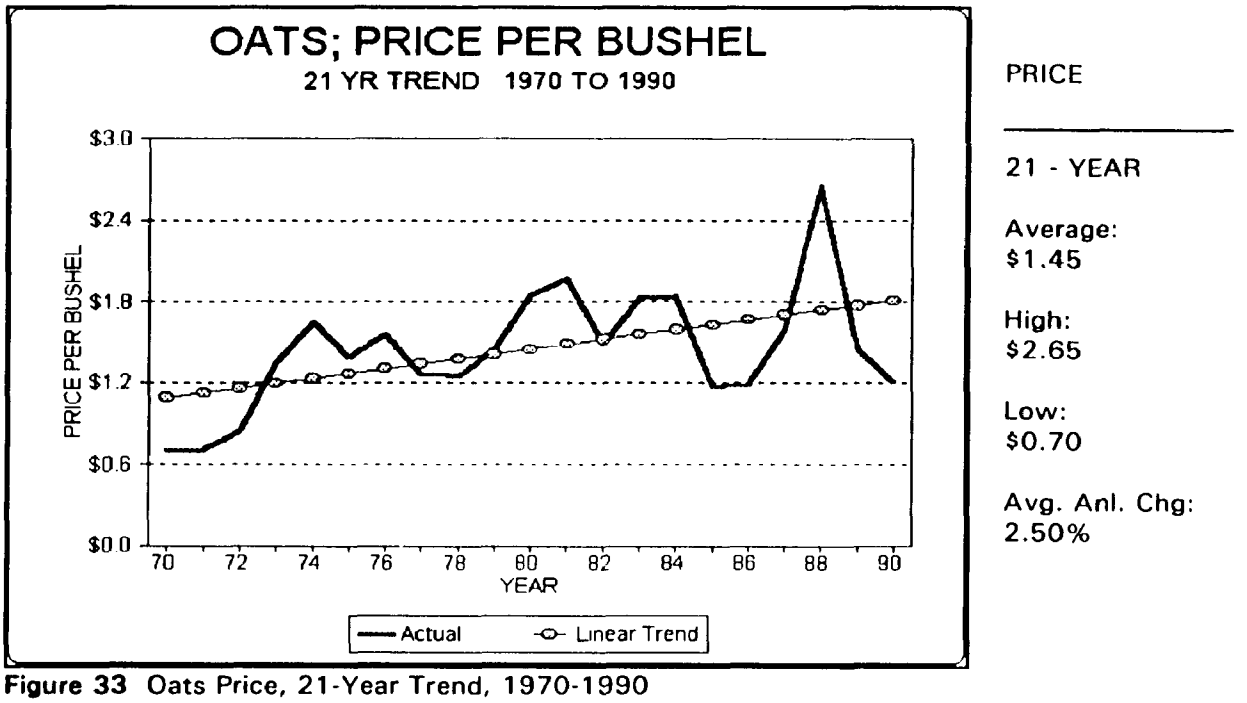


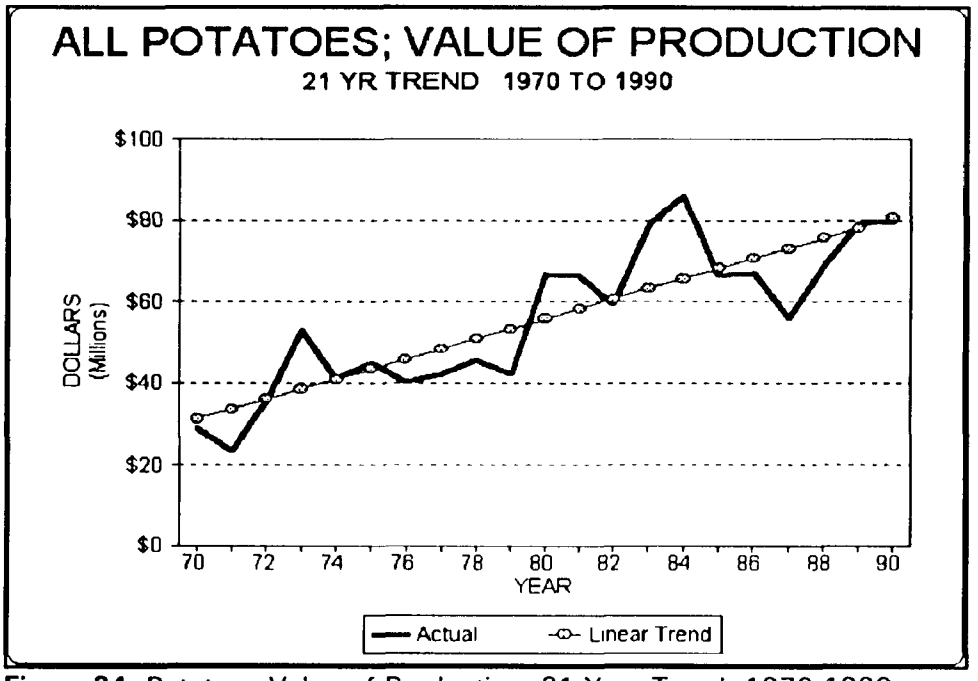
Figure 33 Oats Price, 21-Year Trend, 1970-1990

All Potatoes: Michigan's potatoes are grown during two seasons, the fall and summer. Approximately 80% of total potato production is produced in the fall with the remainder coming during the summer harvest. Most of the State's production is limited to two varieties, the white and russet. White potatoes are grown for table consumption and chips while russets are used for french fries and processing. Potato production is confined to a select number of counties with Montcalm and Bay producing over one third of the total.

Michigan potato production has trended gradually higher for the past 21 years. Both acres harvested and yields have grown an average annual rate of 0.62%, with the quantity of potatoes increasing on average 1.32% per year. In the late eighties Michigan farmers were faced with a number of significant

challenges. In 1986 heavy rains and flooding persisted in central Michigan from mid-September to mid-October. The result was an abandonment of almost one-fourth of the State's planted potato acreage. Total acres harvested declined from 57,800 acres in 1985 to only 42,000 acres in 1986, this drop is highlighted in Figure 35. Then just before the 1987 planting season the State's largest processing plant was closed in Montcalm county. As expected acreage planted declined sharply, down 20% from 1986, as contracts were no longer available for many farmers. The year following the plant closing, production was negatively impacted by the statewide drought of 1988. Even with the set backs of the late eighties, Michigan potatoes have maintained a consistent position of ranking 10th nationally with approximately 2.5% of the market.

Potatoes were 5th in value of production growth for all Michigan field crops. Value of production increased steadily from a low of $23 million in 1971, to a peak in 1984 of $86 million, and to a level of $80 million in 1990. Most of the growth in value of production is attributable to higher price per hundred weight. Price per hundred weight of all potatoes trended higher at an annual average of 3.3% for the decades of the 70's and 80's.



VALUE OF PRODUCTION

21 - YEAR

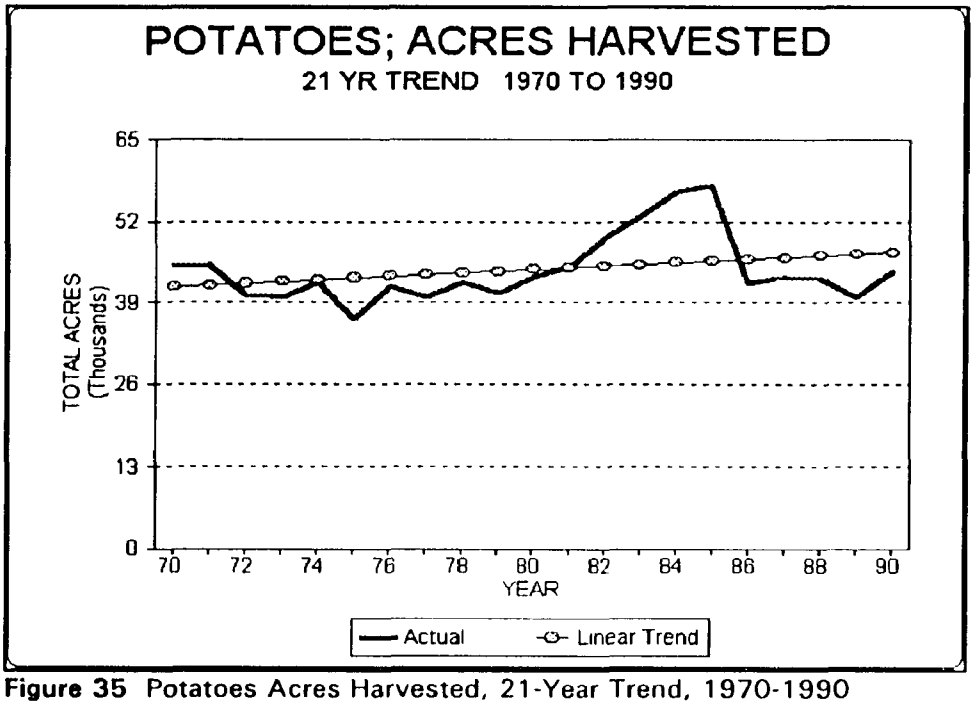
Average:
$55,834,628

High:
$86,070,000

Low:
$23,487,230

Avg. Anl. Chg:
4.45%

Figure 34 Potatoes Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

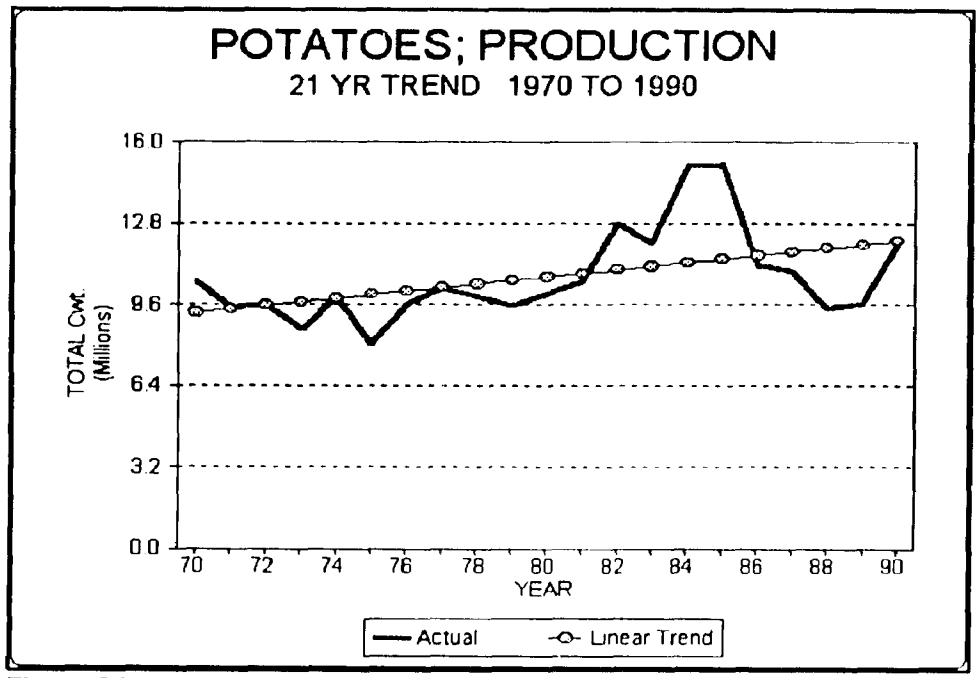
Average:
44,314

High:
57,800

Low:
33,000

Avg. Anl. Chg:
0.62%

Figure 35 Potatoes Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

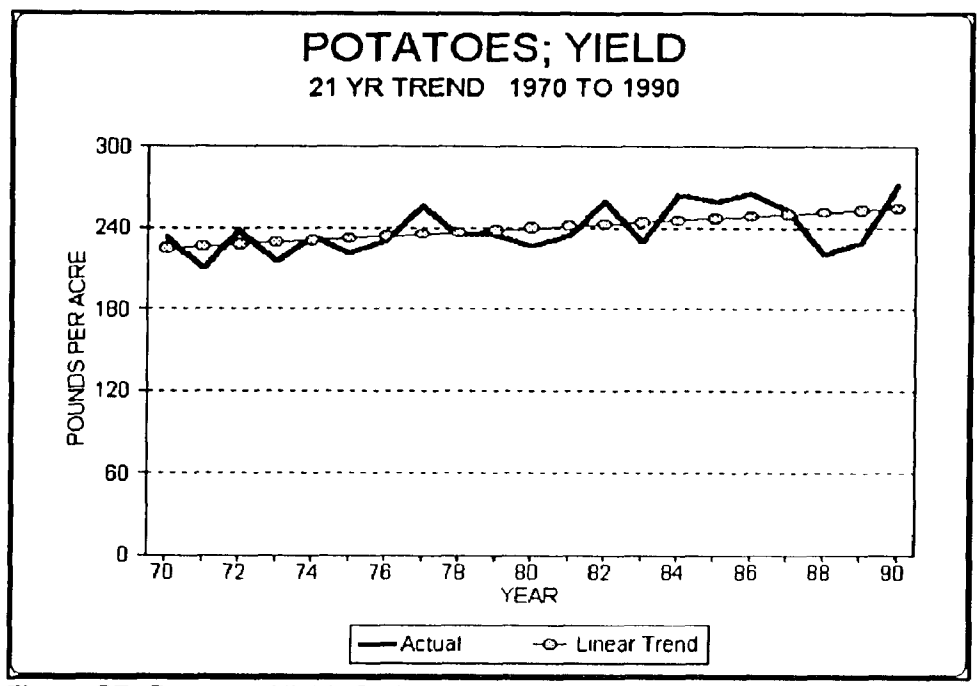
Average:
10,698,905

High:
15,136,000

Low:
8,076,000

Avg. Anl. Chg:
1.32%

Figure 36 Potatoes Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
240

High:
272

Low:
211

Avg. Anl. Chg:
0.62%

Figure 37 Potatoes Yield, 21-Year Trend, 1970-1990

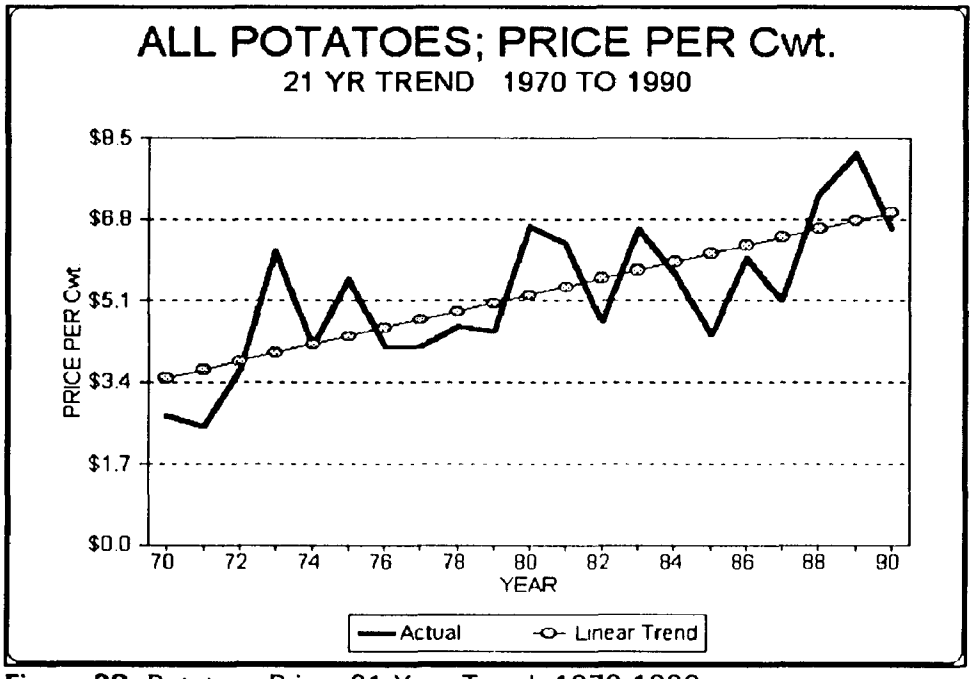
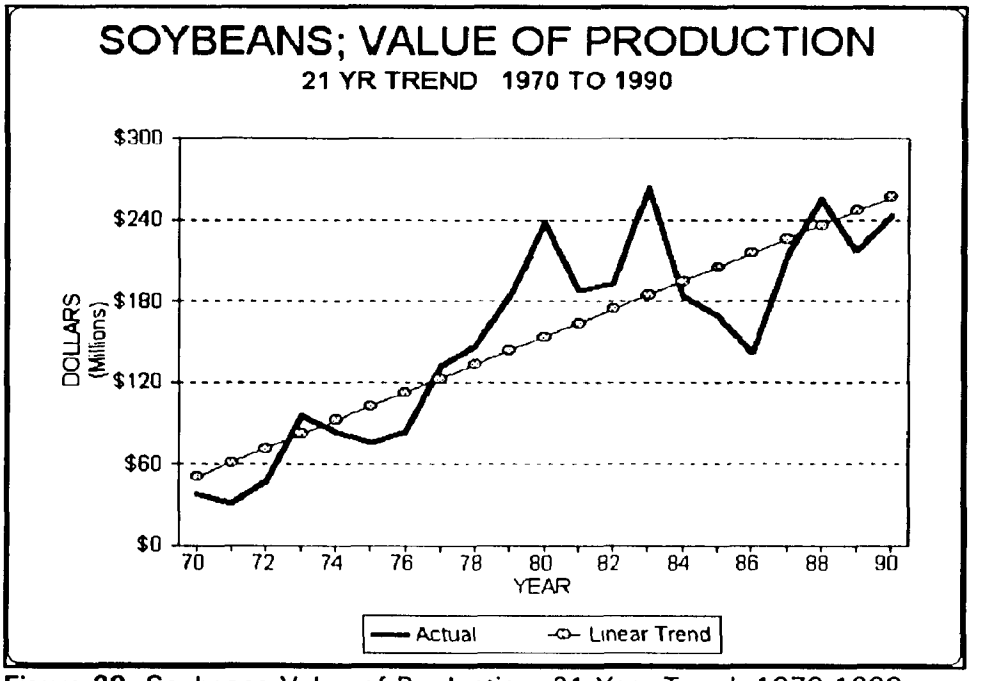


Figure 38 Potatoes Price, 21-Year Trend, 1970-1990

Soybeans: Soybeans are one of the fastest growing field crops in Michigan. Of the ten crops reviewed in this section, soybeans were first in the average annual percent change trend for quantity produced 5.98%, yield per acre 2.30%, and second in terms of acres harvested 4.10%. Soybeans are grown for their oil content and utilization of the crushed by-product for livestock feed because of the high protein content. One 60-pound bushel of beans normally yields about 12 pounds of oil and 48 pounds of meal for feed. The soy oil is used in cooking oils, margarine, salad oils, meat substitutes, paints, varnishes, adhesives, and many other products. Michigan exports all of it's beans to other states or overseas because there are no processing facilities in the state.

Soybean production grew at a faster pace during the 70's than the mid

80's but has regained it's momentum in recent years. Total production reached a low of 10 million bushels in 1971 and a high of 43 million bushels in 1990. Part of the increase in production occurred as result of more acres being planted. Acres harvested grew from approximately 500,000 acres in the early 70's to consistently over 1.0 million acres harvested throughout the 80's. The yield per acre increased from an average of 21 bushels per acre in 1971 to 38 bushels per acre in 1990, an 81% increase. This was the largest absolute percentage yield increase for all field crops. Value of production grew dramatically in the 70's from a low of $31 million in 1971 to over $239 million in 1980 a 671% increase. In the 80's value of production leveled off reaching a high of $264 million in 1983 and $243 million in 1990. Soybeans are third in terms of total value of production behind corn and hay in Michigan. The 21-year growth trend for value of production is an average annual increase of 6.72%.



VALUE OF PRODUCTION

21 - YEAR

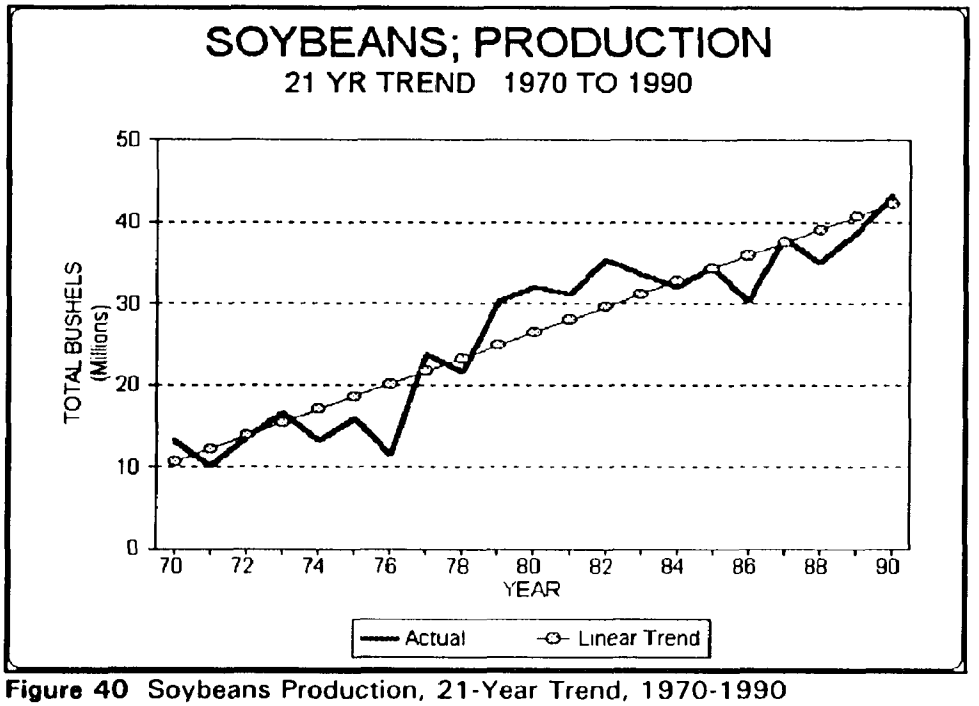
Average: $153,854,215

High: $264,316,000

Low: $31,262,500

Avg. Anl. Chg: 6.72%

Figure 39 Soybeans Value of Production, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

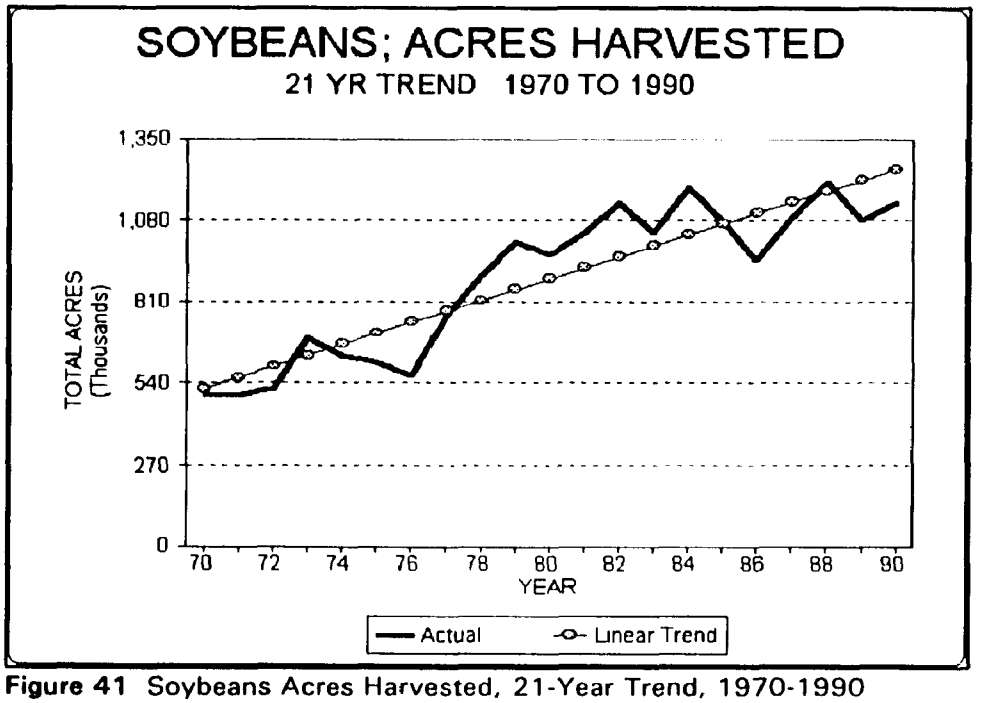
Average: 26,432,333

High: 43,320,000

Low: 10,250,000

Avg. Anl. Chg: 5.98%

Figure 40 Soybeans Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

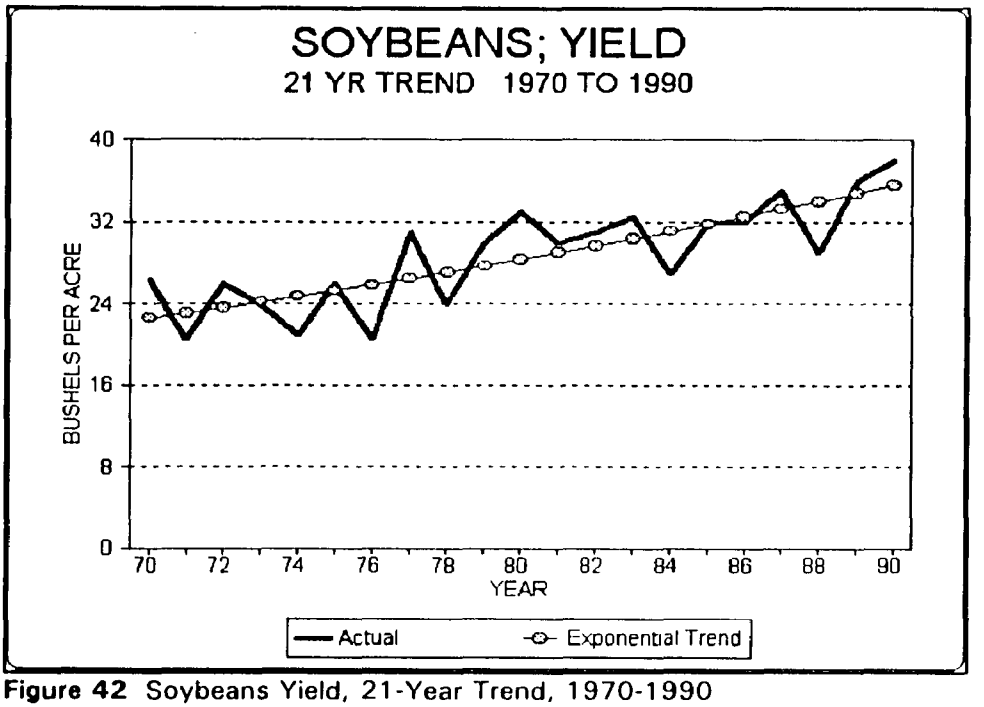
Average:
887,238

High:
1,210,000

Low:
500,000

Avg. Anl. Chg:
4.10%

Figure 41 Soybeans Acres Harvested, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
29

High:
38

Low:
21

Avg. Anl. Chg:
2.30%

Figure 42 Soybeans Yield, 21-Year Trend, 1970-1990

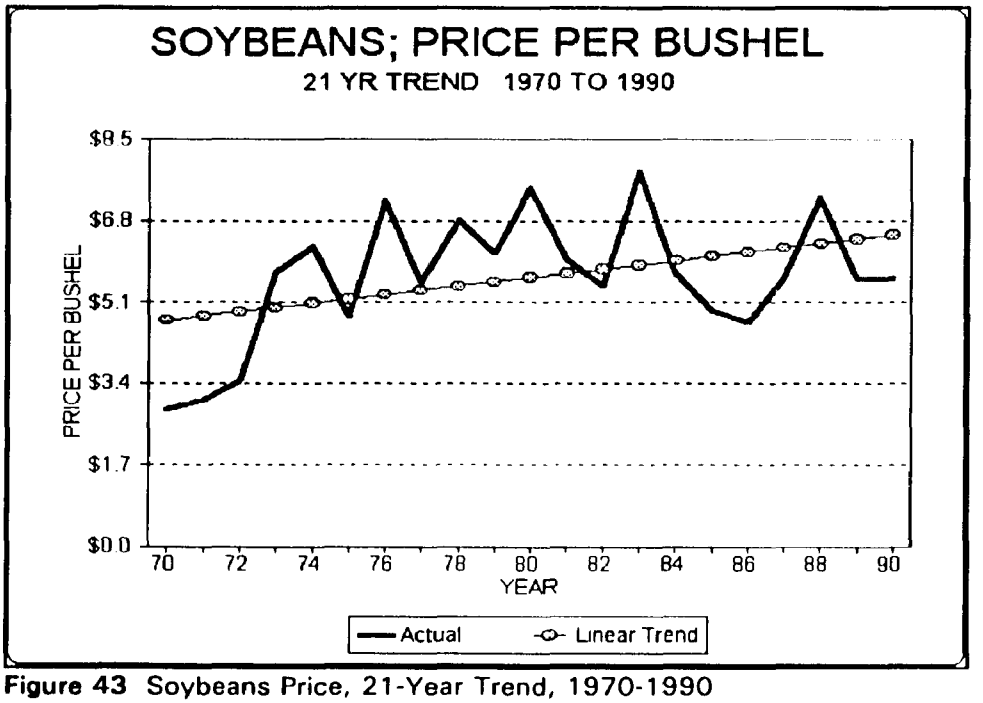


Figure 43 Soybeans Price, 21-Year Trend, 1970-1990

Sugarbeets: Sugarbeets are grown primarily for their sugar content in Michigan. However, a small portion of the beets is used as feed in livestock operations. Sucrose is spun from the beets in a centrifuge leaving a pulp by-product that is combined with other feed ingredients. Almost all beets in Michigan are produced under contractual agreements with processing plants. The top five production counties are Tuscola, Huron, Gratiot, Saginaw, and Bay all in the Thumb and Bay regions of the state. These five counties account for over 80% of the state's annual sugarbeet output. In the United States, the production of sugarcane and sugarbeets, is split about half and half.

The sugarbeet industry in Michigan continues to grow at a record pace.

In 1990 Michigan passed North Dakota as the fourth largest producing state accounting for almost 12 percent of the national output. The trend[64] for sugarbeet production has been steadily upward during the decades of the 70's and 80's. In terms of Michigan field crop production, sugarbeets tied hay with the third fastest average annual growth rate of 3.26%, just behind soybeans and barley. Production in total tons increased from below 1.5 million in the early 70's to above 3.2 million in 1990. The increase in production is due almost exclusively to a rise in acres harvested. Acres harvested has expanded an average of 3.05% per year for the last 21 years. Yields for sugarbeets have remained flat, growing an average of only 0.20% per year, last among the ten field crops. Sugarbeets have now passed wheat and dry beans with regards to total value of production. Given a steady rise in beet prices per ton and the expansion of acres harvested, the value of production has increased rapidly. The 21-year growth trend for value of production is exponential, see Figure 44, increasing at an average annual rate of 7.69%, first for all field crops. Total value of production has increased from a low of approximately $19 million in 1971 to a high of over $125 million in 1990.

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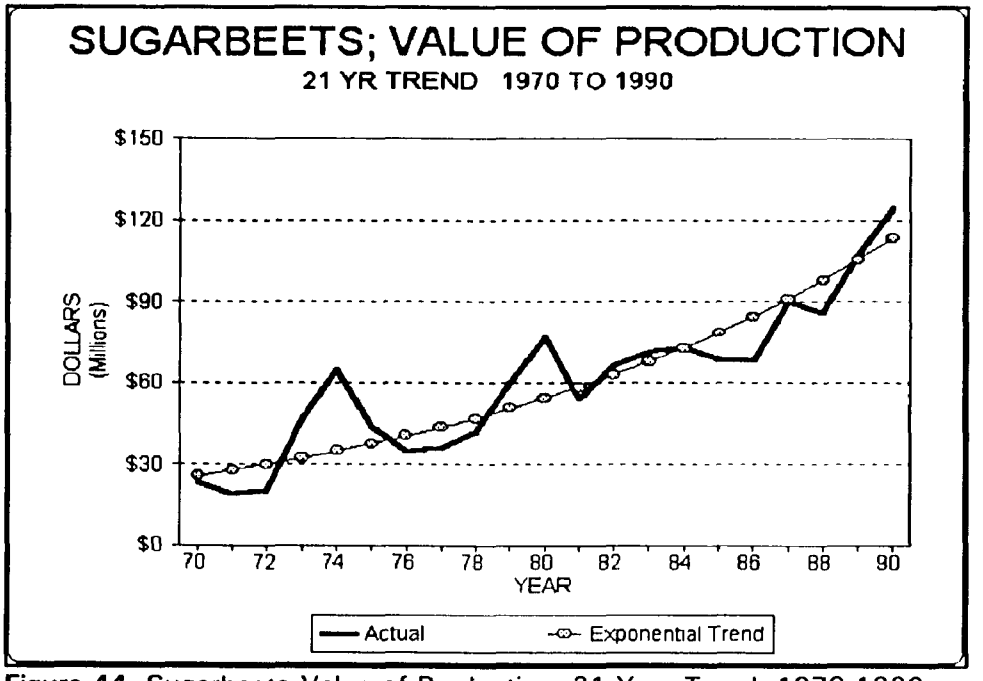
[64] Note: the production trend for sugarbeets is exponential.



VALUE OF PRODUCTION

21 - YEAR

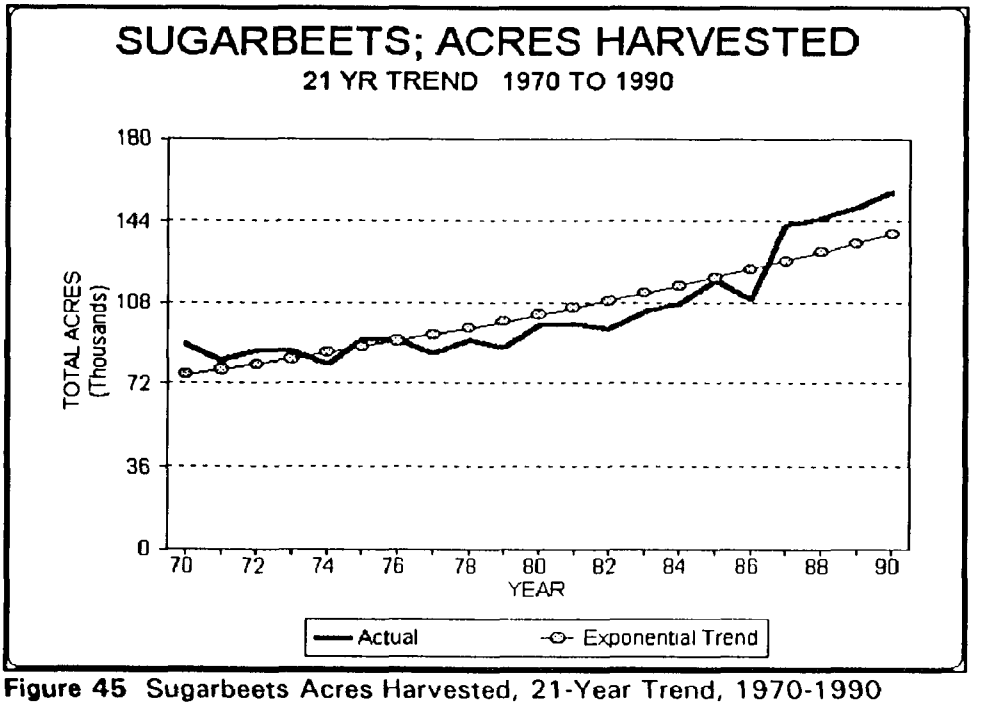
Average: $60,835,976

High: $125,087,800

Low: $18,961,000

Avg. Anl. Chg: 7.69%

Figure 44 Sugarbeets Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

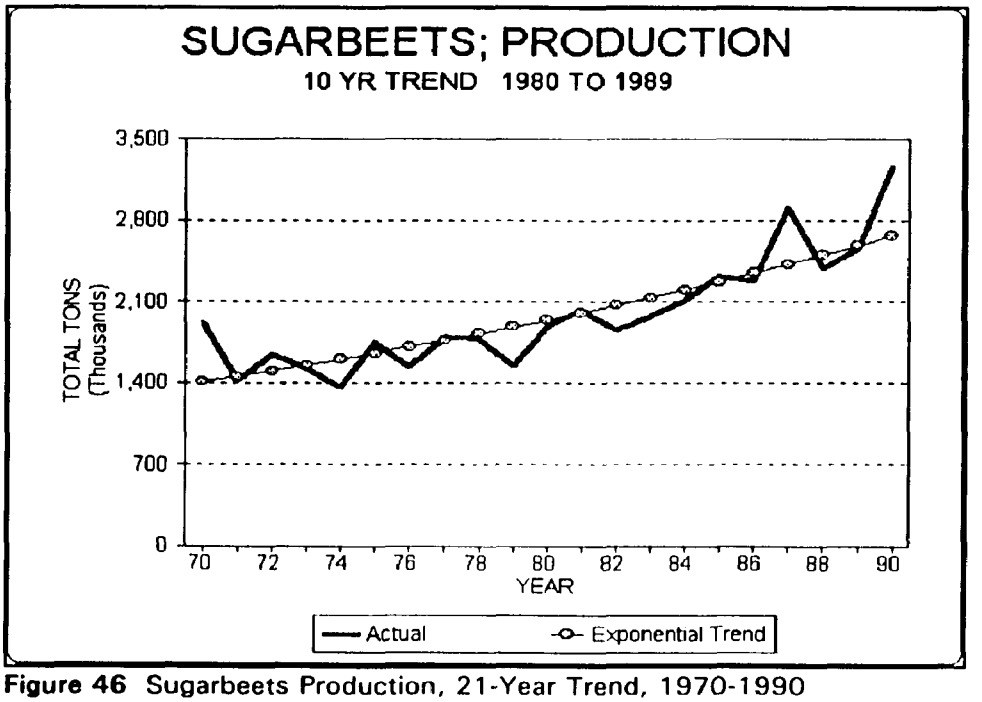
Average: 104,814

High: 157,000

Low: 80,400

Avg. Anl. Chg: 3.05%

Figure 45 Sugarbeets Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

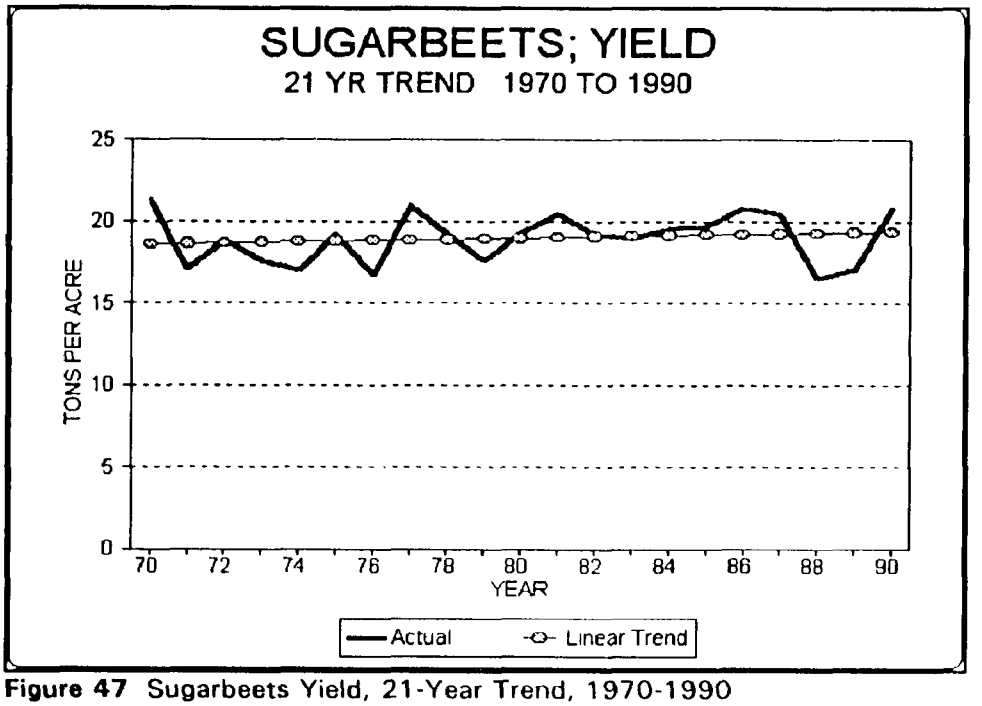
Average:
1,993,952

High:
3,266,000

Low:
1,364,000

Avg. Anl. Chg:
3.26%

Figure 46 Sugarbeets Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
19

High:
21

Low:
17

Avg. Anl. Chg:
0.20%

Figure 47 Sugarbeets Yield, 21-Year Trend, 1970-1990

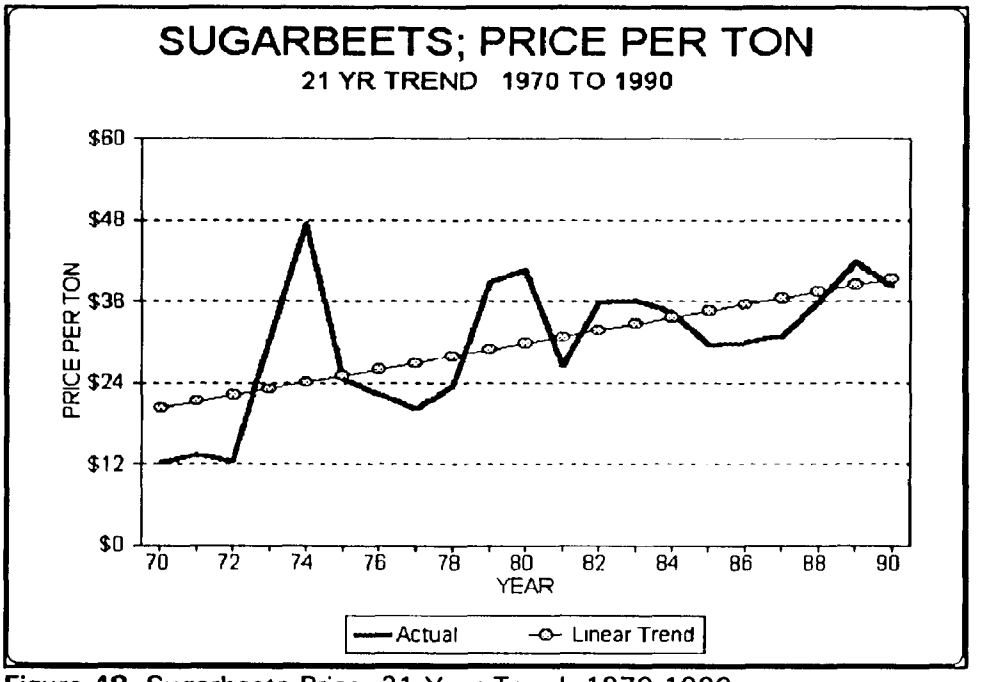


Figure 48 Sugarbeets Price, 21-Year Trend, 1970-1990

Wheat: Michigan grows two primary varieties of wheat, soft white winter and soft red. Soft white winter wheat accounts for approximately 80% of the wheat grown while soft red accounts for the remaining 20%. Soft red wheat is used primarily by manufactures for heavy dough found in cake mixes, doughnuts, and cookies. The soft white winter wheat is milled into a light-textured dough used in breakfast cereals, pie crust, and pastries.

Wheat is grown in almost every county in the state. The thumb area is the major production region. Four counties, Sanilac, Huron, Lapeer, and Tuscola account for approximately one sixth of the state's output. During the decades of the 70's and 80's wheat production trended slowly upward, at an average annual rate of 2.11%. Acres harvested vacillated greatly, ranging

from a high of 940,000 acres in 1974 to a low of 400,000 in 1987, see Figure 50. The calculated trend for acres harvested is an average annual change of 0.35%. The major influence for the increase in production comes from higher yields. Wheat yields improved consistently during the 70's and 80's. Wheat yields increased in 12 of the 21 years of analysis. The 21 year trend is an average annual rate of 1.96%, which was third among field crops. Price per bushel however, did not keep pace with other field crops. A bushel of wheat increased at an average annual rate of 1.40%, only corn increased more slowly at 1.32%. The trend for value of production was gradually up, centered around wide annual fluctuations see Figure 49. Value of production grew at an average annual rate of 2.87%, ranked seventh for field crops.

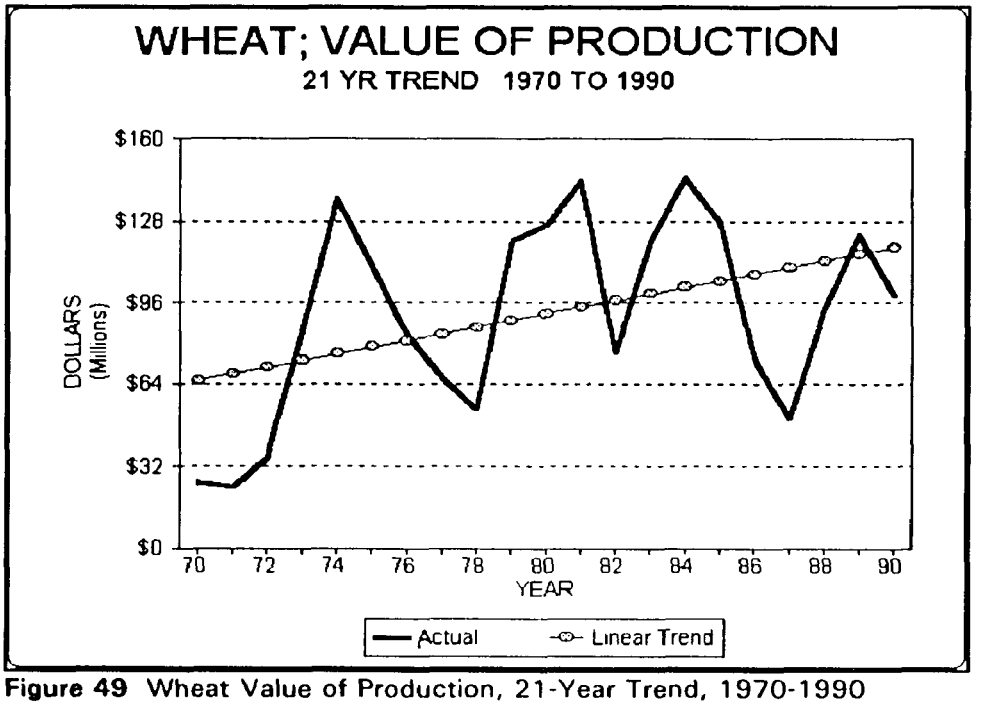
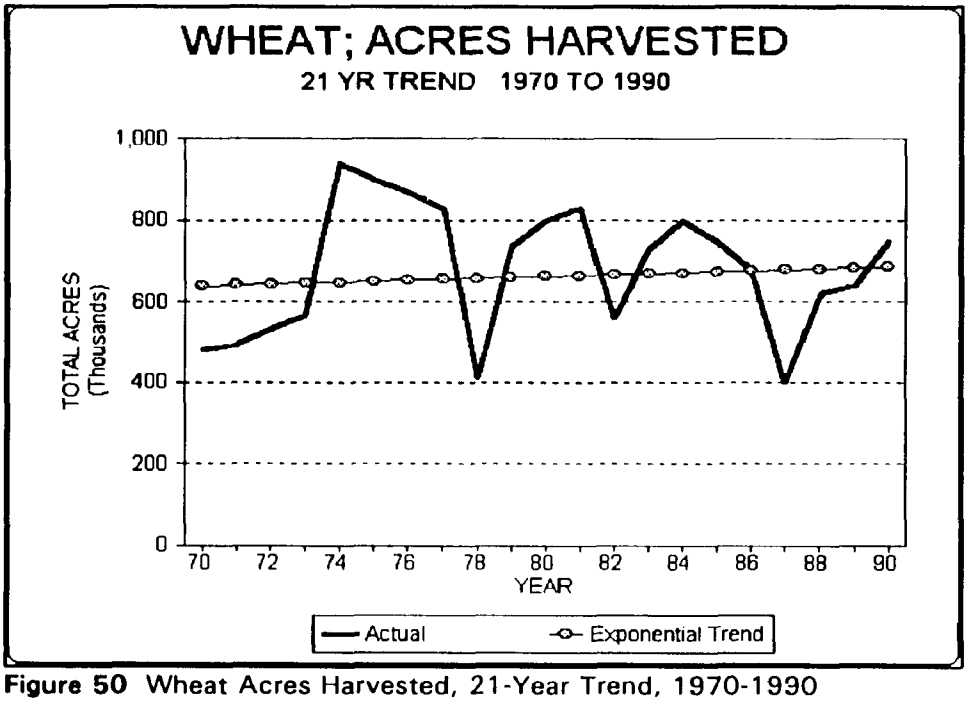


Figure 49 Wheat Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

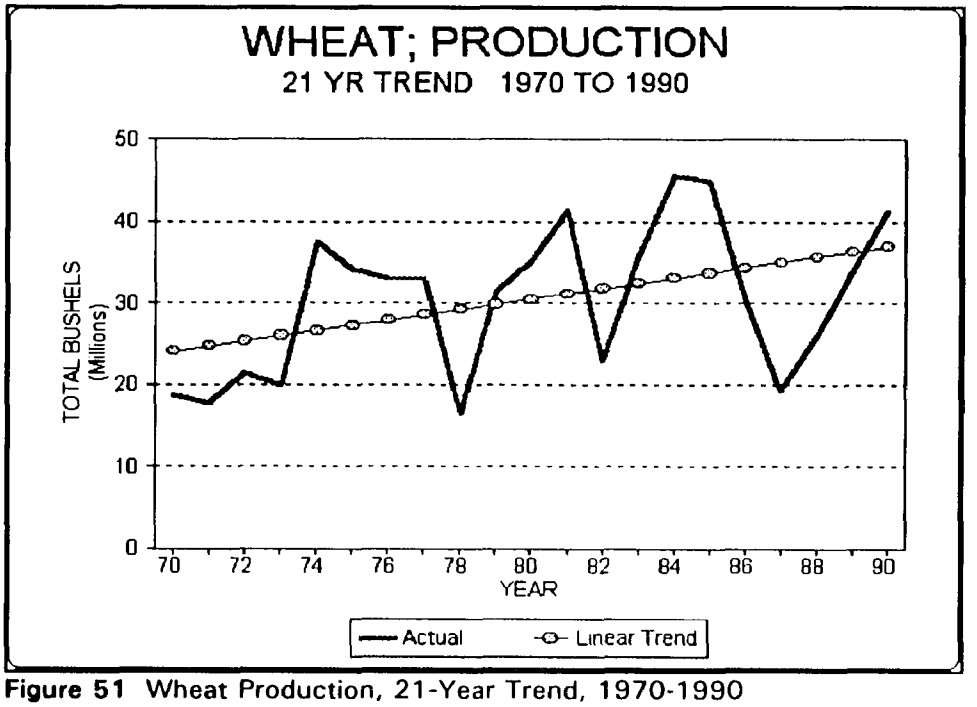
Average: 681,810

High: 940,000

Low: 400,000

Avg. Anl. Chg: 0.35%

Figure 50 Wheat Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

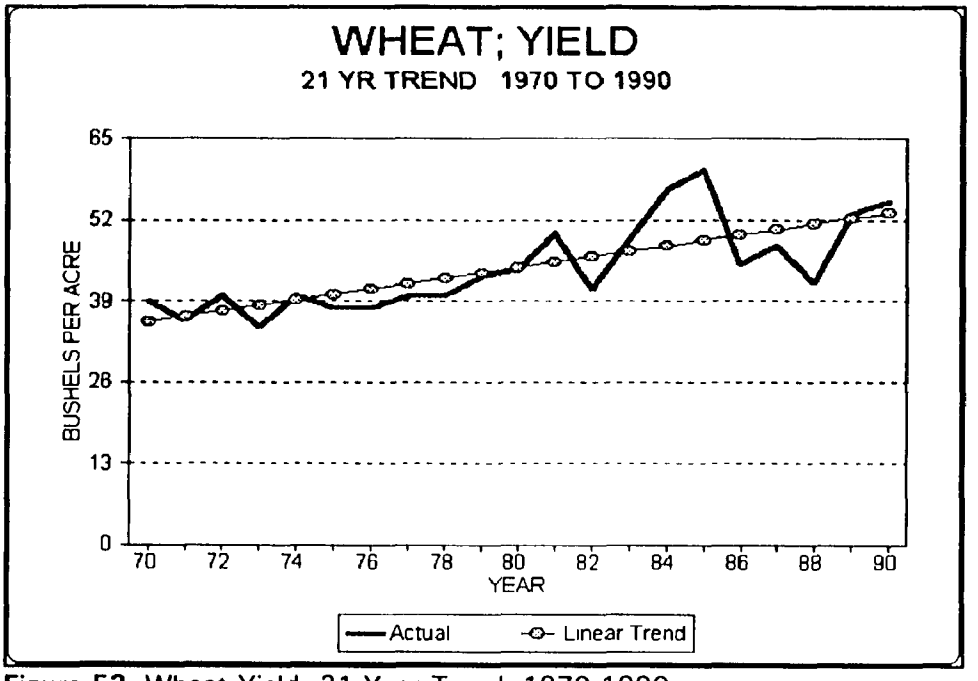
Average: 30,510,714

High: 45,600,000

Low: 16,400,000

Avg. Anl. Chg: 2.11%

Figure 51 Wheat Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

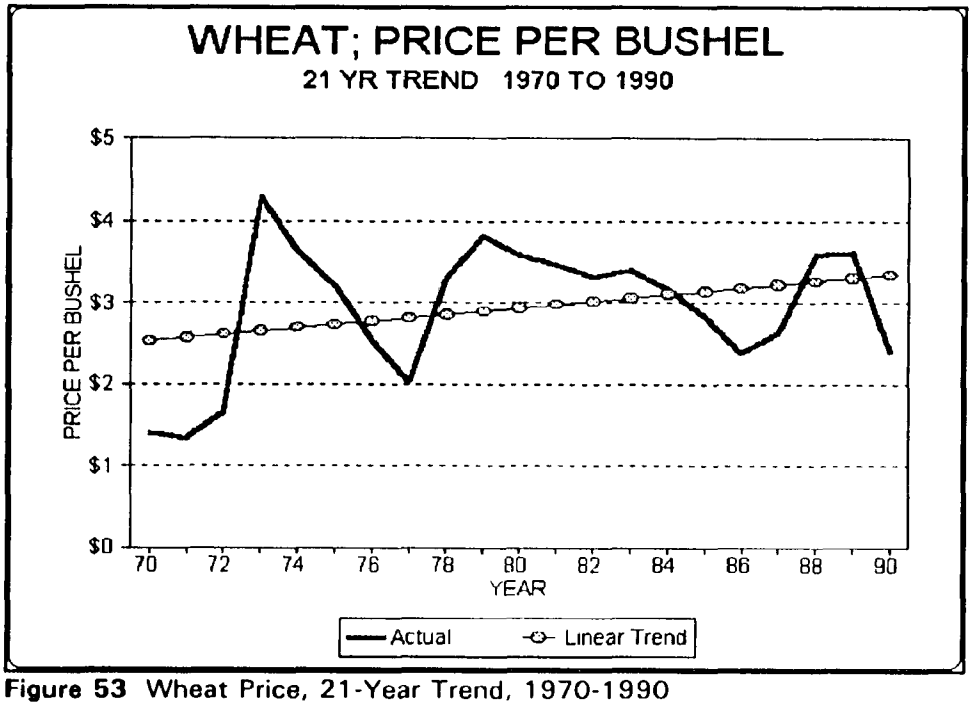
Average:
44

High:
60

Low:
35

Avg. Anl. Chg:
1.96%

Figure 52 Wheat Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$2.94

High:
$4.30

Low:
$1.34

Avg. Anl. Chg:
1.40%

Figure 53 Wheat Price, 21-Year Trend, 1970-1990

General Livestock Overview

This section reviews the important livestock trends of price, yield, value of production, numbers, and quantity produced for each of Michigan's top livestock sectors.[65] Figure 54 is an aggregation of all livestock sectors and their value of production. Livestock value of production has grown at an average annual rate of 3.72% during the decades of the 70's and 80's. The $1 billion barrier was broken in 1979, by 1990 value of production had risen to $1.37 billion. Following Figure 54 is Table III. Table III is a trend summary of the livestock sectors ranked by the average annual percent changes for each category (price, number of head, etc.).

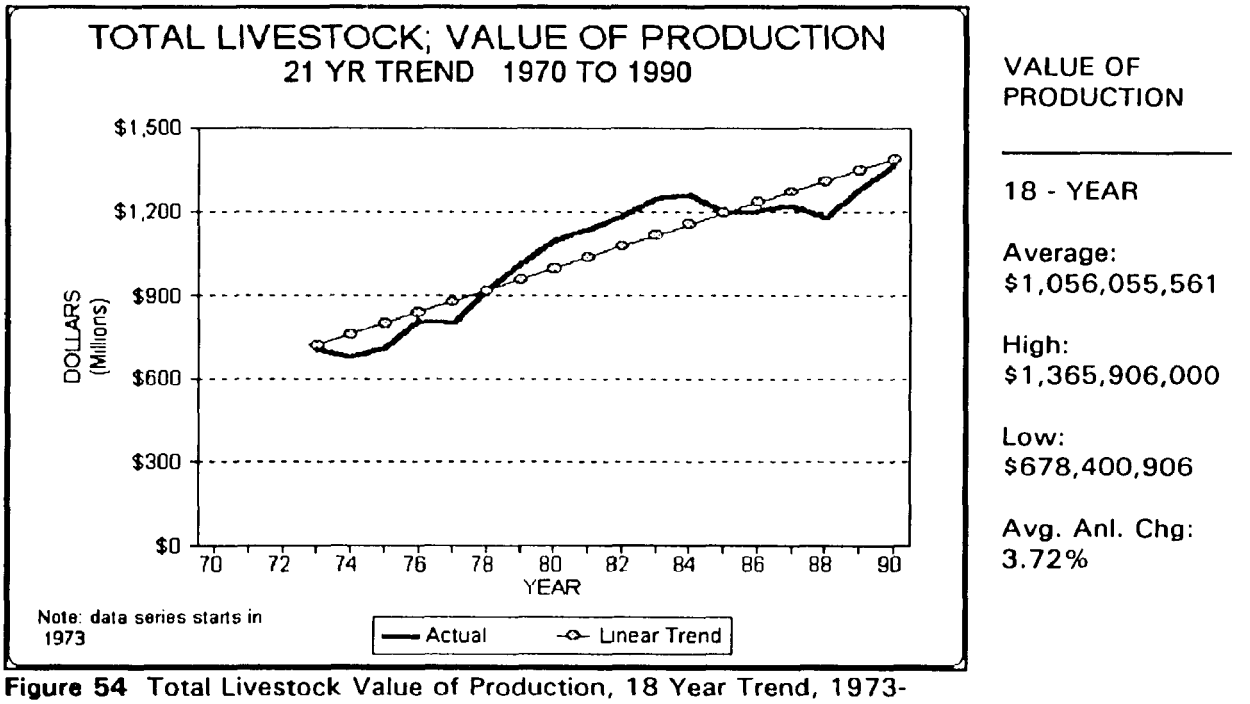


Figure 54 Total Livestock Value of Production, 18 Year Trend, 1973-1990

[65] The top Michigan livestock sectors selected for analysis were based on their value of production. Note: the category of "honey" which is considered to be livestock, was not selected for analysis because of large gaps in Michigan Agricultural Statistical Service time series data.

Table III Trend Summary for Livestock & Poultry, Commodity Rank by Average Annual % Change for 21-Years, 1970-1990

TREND SUMMARY FOR LIVESTOCK & POULTRY
COMMODITY RANK BY
AVERAGE ANNUAL % CHANGE FOR
21-YearS FROM 1970 - 90

Number of Head

Rank	Commodity	% Chg.
1	Turkeys	9.43%
2	Hogs-pigs	3.54%
3	Broilers	1.02%
4	Chickens	-0.36%
5	Hens-pullets	-0.41%
6	Milk cows	-1.02%
7	All Cattle	-1.28%
8	Beef	-1.95%
9	Sheep-lambs	-4.07%
	Average	0.54%

Production

Rank	Commodity	% Chg.
1	Turkeys	10.74%
2	Hogs-pigs	5.10%
3	Milk	0.90%
4	Sheep-lambs	0.51%
5	Hens-pullets (eggs)	0.32%
6	Chickens	0.11%
7	All Cattle	-0.61%
8	Broilers	-1.64%
	Average	1.93%

Yield

Rank	Commodity	% Chg.
1	Milk per cow	1.97%
2	Eggs per layer	0.75%
	Average	1.36%

Price

Rank	Commodity	% Chg.
1	Calves	3.84%
2	Milk	3.81%
3	Sheep-lambs	3.62%
4	Cattle	3.43%
5	Broilers	2.67%
6	Turkeys	1.51%
7	Eggs	1.41%
8	Hogs-pigs	1.07%
9	Chickens	-0.38%
	Average	2.33%

Table III (Continued) Trend Summary for Livestock & Poultry, Commodity Rank by Average Annual % Change for 21-Years, 1970-1990

TREND SUMMARY FOR LIVESTOCK & POULTRY
COMMODITY RANK BY
AVERAGE ANNUAL % CHANGE FOR
21-YearS FROM 1970 - 90

Value of Production

Rank	Commodity	% Chg.
1	Turkeys	12.57%
2	Hogs-pigs	6.03%
3	Milk	3.82%
4	Sheep-lambs	2.62%
5	All Cattle	2.33%
6	Eggs	1.67%
7	Broilers	0.56%
8	Chickens	-1.08%
	Average	3.56%

Dairy: Dairy is clearly Michigan's most important farm enterprise. Throughout the 70's and 80's dairy cash receipts consistently accounted for one-fourth of the state's total farm receipts. Nationally; Michigan ranks 7th in cow numbers and milk output,[66] and 10th in production per cow.[67] Not surprisingly, Michigan is also a national leader in processed milk products such as, cheeses ranking 13th, ice cream 10th, butter and ice milk 8th, and nonfat dry milk and dry buttermilk 4th. Six counties in Michigan produce approximately one-third of the state's total output. The top producing counties are Shiawasee, Huron, Clinton, Allegan, Ionia, and Ottawa.

The dairy industry nationwide has been undergoing significant structural changes. Milk production levels have steadily increased while the number of cows has declined. In Michigan since 1970 the number of cows has dropped from 433,000 to 344,000 in 1990 (a decline of 20.6%), the lowest level since 1882. Meanwhile total output has increased an average annual amount of 0.90%, expanding from approximately 4.6 billion pounds of fluid milk per year in the early 70's to over 5.3 billion pounds in the late 80's. The reason for the noticeable production divergence is the remarkable surge in yield per cow. The 21 year trend for Michigan output per cow is exponential, increasing at an average annual rate of 1.97%, see Figure 58. Over the last two decades yields have increased in 17 of the 20 years, two of the down

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[66] A national production share ranging from 3.5% to 4.0%.

[67] Michigan's milk output per cow is second only to California among the top producing states.

years occurred in 1973 and 1974, when P.B.B. was found in dairy feed. In 1970 the per cow yield was 10,628 pounds of milk per year, by 1990 the yield had expanded to 15,212 pounds of milk, a growth of 43.1%. Several factors have influenced the higher milk production per cow. Three of the most important reasons are genetic improvements, management and technological innovations. Breeding practices have been used to improve a cows ability to convert feed ration concentrate more efficiently. Cows are now able to transform higher levels of concentrate into correspondingly higher levels of milk production. The Michigan Agricultural Statistic Service reports that, "concentrates in feed rations have been increased by more than 40 percent since 1970." During this time period the concentrate-milk output ratio has remained stable as total milk output rose.

Two important events occurred in the 80's which impacted Michigan's dairy industry. The first event was the enactment of the Dairy Termination Program (DTP), April 1, 1986. The program was initiated by the federal government in the 1985 Food Security Act (Farm Bill). The goal of the U.S.D.A. was to reduce the U.S. milk surplus by 12 billion pounds by October 1, 1987. The DTP impacted all segments of the state's industry; milk haulers, processing plants, inputs suppliers, service firms and of course the farmers. The number of Michigan cows declined approximately 10% during the 18-month program. Michigan Grade A dairy herds also dropped from 6,800 in 1985 to only 5,300 in 1987. Even with the large drop in milk cows and farm

numbers, total milk production fell only 6% from 1985[68] to 1987. The other important factor that influenced the dairy industry was the drought of 1988. As mentioned above, the number of cows and farms declined as a result of the DTP, the 1988 drought led to an additional culling of less productive cows. Short supplies of feed ration inputs such as corn, oats and hay, and higher feed costs initiated the culling process. The U.S. Congress passed the Disaster Assistance Act of 1988 in late August to provide relief to the farmers. Fluid milk value of production of increased steadily through the 70's and into the early 80's. However, from 1983 to 1988 value of production fell approximately 13.7%, from $754 million to $650 million. During this period both the price of milk per Cwt. and total quantity of milk produced declined. These declines occurred during the federal governments dairy diversion and dairy termination programs. Once the programs were lifted, the previous trends for value of production, price and quantity of milk produced regained their trajectory. By 1990, the wholesale price of milk per hundredweight[69] reached an all-time high of $14.10 and production was only 9.9% from the all-time set in 1964.

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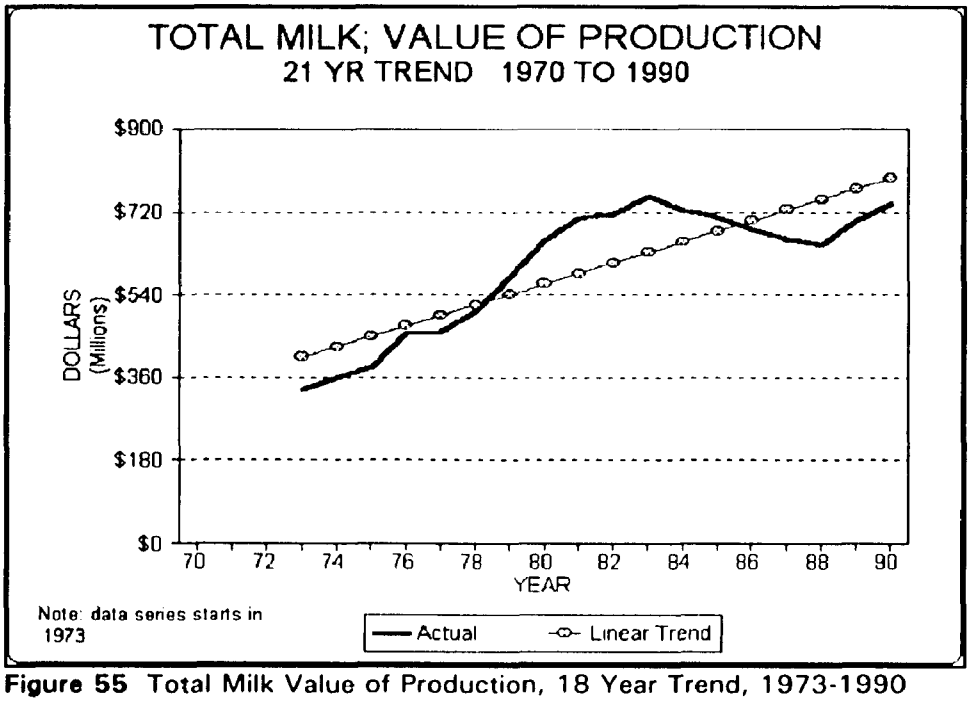
[68] In 1985 production reached 5.57 billion pounds of milk, just shy of the all-time record of 5.75 reached in 1964.

[69] Note: the 21 year growth rate trend for milk prices was an average annual rate of 3.81%, this was the second largest growth rate for all livestock prices.



VALUE OF PRODUCTION

18 - YEAR

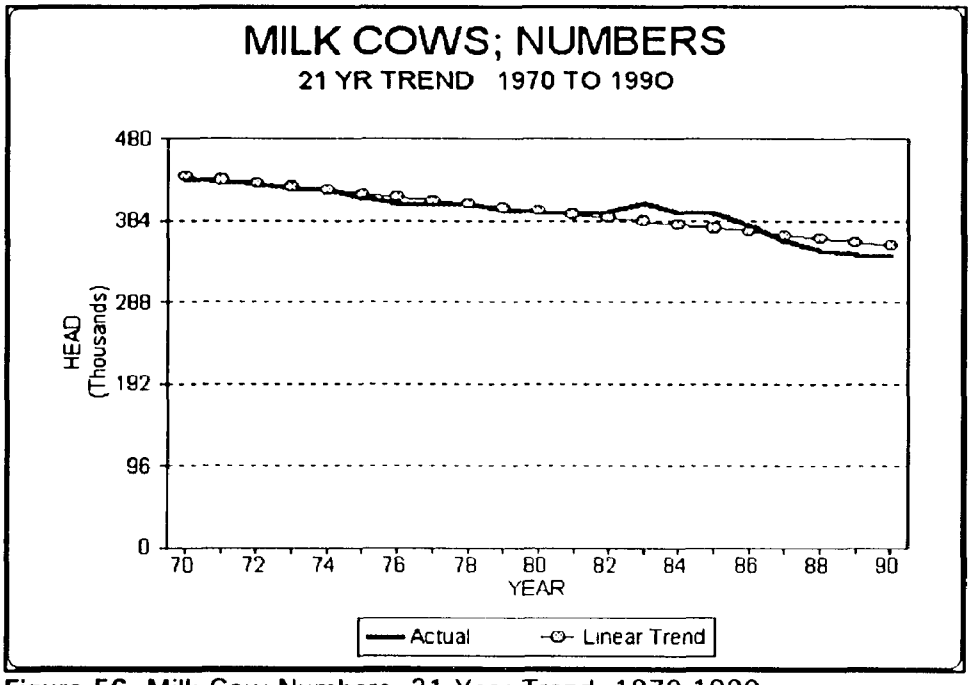
Average: $599,105,389

High: $753,578,000

Low: $333,328,000

Avg. Anl. Chg: 3.82%

Figure 55 Total Milk Value of Production, 18 Year Trend, 1973-1990



NUMBER

21 - YEAR

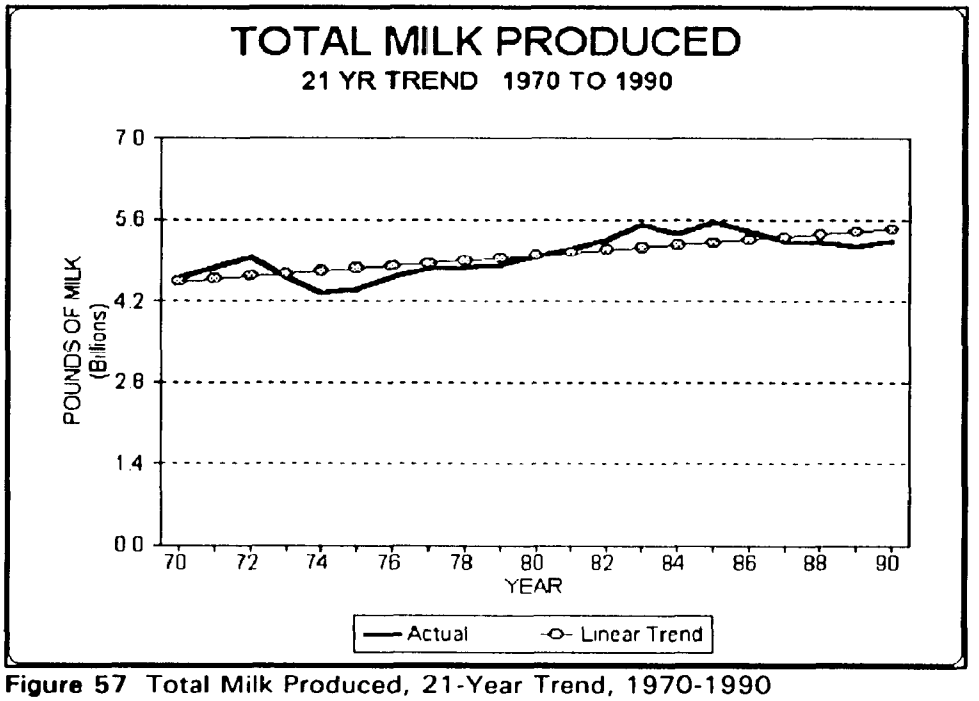
Average: 395,571

High: 433,000

Low: 344,000

Avg. Anl. Chg: -1.02%

Figure 56 Milk Cow Numbers, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

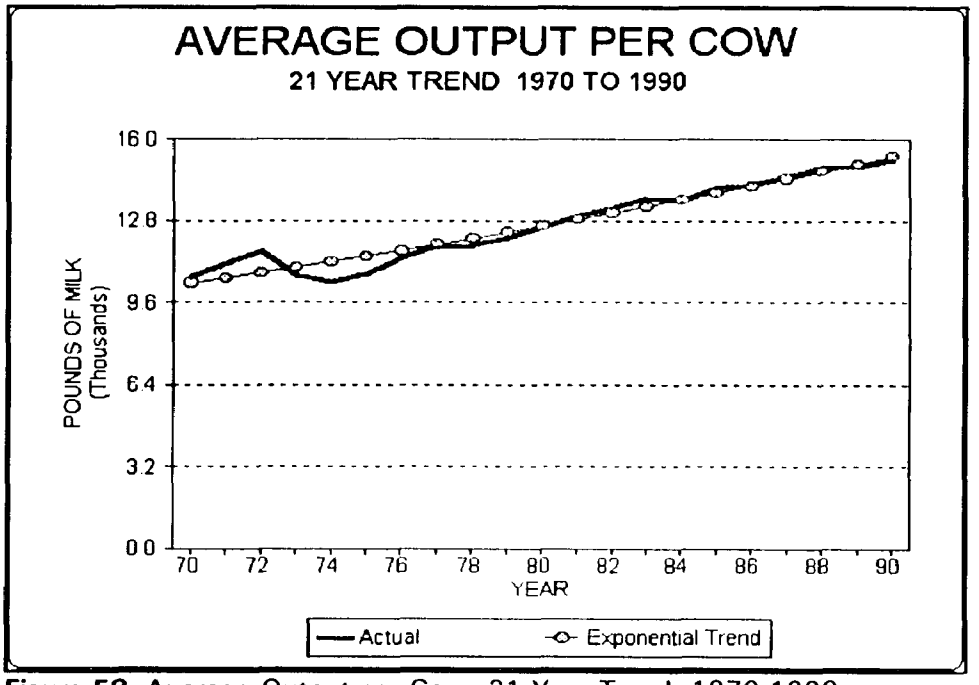
Average:
4,990,571,429

High:
5,568,000,000

Low:
4,350,000,000

Avg. Anl. Chg:
0.90%

Figure 57 Total Milk Produced, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
12,698

High:
15,212

Low:
10,407

Avg. Anl. Chg:
1.97%

Figure 58 Average Output per Cow, 21-Year Trend, 1970-1990

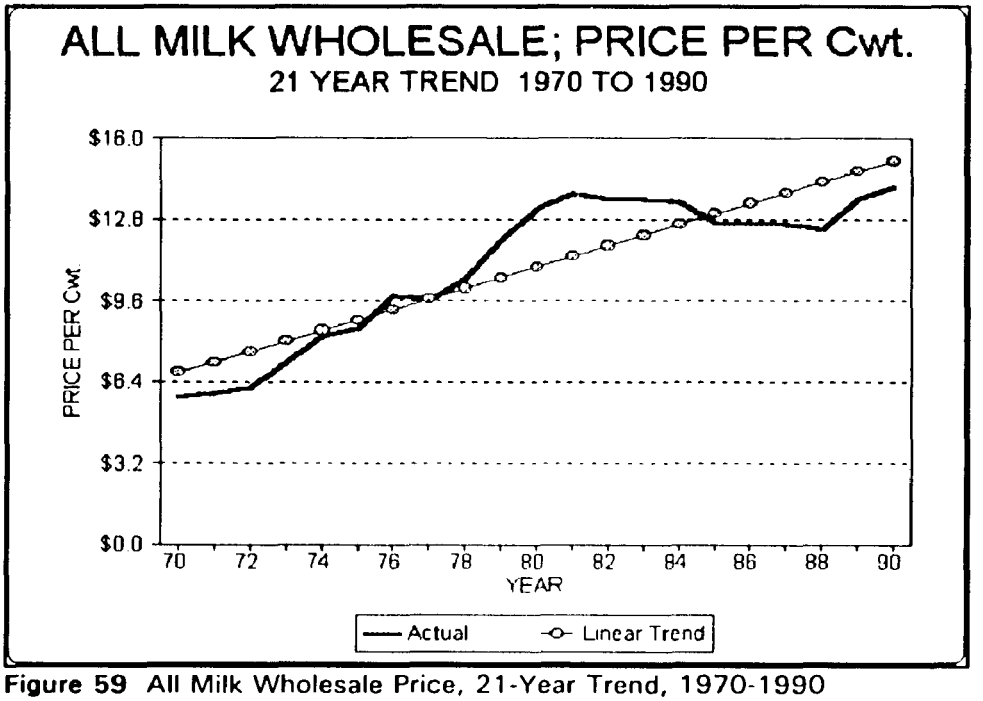


Figure 59 All Milk Wholesale Price, 21-Year Trend, 1970-1990

Hogs and Pigs: The hog and pig industry is the one of the fastest[70] growing livestock sectors in the state in terms of growth in animal numbers, value of production, and level of output. From 1970 to 1990 the trend for hog and pig numbers expanded exponentially at an average annual rate of 3.54%, see Figure 61. The upward trend in hog numbers is highlighted by a 21 year high reached in 1987 of 1.35 million head. This was the second largest hog total recorded, compared to the all-time high set in 1944 of 1.40 million head. The poundage of pork produced also increased proportionally. Pounds produced

[70] The turkey industry is the fastest growing livestock sector in Michigan for the decades of the 70's and 80's.

grew at an average annual rate of 5.10%.[71] Total pork pounds doubled from a level of 240 million pounds in the mid 1970's to 480 million pounds in 1990. Hog prices have trended gradually higher, increasing at an annual rate of 1.06%, next to last for the livestock commodities ranked. Price per Cwt. ranged from a low of $24.50 to a high of $61.00, often following the classic four year hog; price-production cycle. The modest trend toward higher hog prices coupled with higher poundage output, yielded a commensurate increase in the value of production. Value of production climbed from a level of $89 million in 1974 to a 21 year high of $251 million in 1990, up 182%.

Almost one-half of the state's hogs and pigs are grown in the Southwest region. Just three counties in the Southwest region, Cass, Allegan, and Ottawa account for approximately 30% of the state total. In 1990 Michigan ranked 11th in the county for the number of head of hogs and pigs with 2.3% of the total, Iowa is the leading state. Michigan is even more prominent in terms of the amount of pork slaughtered, ranking 5th nationally. Hogs are shipped to Michigan from Canada and throughout the mid-west to be processed.

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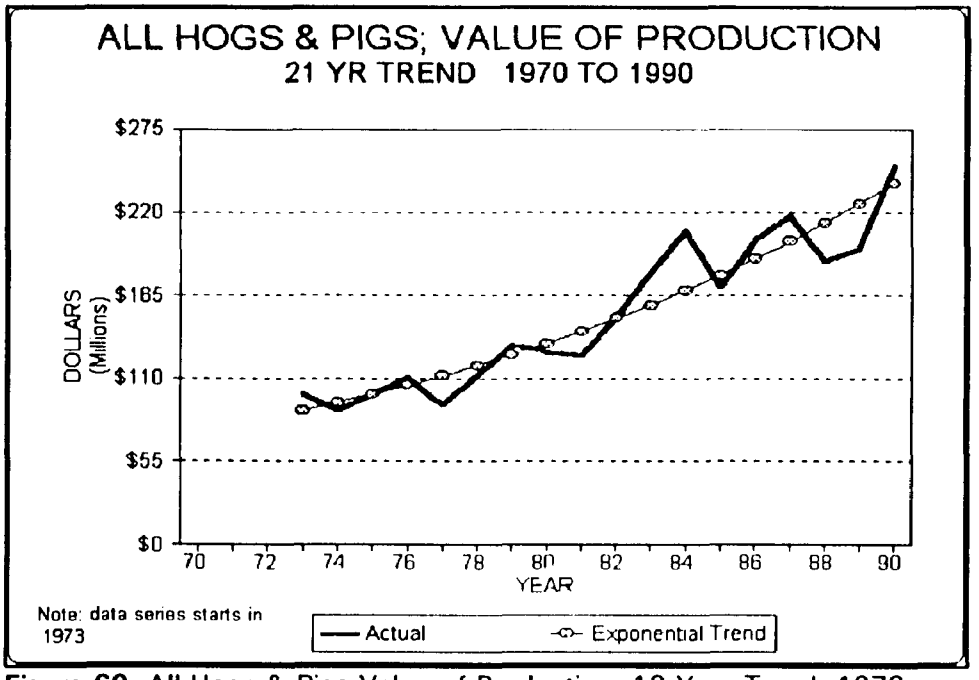
[71] Second in percentage growth relative to turkeys.



VALUE OF PRODUCTION

18 - YEAR

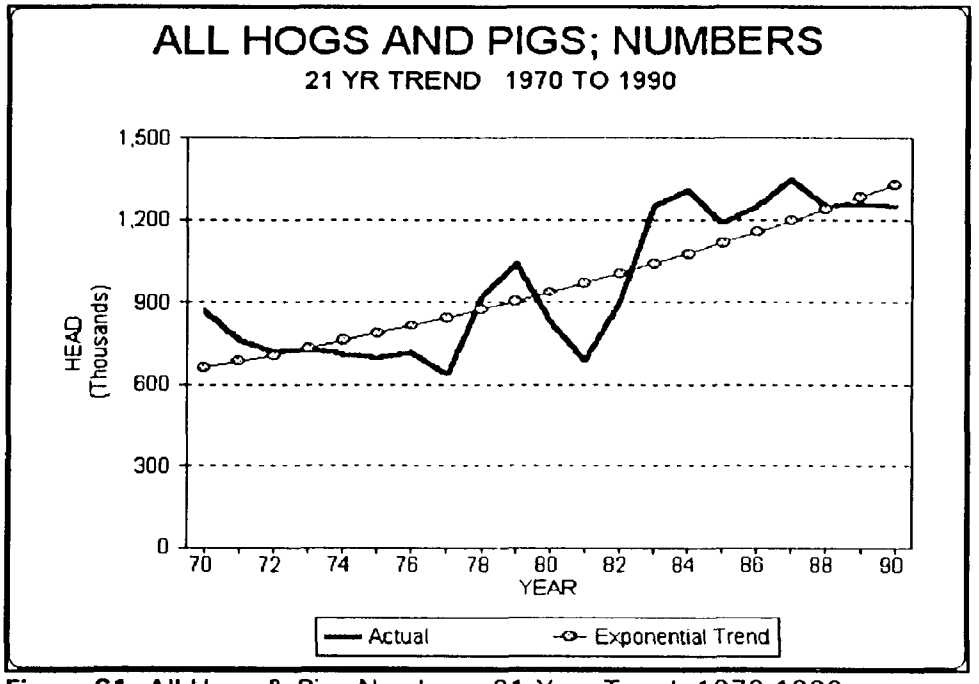
Average: $153,000,722

High: $251,359,000

Low: $88,903,000

Avg. Anl. Chg: 6.03%

Figure 60 All Hogs & Pigs Value of Production, 18 Year Trend, 1973-1990



NUMBER

21 - YEAR

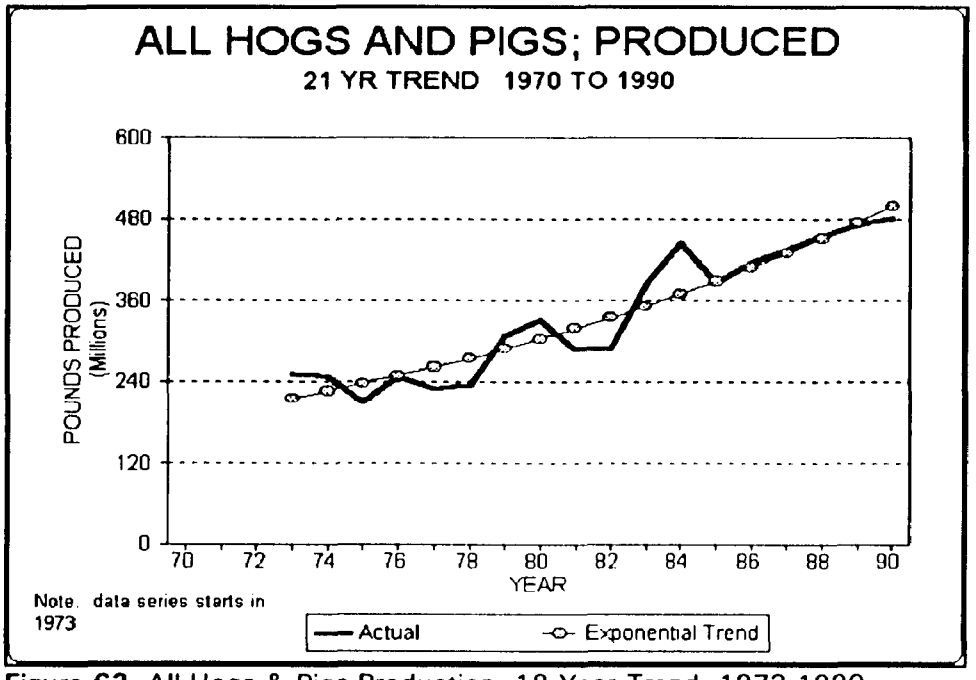
Average: 969,100

High: 1,350,000

Low: 640,000

Avg. Anl. Chg: 3.54%

Figure 61 All Hogs & Pigs Numbers, 21-Year Trend, 1970-1990



PRODUCTION

18 - YEAR

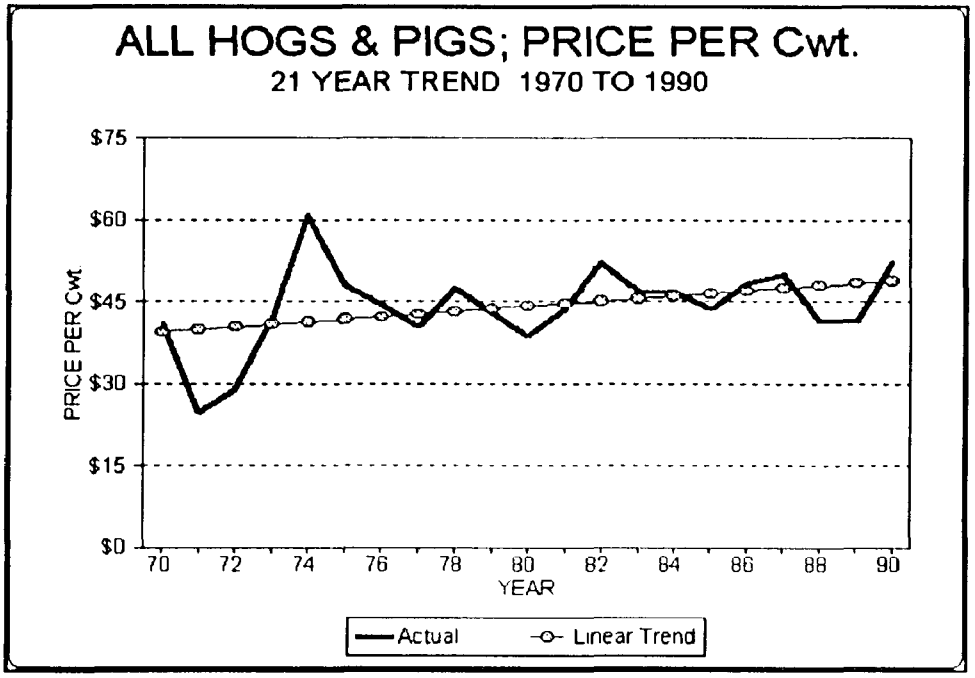
Average:
339,457,778

High:
480,809,000

Low:
208,124,000

Avg. Anl. Chg:
5.10%

Figure 62 All Hogs & Pigs Production, 18 Year Trend, 1973-1990



PRICE

21 - YEAR

Average:
$44.16

High:
$61.00

Low:
$24.50

Avg. Anl. Chg:
1.07%

Figure 63 All Hogs & Pigs Price, 21-Year Trend, 1970-1990

All Cattle and Calves:[72] As described in the footnote below, the cattle and calves classification includes a number of subgroups such as milk cows[73] and beef cows. The number of cattle and calves in the state have been steadily falling. The 21-year trend is an average annual decline of 1.28%, see Figure 65. In 1990 total cattle and calve numbers stood at 1.2 million head, this was the lowest level since 1902. The number of head record high was set in 1944[74] at 2.04 million. Beef cow numbers have also been in a downward trajectory in the decades of the 70' s and 80's. In the early 70's the number of beef cows rose rapidly from 170,000 head in 1970 to a peak of 239,000[75] head in 1977. Since 1977, beef cow numbers fell 45%, to 131,000 in 1990, see Figure 69. Total production, in pounds, declined for all cattle and calves but not as rapidly as the number of head. Production fell an average annual rate of 0.61%, only broilers posted a larger production rate decline, see Table III. Prices for both cattle and calves rose. Calve prices increased an average annual amount of 3.84%, highest for all of the commodities. The price per

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[72] The cattle and calves classification includes the following categories; (1) cows and heifers that have calved (beef cows and milk cows), (2) heifers, 500 pounds and over, (3) steers, 500 pounds and over, (4) bulls, 500 pounds and over, (5) calves, less than 500 pounds.

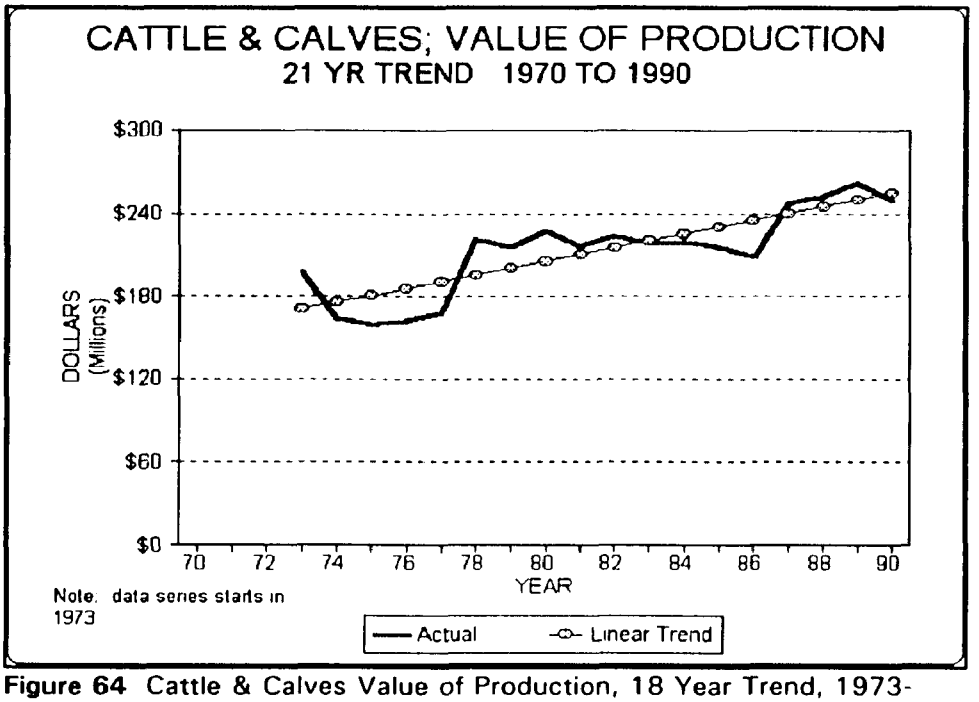
[73] Milk cows are described in greater detail in the dairy section. As a proportion of the number of cattle and calves in the state, dairy cows constitute approximately 29% of the total.

[74] This was during World War II when the U.S. and it's Allies required larger amounts of food supplies to feed the troops.

[75] This is a all-time high.

Cwt. climbed from the $35 range in the early 70's to almost $100 in 1990. Cattle prices rose from the $25 per Cwt. range, to above $60 per Cwt. in 1990. The value of production increased modestly, due to the higher prices, despite the decline in livestock numbers. Value of production expanded an average annual amount of 2.33%, to approximately $250 million a year in the late 1980's.

Cattle and calve operations are primarily concentrated in the East Central (Huron and Sanilac counties) and Southwest (Allegan and Ottawa counties) regions of the state. These four counties accounted for 20% of the state's total number of animals in 1990. Michigan is not considered a significant producer in the cattle and calve industry. The state ranks 30th in the country in terms of cash receipts from cattle and calves, with only 0.88% of a share of the total.



VALUE OF PRODUCTION

18 - YEAR

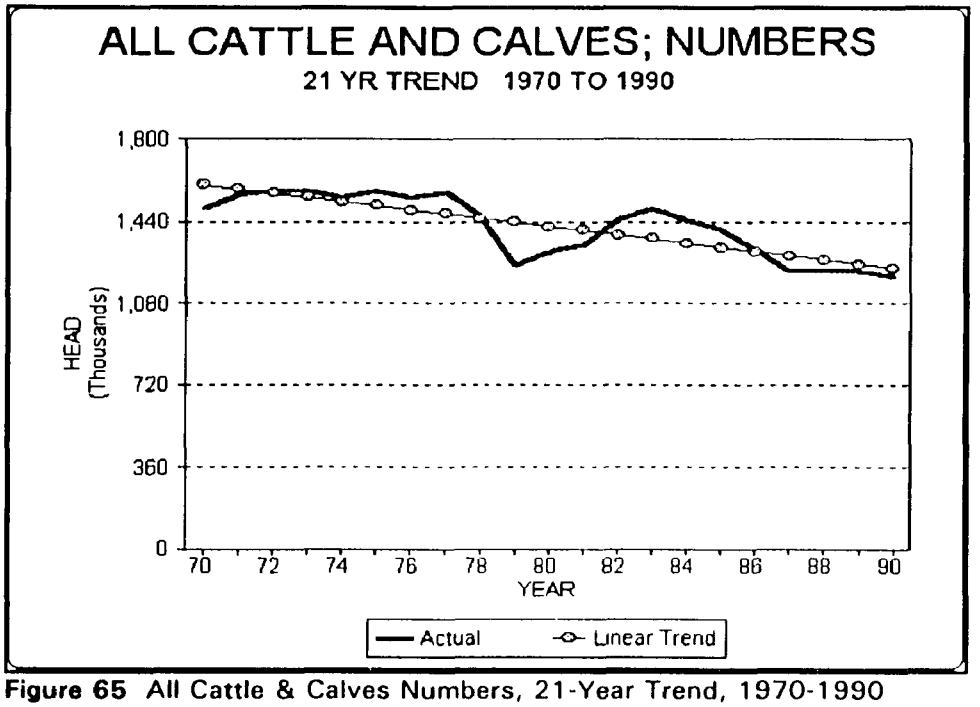
Average: $212,816,611

High: $262,090,000

Low: $159,569,000

Avg. Anl. Chg: 2.33%

Figure 64 Cattle & Calves Value of Production, 18 Year Trend, 1973-1990



NUMBER

21 - YEAR

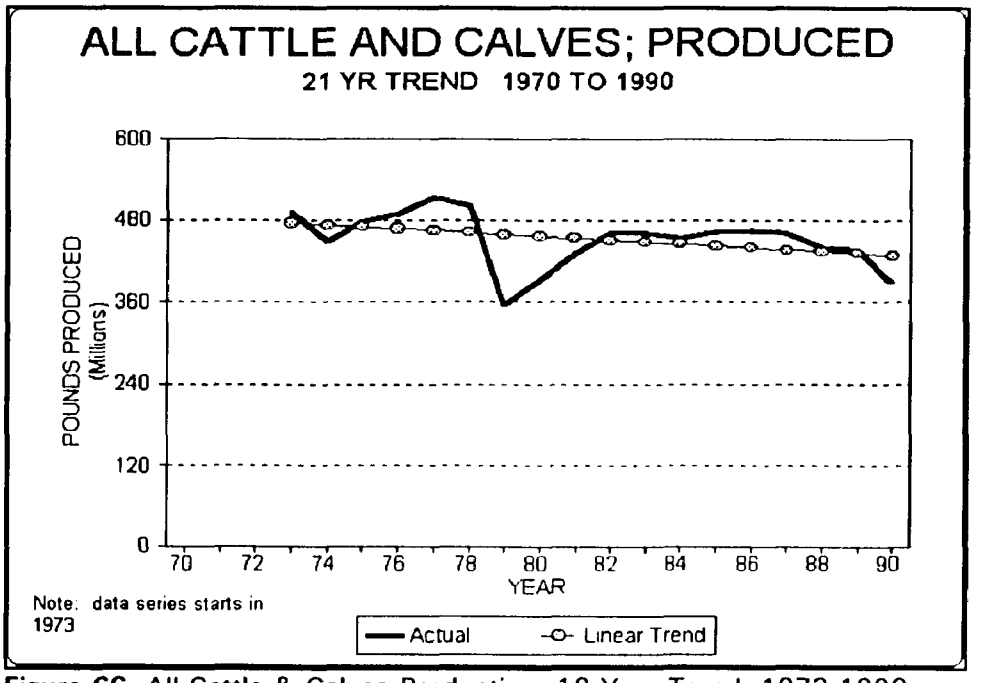
Average: 1,421,048

High: 1,580,000

Low: 1,200,000

Avg. Anl. Chg: -1.28%

Figure 65 All Cattle & Calves Numbers, 21-Year Trend, 1970-1990



PRODUCTION

18 - YEAR

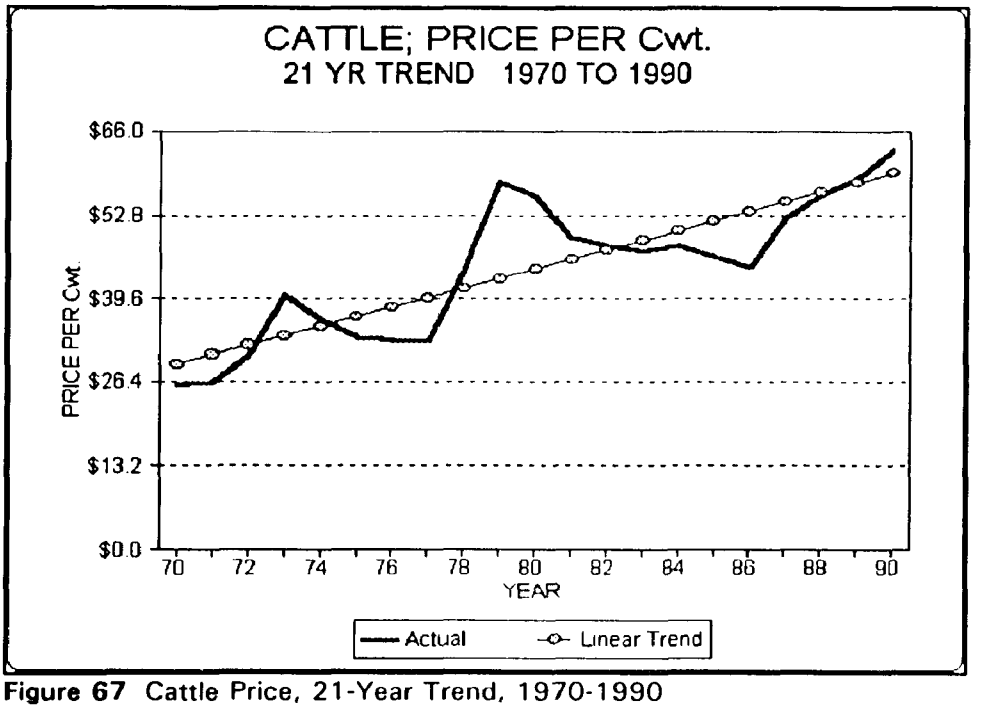
Average:
452,206,389

High:
513,715,000

Low:
356,865,000

Avg. Anl. Chg:
-0.61%

Figure 66 All Cattle & Calves Production, 18 Year Trend, 1973-1990



PRICE

21 - YEAR

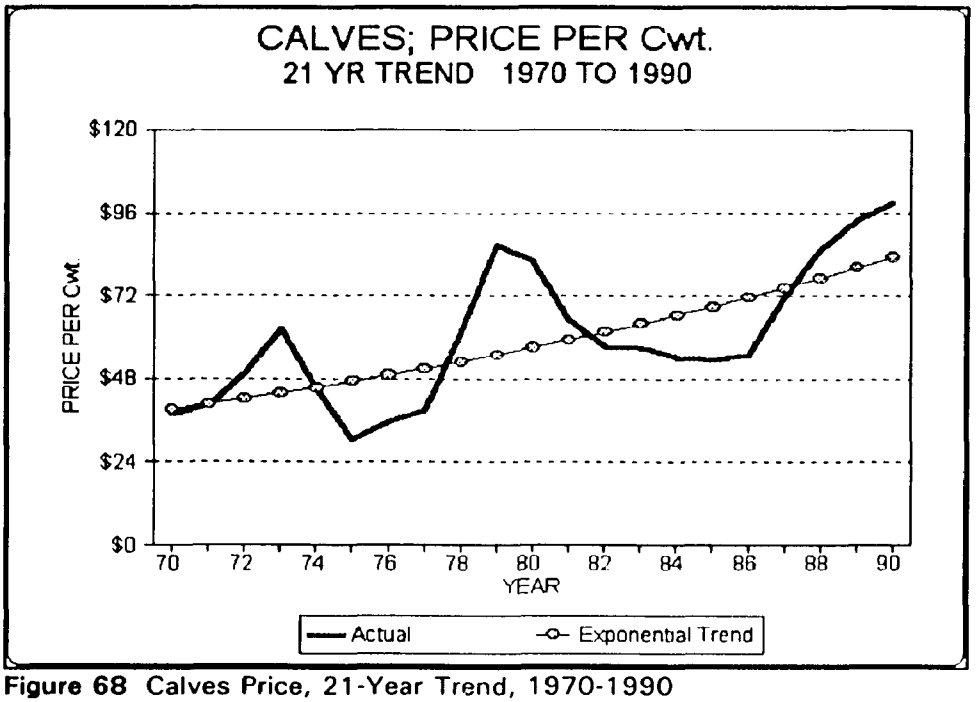
Average:
$44.32

High:
$63.20

Low:
$25.80

Avg. Anl. Chg:
3.43%

Figure 67 Cattle Price, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

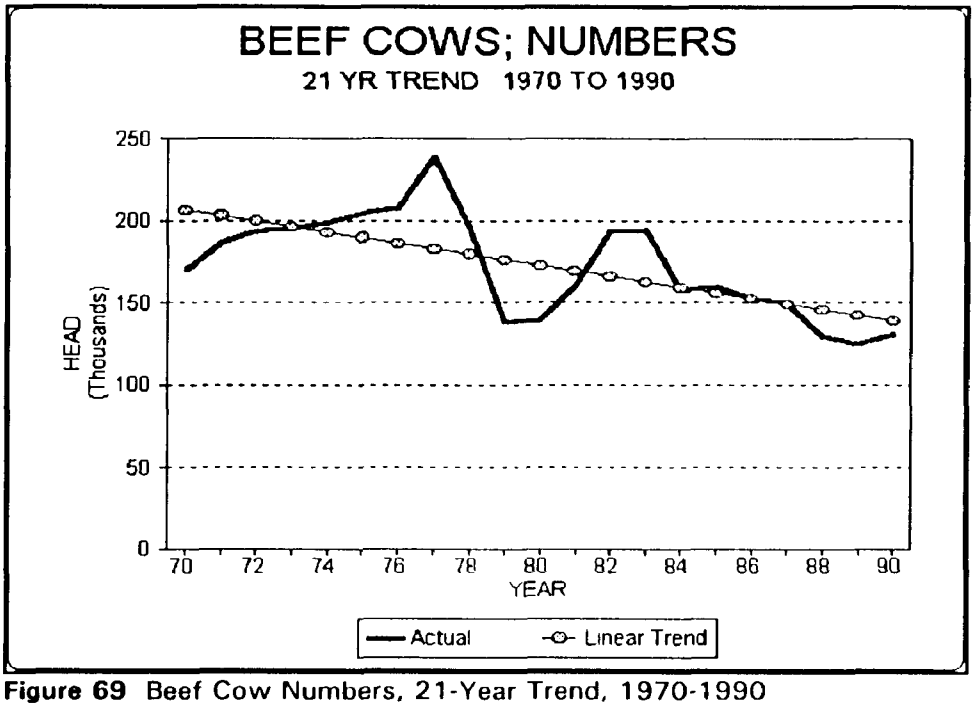
Average:
$60.10

High:
$99.00

Low:
$30.40

Avg. Anl. Chg:
3.84%

Figure 68 Calves Price, 21-Year Trend, 1970-1990



NUMBER

21 - YEAR

Average:
172,762

High:
239,000

Low:
125,000

Avg. Anl. Chg:
-1.95%

Figure 69 Beef Cow Numbers, 21-Year Trend, 1970-1990

Sheep and Lambs: The state's sheep and lamb numbers declined throughout the 70's and 80's,[76] see Figure 71, falling from approximately 264,000 in 1970 to 121,000 in 1990, a drop of 54%. Sheep and lamb numbers reached a record low[77] of 105,000 head in 1988. The 21 year average annual decline is 4.07%, last for all livestock commodities. Production in pounds of meat however, have trended gradually higher. The 21 year trend is an average annual increase of 0.51%. Price of lamb per Cwt. has also been increasing, see Figure 73. Lamb prices ranged from a low of $26.60 per Cwt. in 1971, to a high of $75.00 per Cwt. in 1987. The combination of higher lamb prices and output, produced steady increases the value of production. Total value of sheep and lamb production averaged only $5.0 million a year, in the late eighties.

Production in the state is concentrated in four counties: Washtenaw, Jackson, Lenawee, and Ingham. The four counties account for approximately 31% the total. Washtenaw county alone has approximately 16% of the state's sheep and lamb population.

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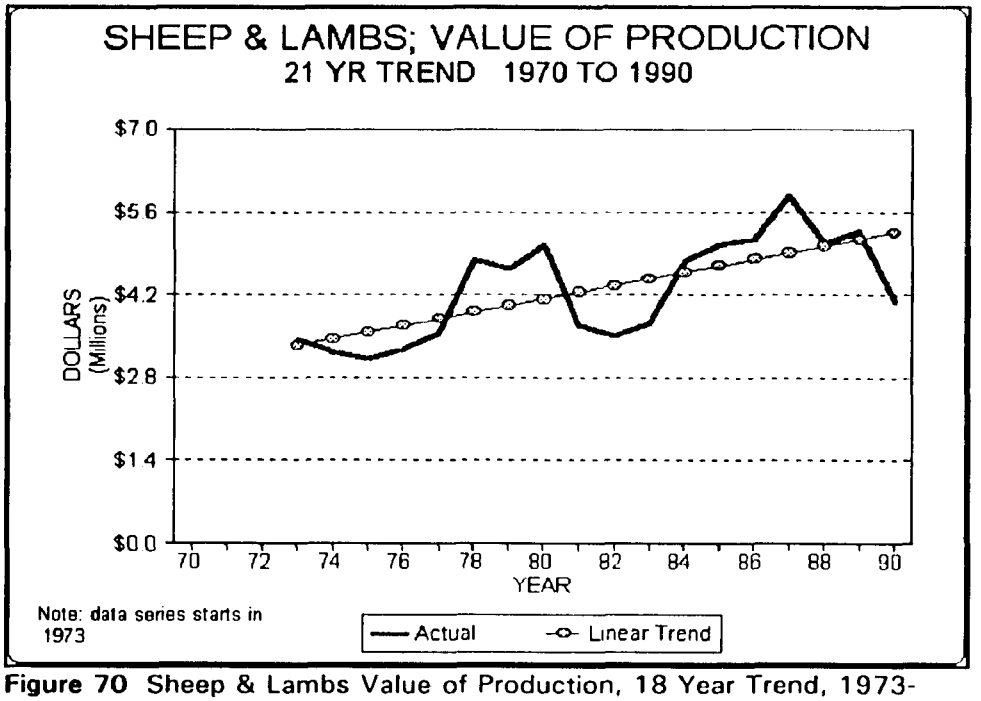
[76] This is a continuation of a much longer downward trend.

[77] The all time high was set in 1867, of 3,100,000 sheep and lamb.



VALUE OF PRODUCTION

18 - YEAR

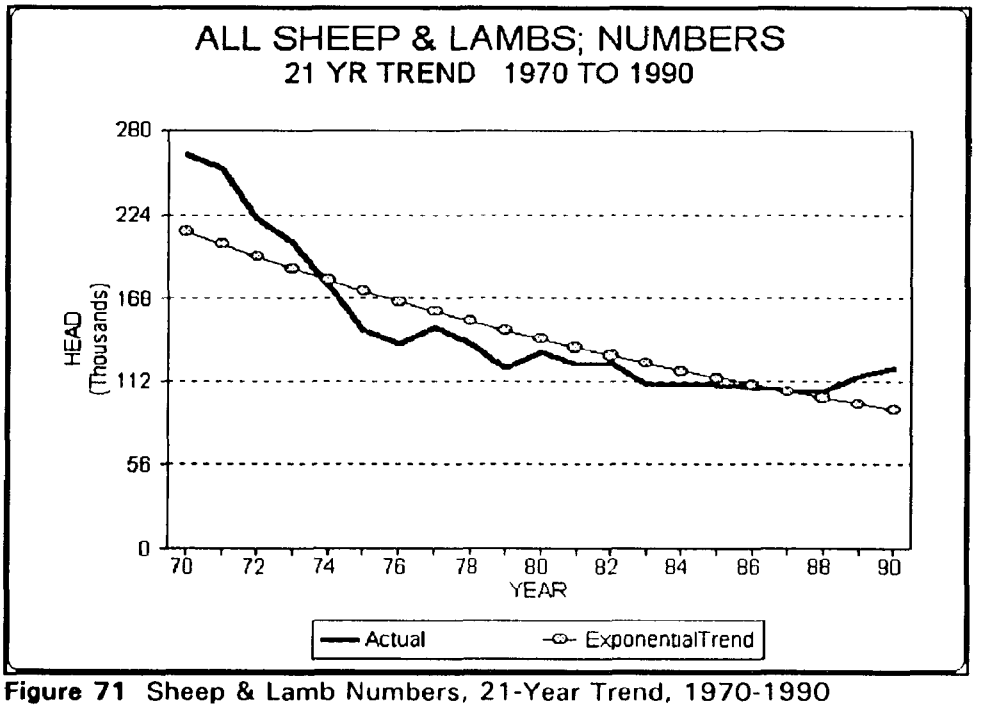
Average: $4,299,778

High: $5,894,000

Low: $3,122,000

Avg. Anl. Chg: 2.62%

Figure 70 Sheep & Lambs Value of Production, 18 Year Trend, 1973-1990



NUMBER

21 - YEAR

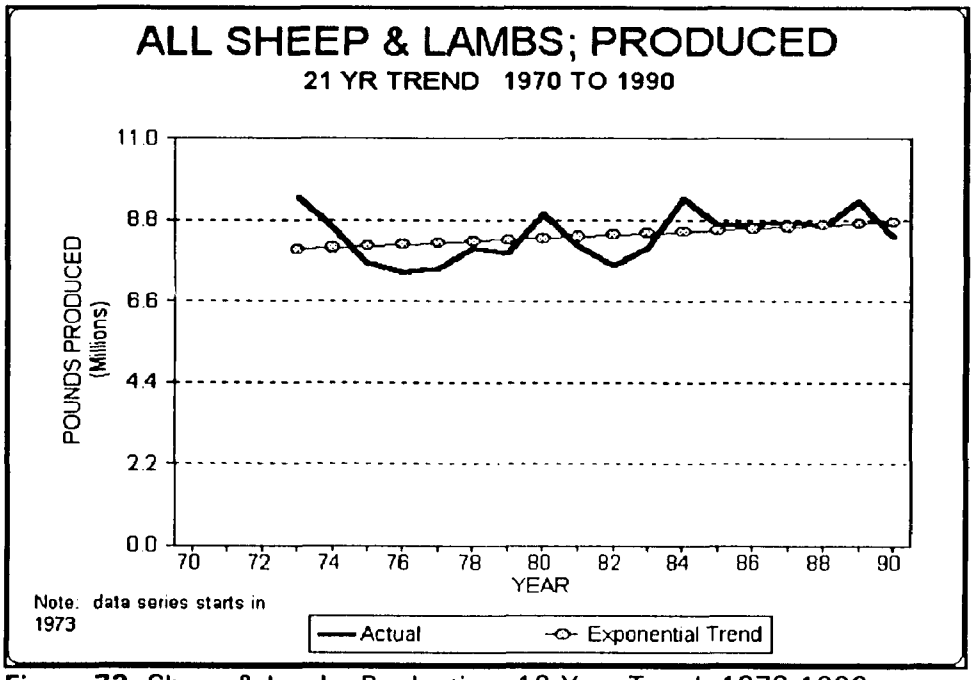
Average: 146,810

High: 264,000

Low: 105,000

Avg. Anl. Chg: -4.07%

Figure 71 Sheep & Lamb Numbers, 21-Year Trend, 1970-1990



PRODUCTION

18 - YEAR

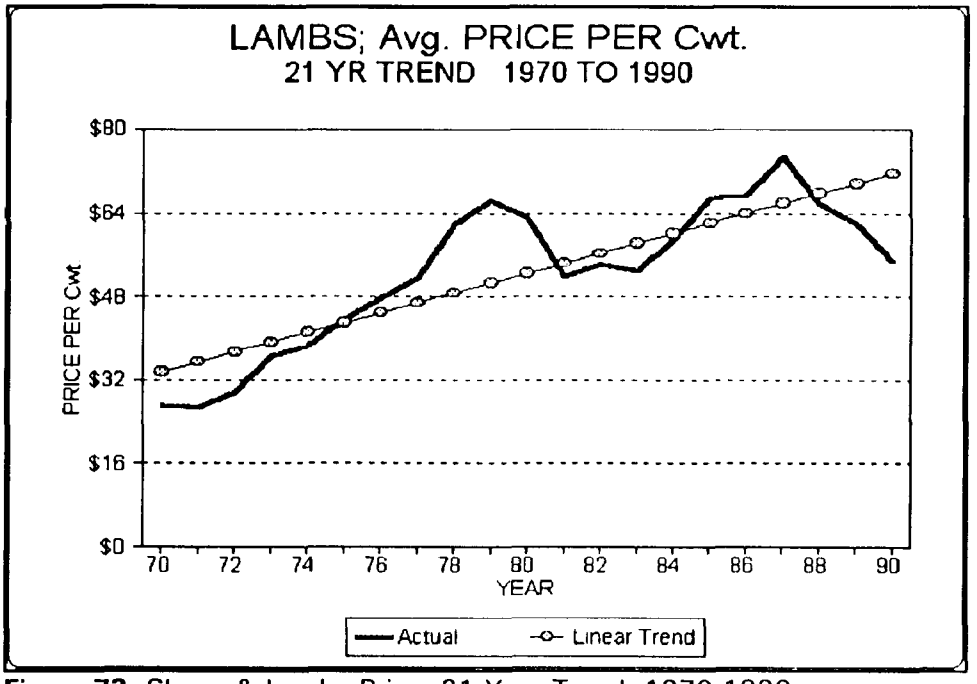
Average:
8,883,400

High:
9,399,000

Low:
7,385,000

Avg. Anl. Chg:
0.51%

Figure 72 Sheep & Lambs Production, 18 Year Trend, 1973-1990



PRICE

21 - YEAR

Average:
$52.60

High:
$75.00

Low:
$26.60

Avg. Anl. Chg:
3.62%

Figure 73 Sheep & Lambs Price, 21-Year Trend, 1970-1990

Layers: The layer industry is the largest poultry sector in the state. Annual sales from eggs are in the $60 to $70 million range. The number of hens and pullets of laying age has gradually declined throughout the decades of the 70's and 80's. The number of birds has declined from the low six million range to the high five million level. The 21-year trend is an average annual decline of 0.41%, see Figure 75. Layer egg production has trended modestly higher, ranging from a low of 1.3 billion eggs in 1975, to 1.7 billion eggs in 1985. One reason for the rise in production is the growth in eggs laid per bird. The average layer in 1970 yielded 223 eggs, by 1990, the number of eggs per bird rose to 257, an increase of 15%.[78] The price farmers receive per dozen eggs expanded at an average annual rate of 1.41%. Egg prices ranked 7th in the annual trend growth rate for the Michigan livestock product prices analyzed, see Table III. The modest gains in both prices and output, combine to generate a higher value of production for eggs during the 21 years. Value of production expanded at an average annual rate of 1.67%. A high of $75 million was reached in 1984,[79] and a low $34 million occurred in 1971.

Production is primarily located in the Thumb and Southwestern regions of the state. Five counties alone account for over 80% of the hens and pullets of laying age in Michigan, they are; Huron, Ottawa, Ionia, Allegan, and Kalamazoo. In 1990, Ottawa county had the largest number of hens and

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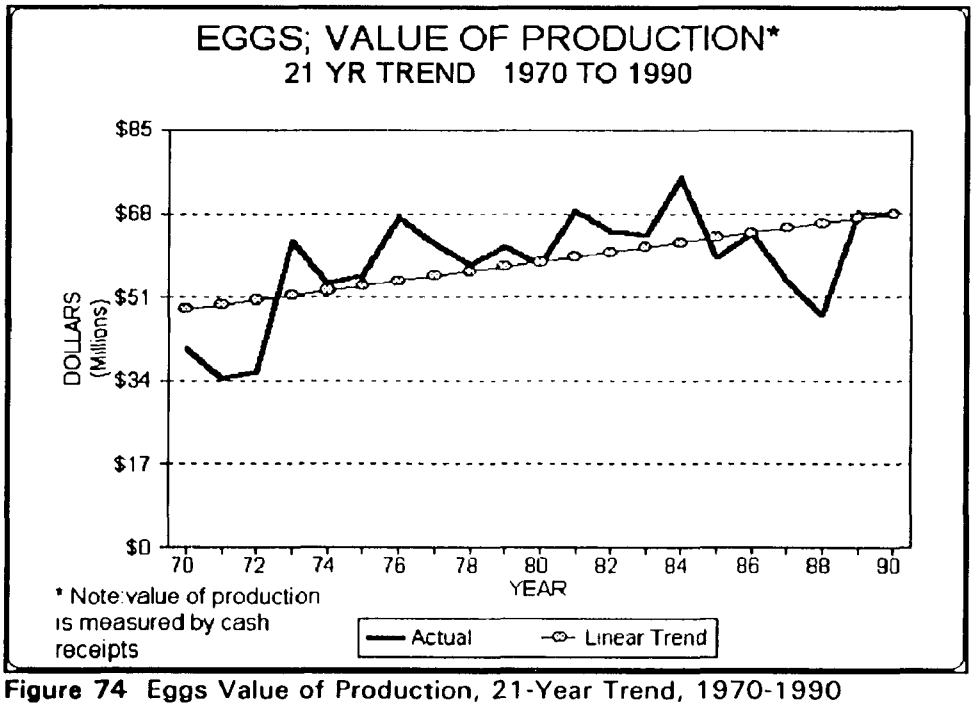
[78] Note: the yield growth trend is exponential, see Figure 77.

[79] The value of production high coincides with a 21 year high of $0.60 per dozen eggs, received by farmers.

layers, 1.6 million birds, or 30% of Michigan's total. In terms of egg production, Michigan ranked 16th in the country in 1990.



VALUE OF PRODUCTION

21 - YEAR

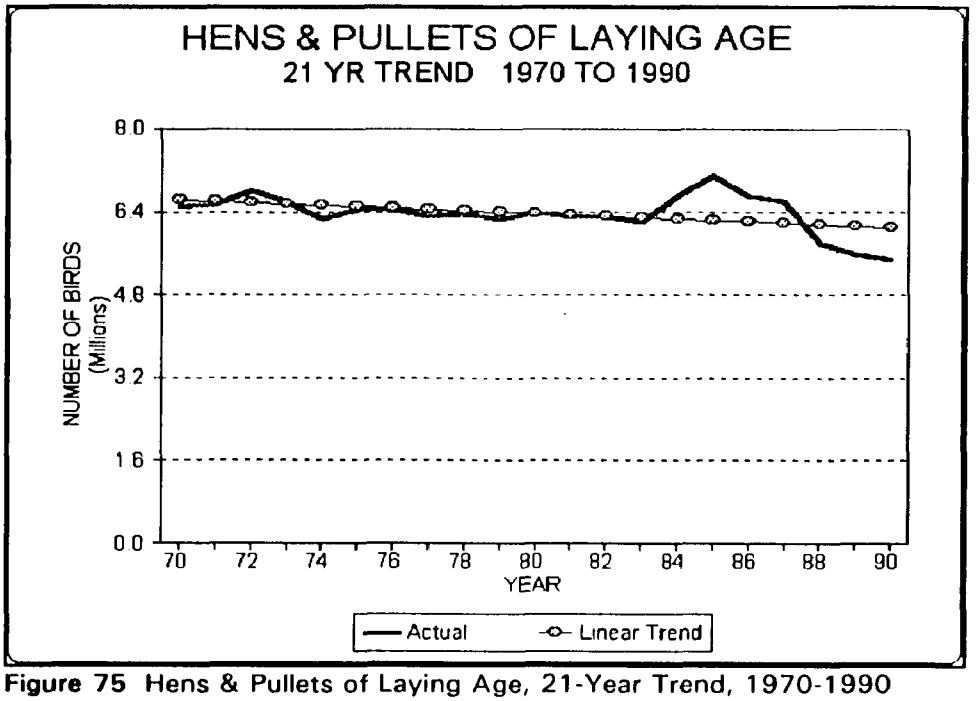
Average: $58,241,000

High: $75,350,000

Low: $34,479,000

Avg. Anl. Chg: 1.67%

Figure 74 Eggs Value of Production, 21-Year Trend, 1970-1990



NUMBER

21 - YEAR

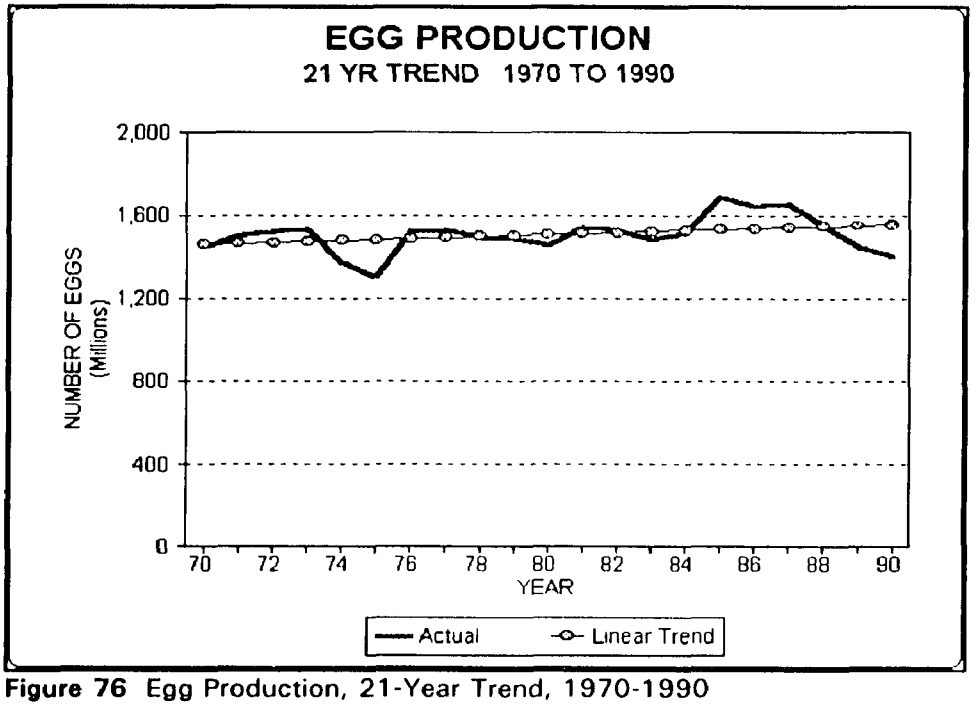
Average:
6,366,524

High:
7,100,000

Low:
5,500,000

Avg. Anl. Chg:
-0.41%

Figure 75 Hens & Pullets of Laying Age, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

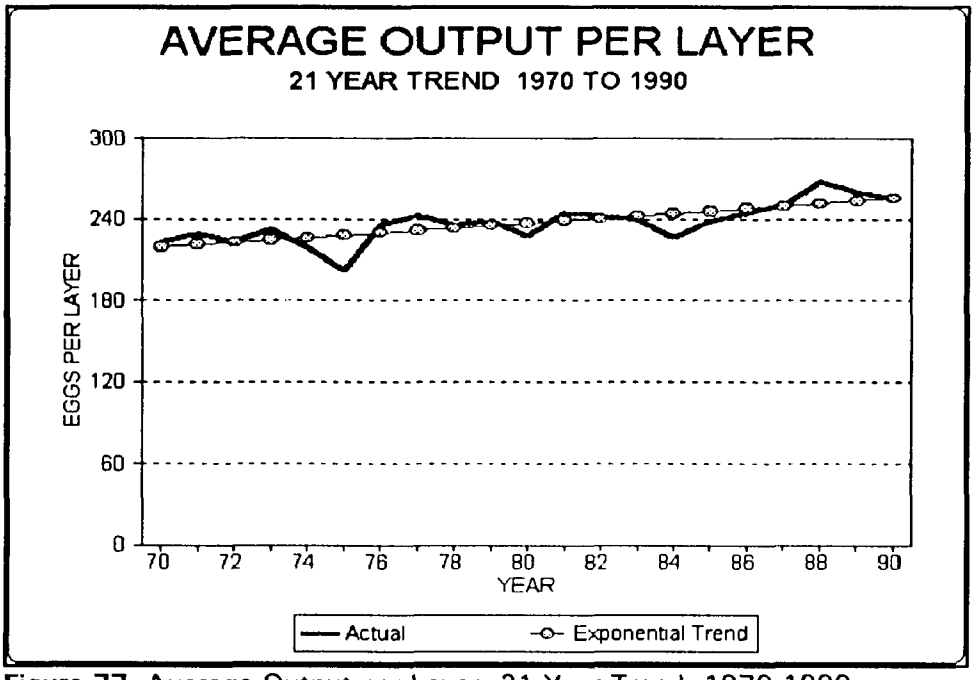
Average:
1,508,286,714

High:
1,693,000,000

Low:
1,303,000,000

Avg. Anl. Chg:
0.32%

Figure 76 Egg Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

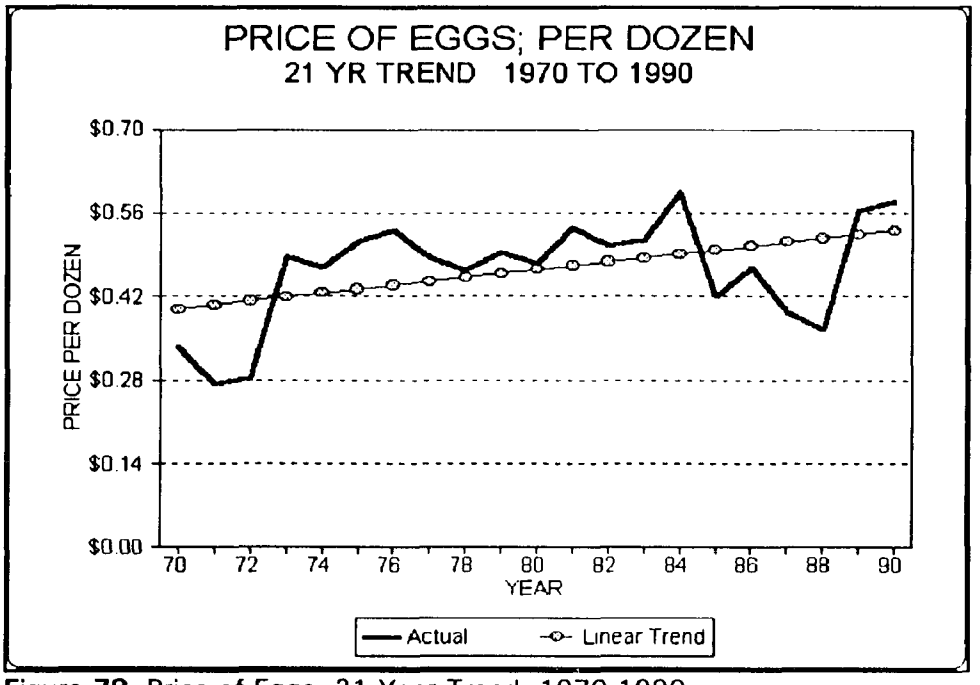
Average:
237

High:
268

Low:
202

Avg. Anl. Chg:
0.75%

Figure 77 Average Output per Layer, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$0.46

High:
$0.60

Low:
$0.27

Avg. Anl. Chg:
1.41%

Figure 78 Price of Eggs, 21-Year Trend, 1970-1990

Chickens: The number of chickens sold in the state is closely related to the culling of hens from the layer industry. As mentioned above in the layer section, the number of hens and pullets of laying age has declined an average annual rate of 0.41% in the 70's and 80's. The number of chickens sold has also declined a similar amount, an average annual rate of 0.36%, see Figure 80. A low of 3.9 million chickens sold occurred in 1989 while the high was 6.0 million in 1975. The trend for poundage of chickens sold is downward but at a slower rate than the number of birds sold. Pounds of chicken sold fell an average annual rate of only 0.11%. Total weight of the chickens sold averaged 21.5 million pounds per year. The price trend of chicken per pound increased slightly for the two decades, increasing an average 0.40%. Chicken prices fluctuated widely within a range of 8.0 cents and 15.0 cents per pound, averaging 10 cents for the time period. The total value of production for Michigan chicken sales averaged only $2.28 million a year,[80] see Figure 79. The 21 year trend is an average annual rate of decline is 1.08% last for all livestock analyzed, see Table III.

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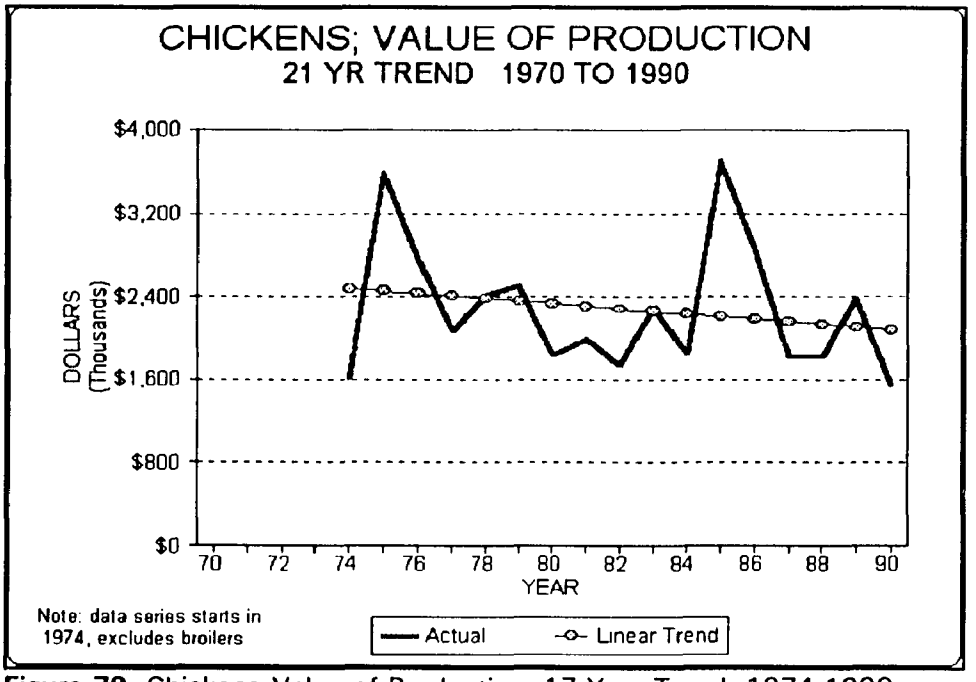
[80] Of the commodities analyzed for value of production, chicken is second to last in terms of total amount.



VALUE OF PRODUCTION

17 - YEAR

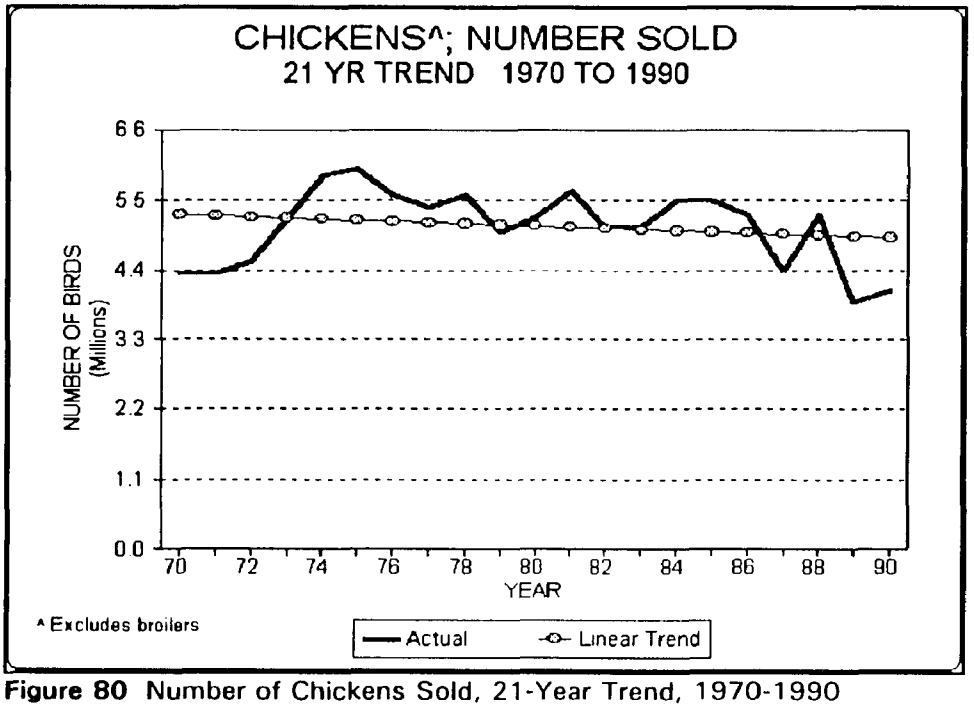
Average: $2,283,353

High: $3,713,000

Low: $1,542,000

Avg. Anl. Chg: -1.08%

Figure 79 Chickens Value of Production, 17-Year Trend, 1974-1990



NUMBER

21 - YEAR

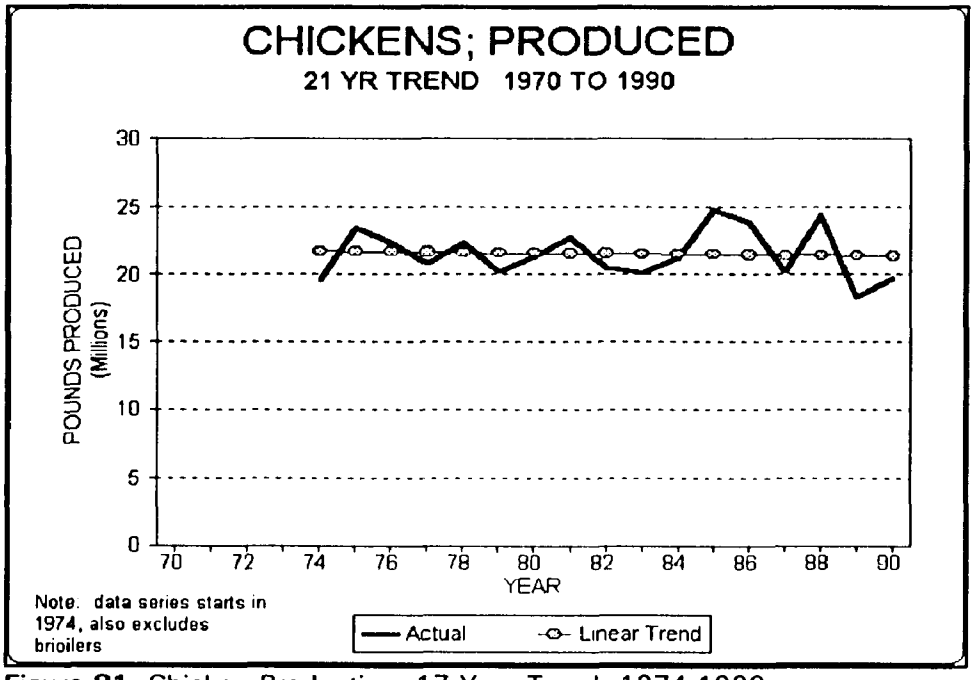
Average: 5,098,286

High: 6,000,000

Low: 3,900,000

Avg. Anl. Chg: -0.36%

Figure 80 Number of Chickens Sold, 21-Year Trend, 1970-1990



PRODUCTION

17 - YEAR

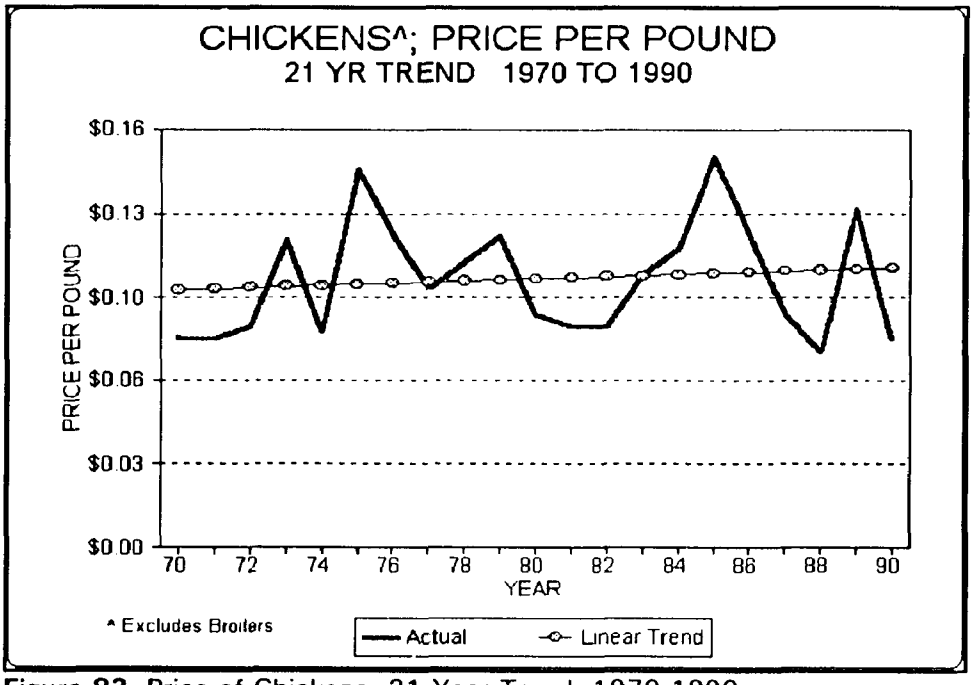
Average:
21,538,765

High:
24,750,000

Low:
18,330,000

Avg. Anl. Chg:
-0.11%

Figure 81 Chicken Production, 17-Year Trend, 1974-1990



PRICE

21 - YEAR

Average:
$0.10

High:
$0.15

Low:
$0.08

Avg. Anl. Chg:
0.40%

Figure 82 Price of Chickens, 21-Year Trend, 1970-1990

Broilers: Most of the broiler activity in the state is located in the Allegan and Ottawa county region. These operations consist primarily of numerous small farm flocks. It is important to notice the wide fluctuations in the historical data for the broiler sector. One reason for the fluctuations in the production data is the ease of entry and exit from the sector. The hog sector for example, is heavily invested in fixed capital, so farmers are generally committed to longer investment horizons. There is a slight upward trend for the broiler sector regarding the number of birds produced (or sold each year). The average annual growth for the 21 year period is 1.02%, third highest growth for the livestock sector, see Table III. The most birds produced in one year was 2.57 million in 1979, this compares to a low of 0.51 million in 1975, see Figure 84. In 1990, 780,000 birds were produced for market sale. Production in terms of pounds, however, has been declining rapidly. Production has declined an annual average of 1.64%, the largest trend decline for the livestock industry. The price of broilers per pound has steadily increased upward. The 21 year low was 17 cents in 1970, and the high occurred in 1989, at 37 cents. The upward trend is an average annual rate of growth of 2.67%, see Figure 86. The value of production trend is flat, with wide fluctuations in the actual data, see Figure 83. The value of production ranges from a high of $3.0 million in 1979 all the way down to a low of $0.7 million in 1975. In the late eighties the value of production has stabilized in the $1.2 million range.

Compared to other broiler states, Michigan's value of production is not significant. Of the 33 states in the country that report broiler production, Michigan ranks 31, producing only one hundredth of the total production.

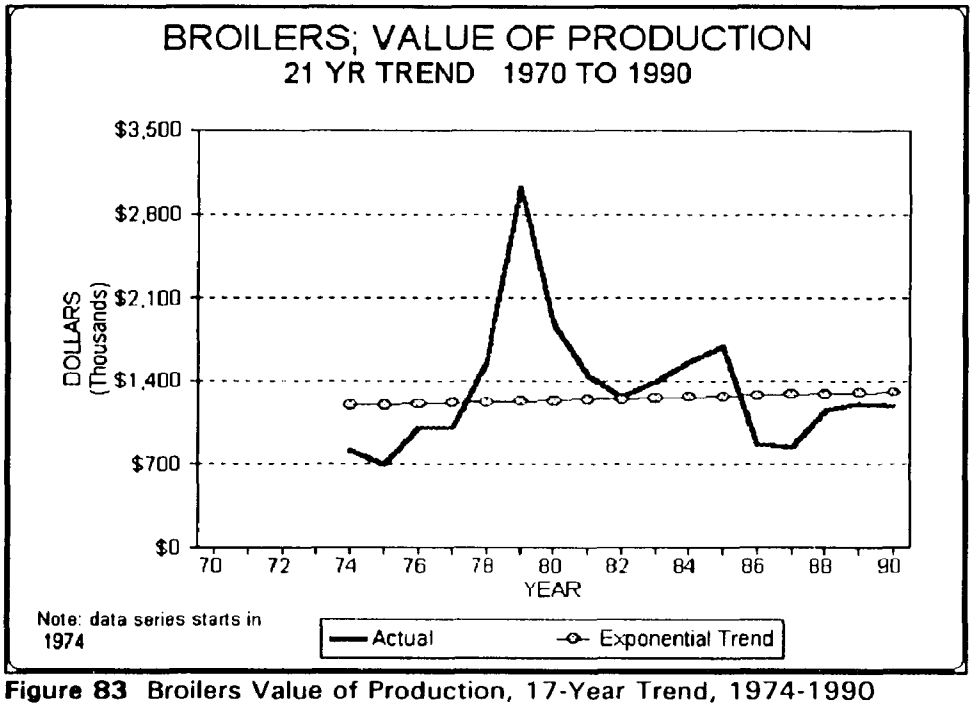
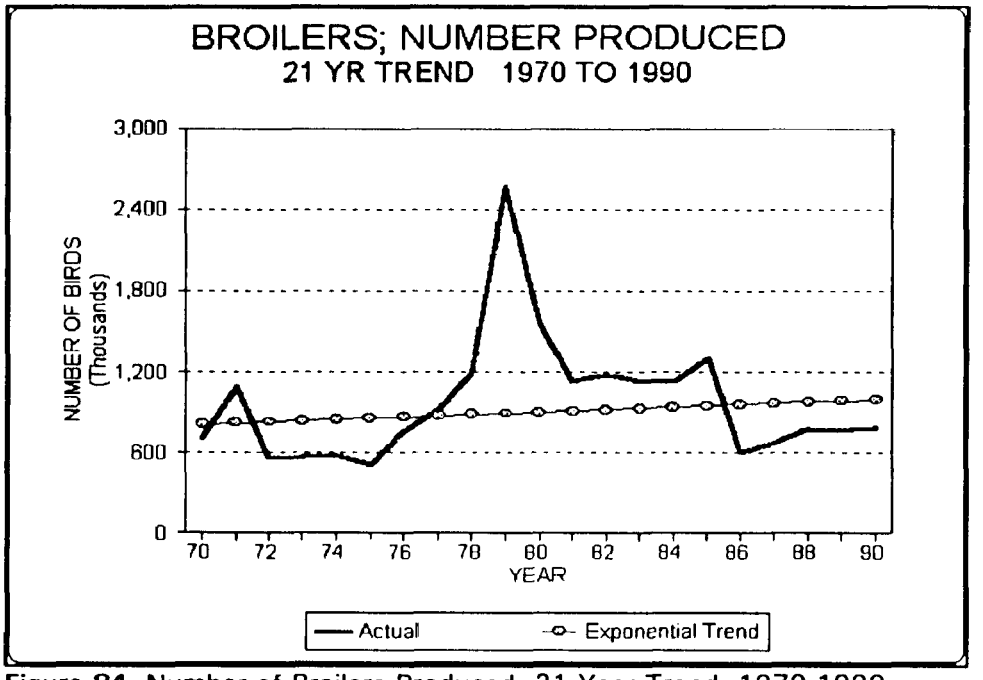


Figure 83 Broilers Value of Production, 17-Year Trend, 1974-1990



NUMBER

21 - YEAR

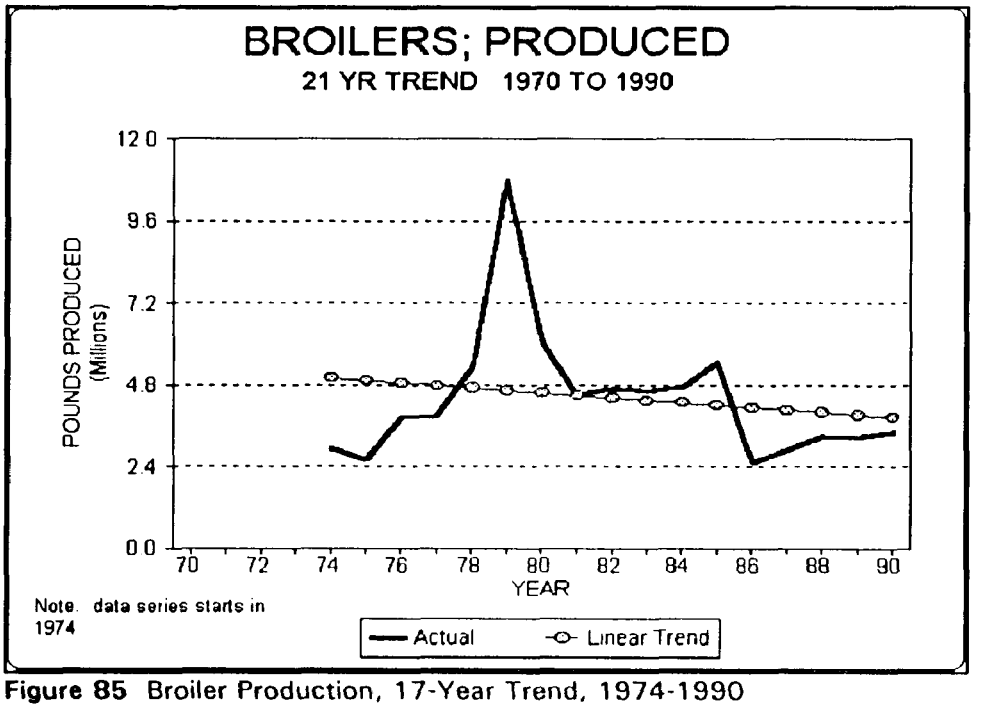
Average:
973,405

High:
2,570,000

Low:
510,000

Avg. Anl. Chg:
1.02%

Figure 84 Number of Broilers Produced, 21-Year Trend, 1970-1990



PRODUCTION

17 - YEAR

Average:
4,413,412

High:
10,794,000

Low:
2,520,000

Avg. Anl. Chg:
-1.64%

Figure 85 Broiler Production, 17-Year Trend, 1974-1990

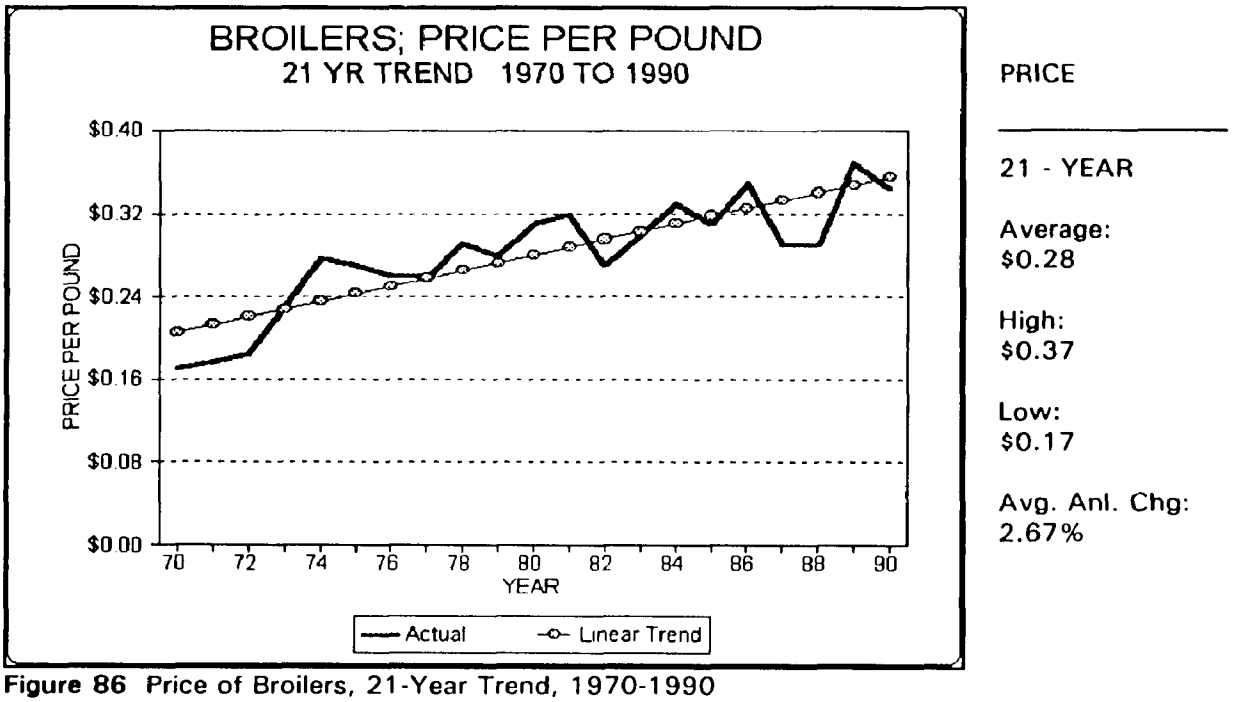


Figure 86 Price of Broilers, 21-Year Trend, 1970-1990

Turkeys:[81] Turkeys were the fastest growing[82] livestock sector in Michigan during the decades of the 70's and 80's. The exceptional growth is exemplified by the fact that the number turkeys raised increased every year except two, 1974 and 1978. The calculated trend for turkey numbers raised is an average annual increase of 9.43%.[83] In 1973 over 1.0 million birds were raised in the state, by 1990 over 4.3 million birds were raised, an increase of

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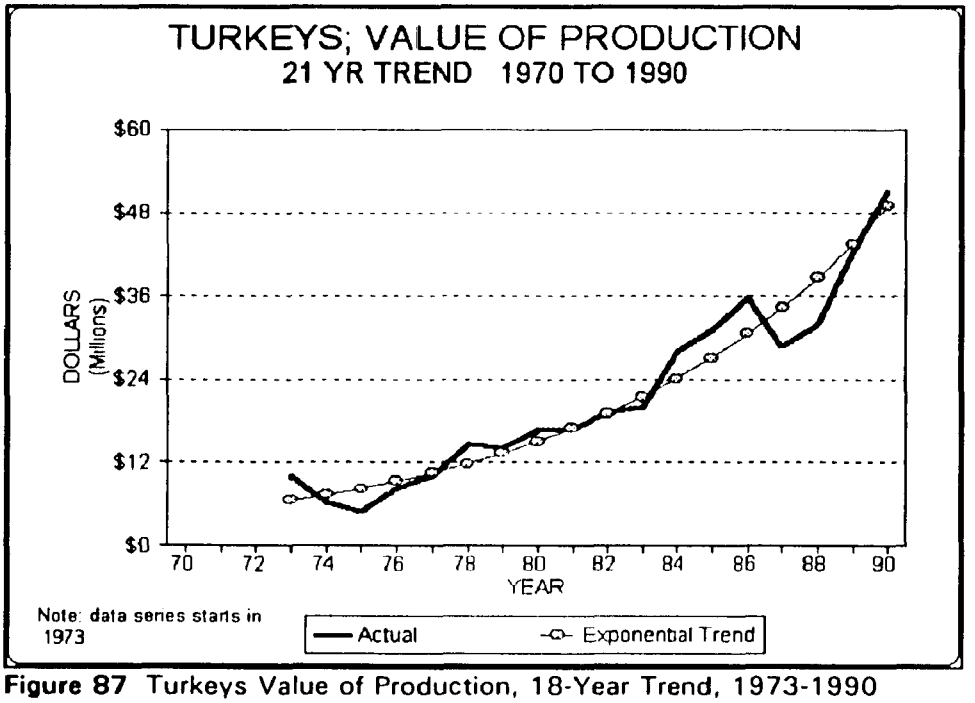
[81] Note: the data for turkey analysis starts in 1973 instead of 1970, this is when the Michigan Agricultural Statistics Service started comprehensive collection.

[82] Note: every category analyzed for turkeys has a calculated trend that is exponential. This highlights the ever increasing growth rates for the turkey sector.

[83] The closest livestock commodity was hogs and pigs with a growth rate of 3.54%.

almost 300%. In the same manner, the pounds of turkey produced grew at an extremely fast pace. In 1973 approximately 26 million pounds of turkey were produced in Michigan, this expanded to over 124 million pounds in 1990, a rise of 377%. The calculated trend for production is an average annual growth rate of 10.74%, see Figure 89. The price of turkeys also expanded but at a much slower rate than the other categories. The trend for price was an increase of an average annual rate of 1.51%, this was sixth out of nine commodities. The combination of higher prices and production output lead to expanding values of production in the 70' and 80's. Value of production expanded from just over $10 million in 1973 to over $51 million in 1990, see Figure 87. The growth trend was an average annual rate of 12.57%, the highest for all commodities.

The major concentration of turkey production in the state is located in Kent county. In 1990, Michigan produced 1.5% of nation's total market turkeys, ranking 13th, with perennial leader North Carolina number one.



VALUE OF PRODUCTION

18 - YEAR

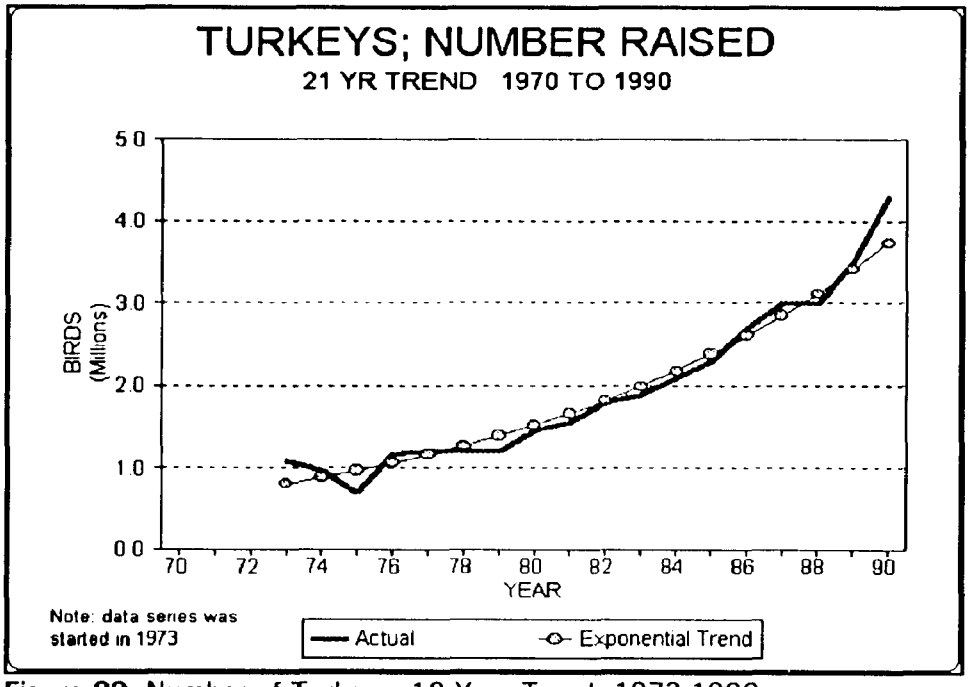
Average: $19,913,712

High: $42,630,000

Low: $5,007,906

Avg. Anl. Chg: 12.57%

Figure 87 Turkeys Value of Production, 18-Year Trend, 1973-1990



NUMBER

18 - YEAR

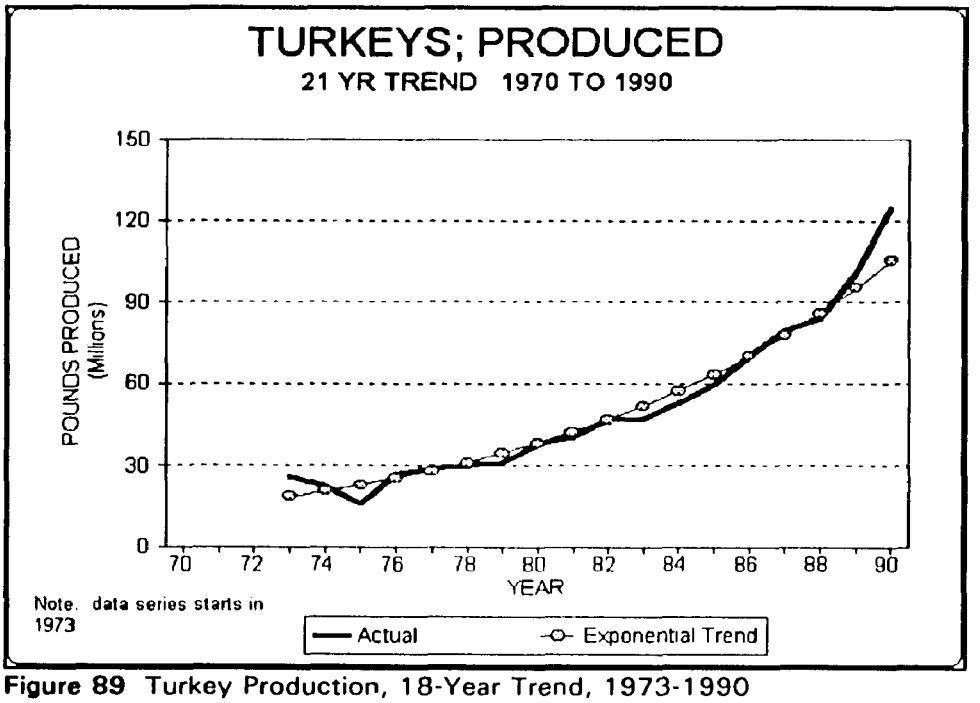
Average: 1,192,722

High: 4,300,000

Low: 700,000

Avg. Anl. Chg: 9.43%

Figure 88 Number of Turkeys, 18-Year Trend, 1973-1990



PRODUCTION

18 - YEAR

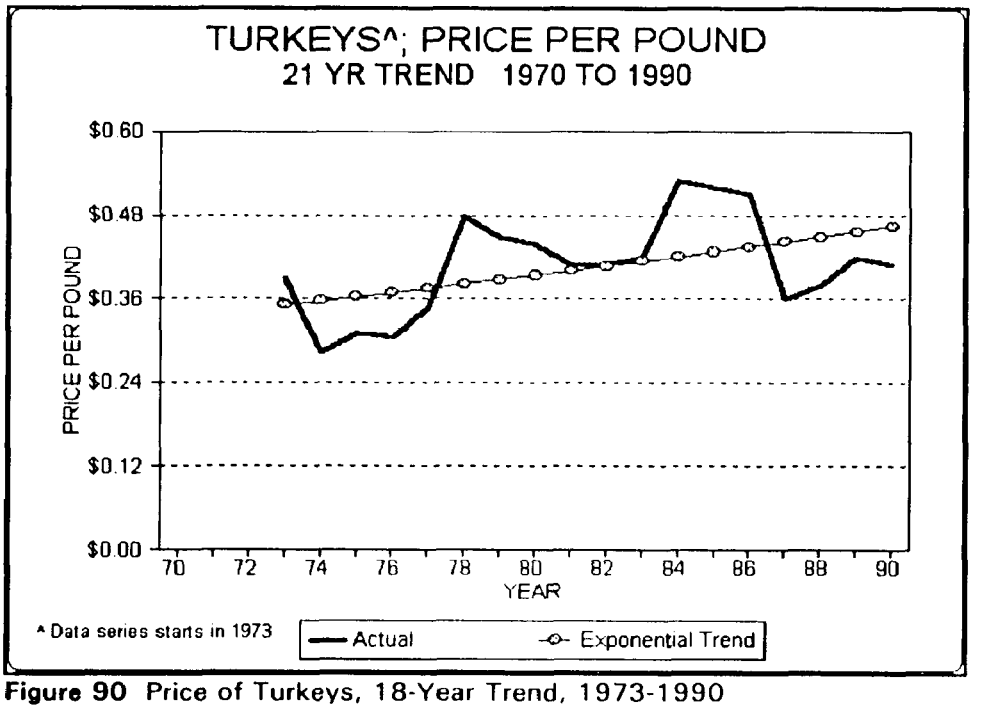
Average:
51,469,167

High:
124,700,000

Low:
16,100,000

Avg. Anl. Chg:
10.74%

Figure 89 Turkey Production, 18-Year Trend, 1973-1990



PRICE

18 - YEAR

Average:
$0.41

High:
$0.53

Low:
$0.28

Avg. Anl. Chg:
1.51%

Figure 90 Price of Turkeys, 18-Year Trend, 1973-1990

General Fruit Overview[84]

This section reviews the important crop trends of price, yield, acres harvested, number of fruit bearing trees, quantity produced, and value of production, for each of Michigan's top seven fruit crops.[85] Table IV is a trend summary of fruit crops ranked by the average annual percent changes for each category (yields, price, etc.). Figures 91 and 92 are the aggregation of all fruit crops for the categories of value of production and acres harvested. Total Michigan fruit crop acres harvested have trended lower during the last two decades, declining at an average annual rate of 1.75%, see Figure 92. The actual pattern of fruit acres harvested shows two different segments. The first segment is a decline from 156 thousand acres in 1970 down to 101 thousand acres in 1982. The second segment is a rebound from the 101 thousand acre level in 1982 to 119 thousand acres in 1990, a rise of 18%. The value of fruit production rose steadily for the 70's and 80's. Total crop value increased an average annual amount of 3.61%. A high of $171 million was record in 1978 and the low occurred in 1970 at $59 million.

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[84] Note: Michigan is consistently ranked either number 1 or number 2 in the country in the production of blueberries. The importance of blueberries to the state is well understood by the author of this dissertation. The crop however, is not included in the dissertation analysis. Blueberry data collection by the Michigan Agricultural Statistical Service has been sporadic during the time period of analysis. It was therefore determined to leave blueberries out of the fruit trend analysis section. Blueberries are however, discussed in the shift-share chapter when time series data is not required and cross sectional data is used.

[85] The selection of the top seven Michigan fruit crops for the analysis is predicated on the value of production for each crop.

Table IV Trend Summary for Fruit Crops, Commodity Rank by Average Annual % Change for 21-Years, 1970-1990

TREND SUMMARY FOR FRUIT CROPS
COMMODITY RANK BY
AVERAGE ANNUAL % CHANGE FOR
21-YearS FROM 1970 - 90

Acres Harvested			Production		
Rank	Commodity	% Chg.	Rank	Commodity	% Chg.
1	Apples	-0.51%	1	Apples	1.99%
2	Tart Cherries	-0.83%	2	Tart Cherries	0.84%
3	Sweet Cherries	-1.74%	3	Grapes	0.36%
4	Grapes	-2.20%	4	Sweet Cherries	0.30%
5	Peaches	-4.74%	5	Peaches	-1.09%
6	Prunes & Plums	-4.96%	6	Prunes & Plums	-2.70%
7	Pears	-11.94%	7	Pears	-6.11%
	Average	-3.85%		Average	-0.92%

Yield			Price		
Rank	Commodity	% Chg.	Rank	Commodity	% Chg.
1	Pears	5.27%	1	Sweet Cherries	4.60%
2	Peaches	3.25%	2	Pears	3.86%
3	Apples	2.36%	3	Prunes & Plums	3.86%
4	Grapes	2.05%	4	Peaches	3.50%
5	Prunes & Plums	2.04%	5	Apples	2.80%
6	Sweet Cherries	1.95%	6	Grapes	2.72%
7	Tart Cherries	1.65%	7	Tart Cherries	2.00%
	Average	2.65%		Average	3.33%

Table IV (Continued) Trend Summary for Fruit Crops, Commodity Rank by Average Annual % Change for 21-Years, 1970-1990

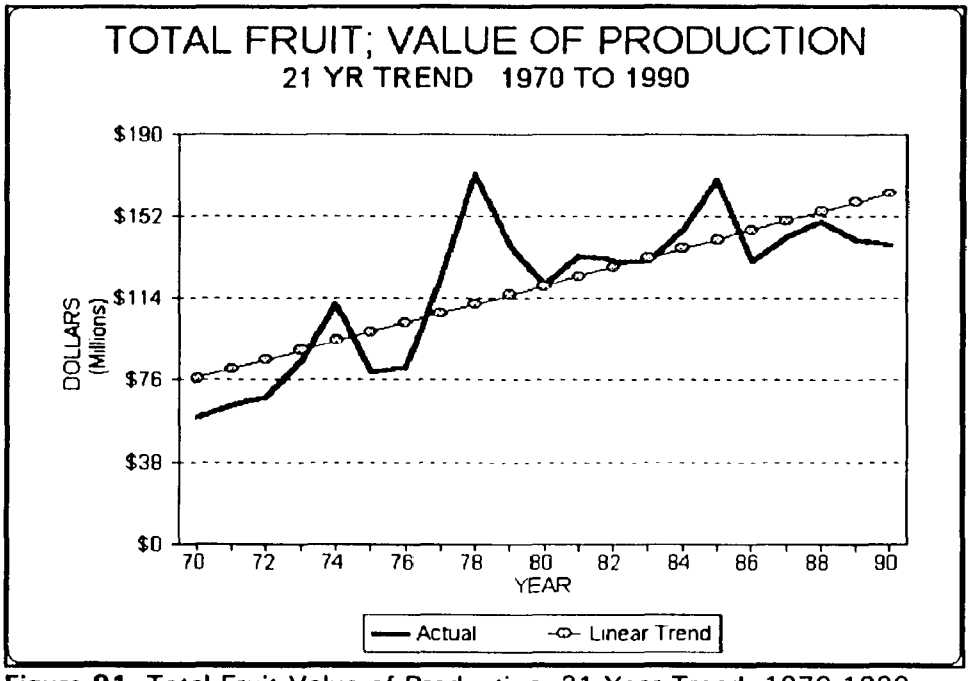
TREND SUMMARY FOR FRUIT CROPS
COMMODITY RANK BY
AVERAGE ANNUAL % CHANGE FOR
21-YearS FROM 1970 - 90

Value of Production

Rank	Commodity	% Chg.
1	Apples	4.82%
2	Sweet Cherries	4.57%
3	Peaches	3.48%
4	Grapes	2.96%
5	Tart Cherries	1.92%
6	Prunes & Plums	0.87%
7	Pears	-1.27%
	Average	2.48%

Fruit Trees of Bearing Age

Rank	Commodity	% Chg.
1	Apples	3.28%
2	Sweet Cherries	0.36%
3	Peaches	-1.48%
4	Grapes	-2.66%
5	Tart Cherries	-3.54%
6	Prunes & Plums	-4.33%
7	Pears	-11.26%
	Average	-2.48%



VALUE OF PRODUCTION

21 - YEAR

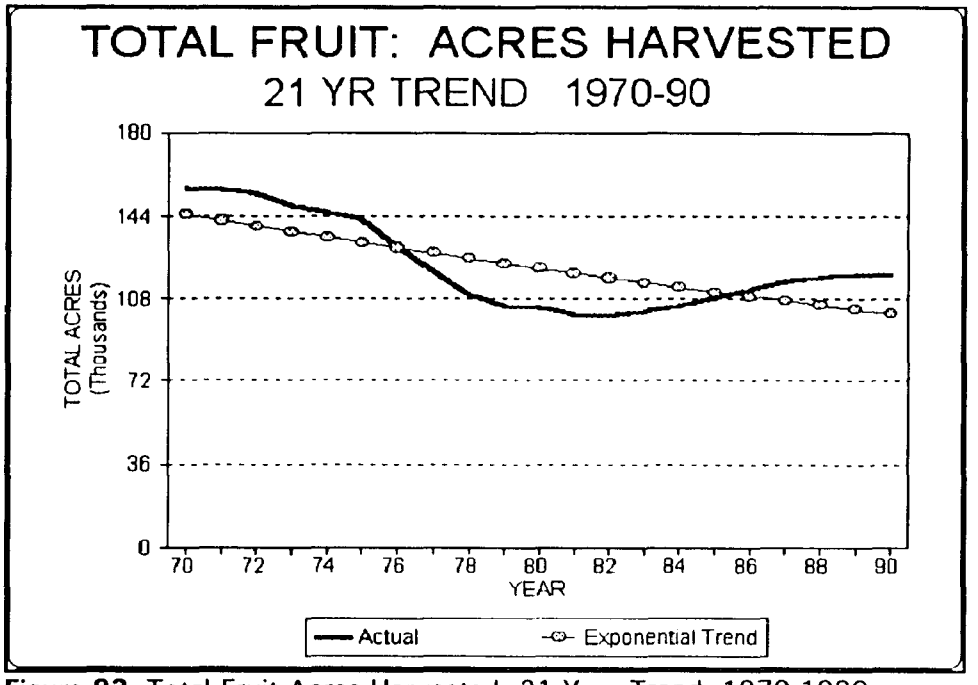
Average: $119,825,524

High: $171,622,000

Low: $58,565,000

Avg. Anl. Chg: 3.61%

Figure 91 Total Fruit Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

Average: 122,733

High: 156,300

Low: 100,900

Avg. Anl. Chg: -1.75%

Figure 92 Total Fruit Acres Harvested, 21-Year Trend, 1970-1990

Apples: Michigan apple production trended higher throughout the decades of the 70's and 80's. The increase in production occurred despite a 21 year negative trend for acres harvested, an average annual decline of 0.51%. The acres harvested trend can be split into two different segments, see Figure 94. The first trend segment is an acreage decline for every year from 1970 to 1979 of 56,000 acres to 42,500 acres. And the second trend segment is an increase in acreage of 42,500 acres to 52,100 acres, up every year from 1979 to 1990. One explanation in the increase in overall production can be explained by the growers shift away from standard trees toward new dwarf and semi-dwarf varieties. The number of trees per acre climbed from 52 in 1970 to 106 in 1990. Total Michigan apple trees expanded from 2.9 million in 1970 to 5.5 million in 1990. The 21 year trend for the number of fruit bearing trees is an average annual increase of 3.28%, see Figure 95. Given the management shift to more apple trees (the smaller dwarf varieties) per acre, production yields per acre have increased an average annual rate of 2.36%. The faster growth in yields compared to the smaller decline in acres harvested, translated into higher total production levels. Apple output grew at an average annual rate of 1.99%[86] for the two decades. Prices for all apples improved steadily in the 70's and 80's. The combination of higher prices and expanded production pushed the value of production trend consistently higher.

---

[86] See Table IV, the increase in apple production trend was greater than all the fruit sectors analyzed. Note: tart cherries, grapes, and sweet cherries were the only other fruits to post positive gains.

Value of production tripled from $25 million to over $75 million[87] at the end of the eighties, see Figure 93.

The largest areas of apple production in the state are the counties of Kent, Van Buren, and Berrien. The top apple varieties grown are Red Delicious (with over 25% of the market), Jonathan, Golden Delicious, and Ida Red. Most of the apples are used for processing with the remainder going to the fresh markets. In 1990 Michigan ranked 3rd in the country in term of the amount of pounds produced. Michigan produces approximately 9.5% of the total U.S. apple market, the states' of Washington and New York are the other perennial leaders in production.

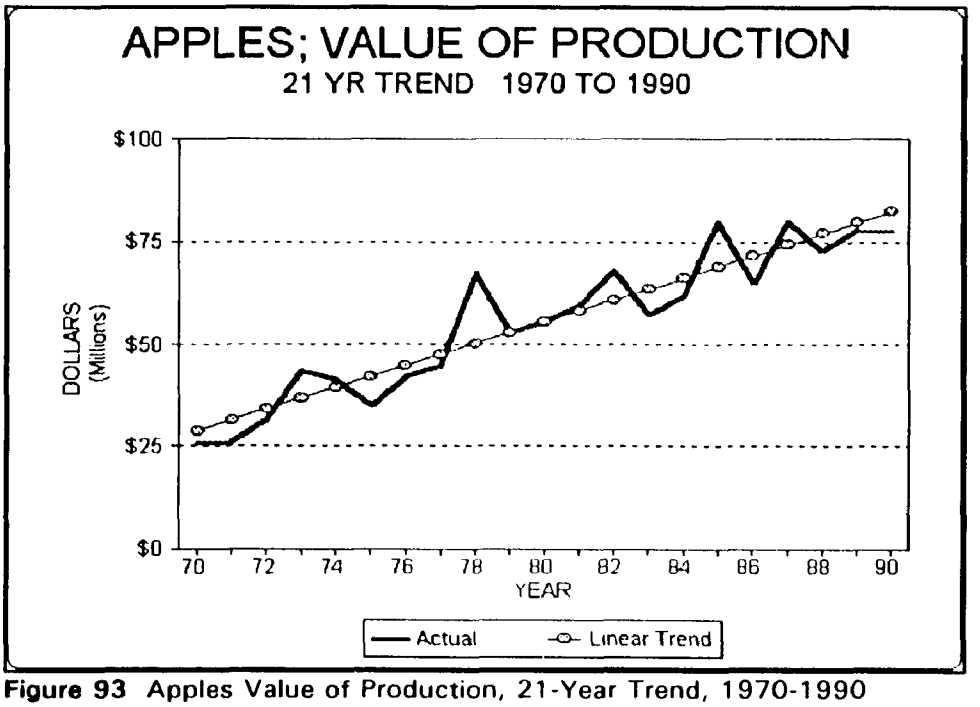
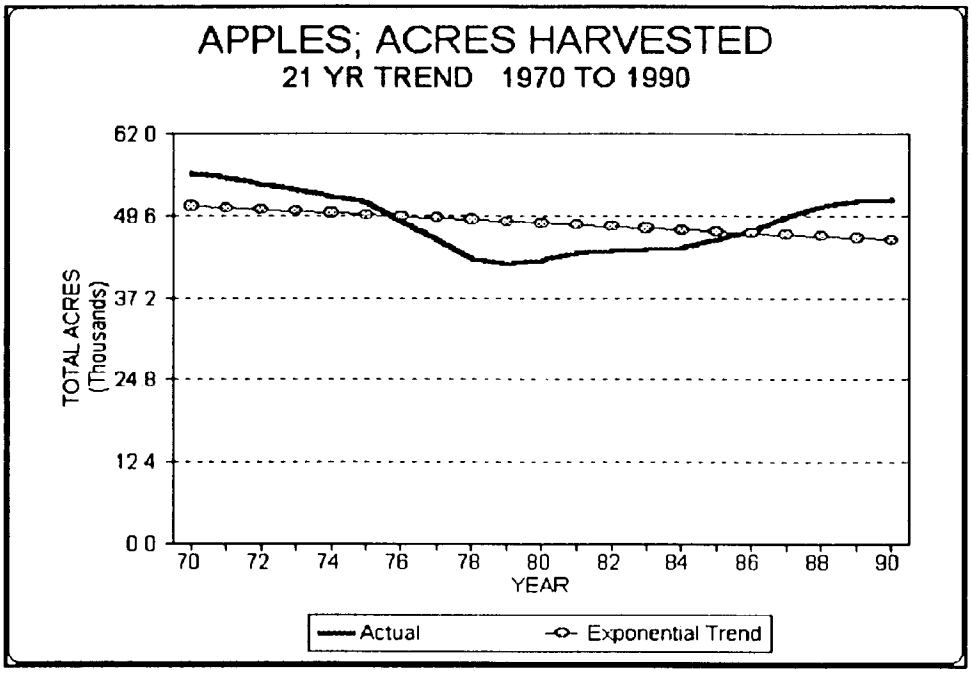


Figure 93 Apples Value of Production, 21-Year Trend, 1970-1990

[87] Apple production is the largest fruit sector in the state in terms of value of production.



ACRES HARVESTED

21 - YEAR

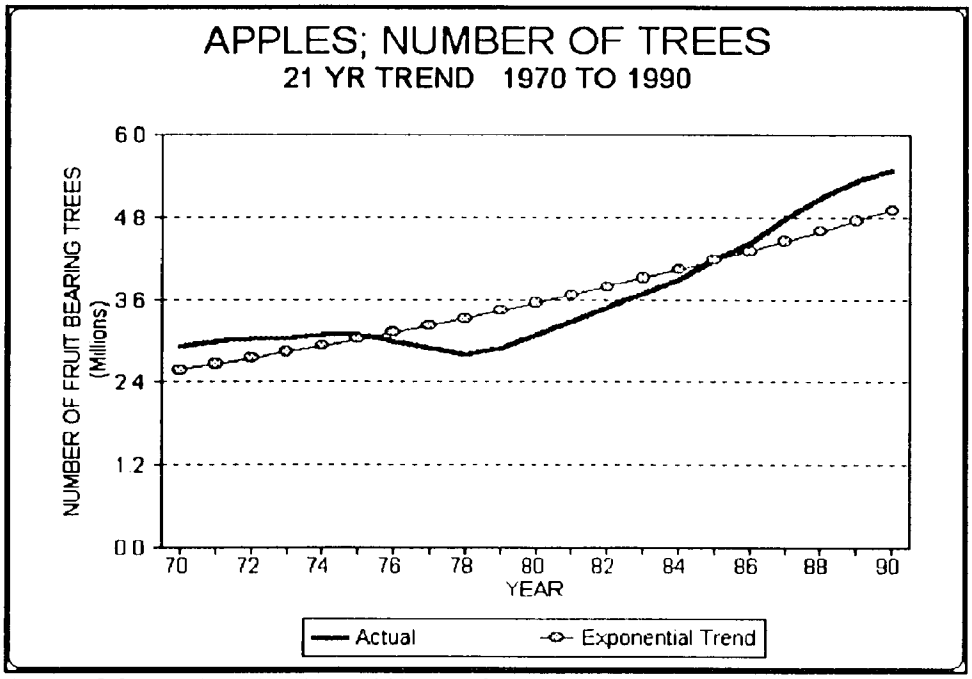
Average: 48,733

High: 56,000

Low: 42,500

Avg. Anl. Chg: -0.51%

Figure 94 Apples Acres Harvested, 21-Year Trend, 1970-1990



NUMBER OF TREES

21 - YEAR

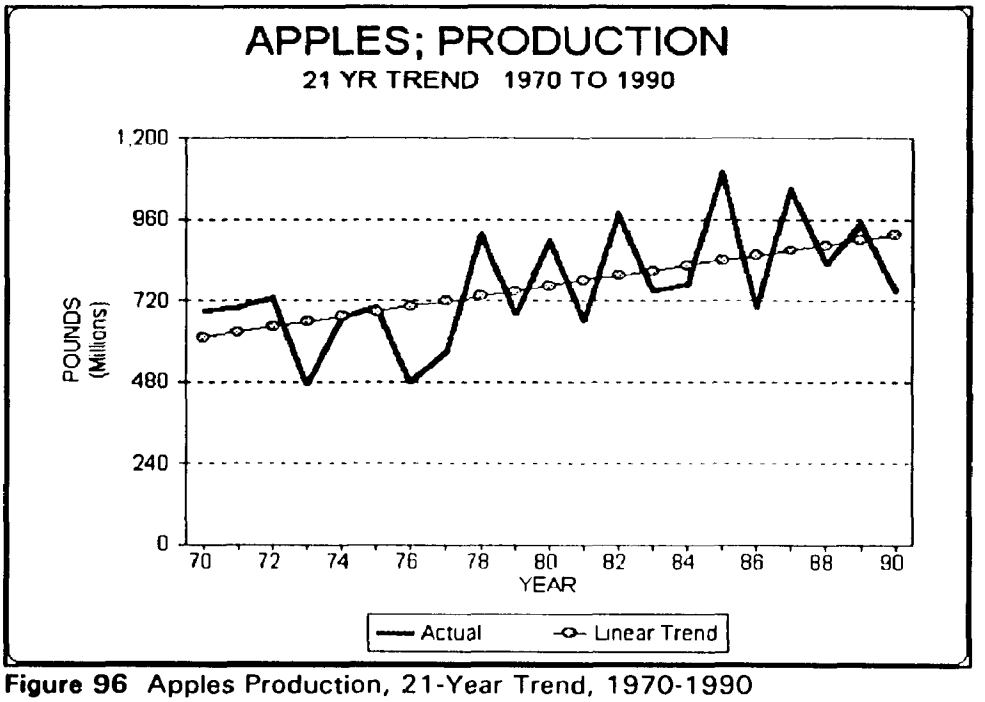
Average: 3,653,333

High: 5,500,000

Low: 2,800,000

Avg. Anl. Chg: 3.28%

Figure 95 Apples Number of Trees, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

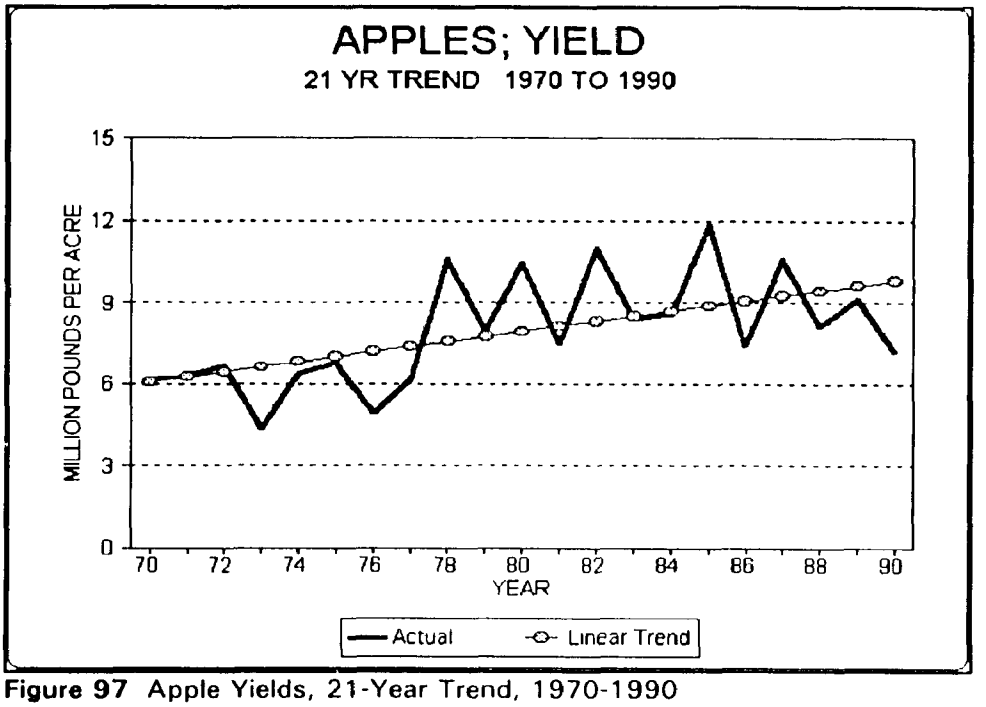
Average:
764,285,714

High:
1,100,000,000

Low:
470,000,000

Avg. Anl. Chg:
1.99%

Figure 96 Apples Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
7.94

High:
11.90

Low:
4.39

Avg. Anl. Chg:
2.36%

Figure 97 Apple Yields, 21-Year Trend, 1970-1990

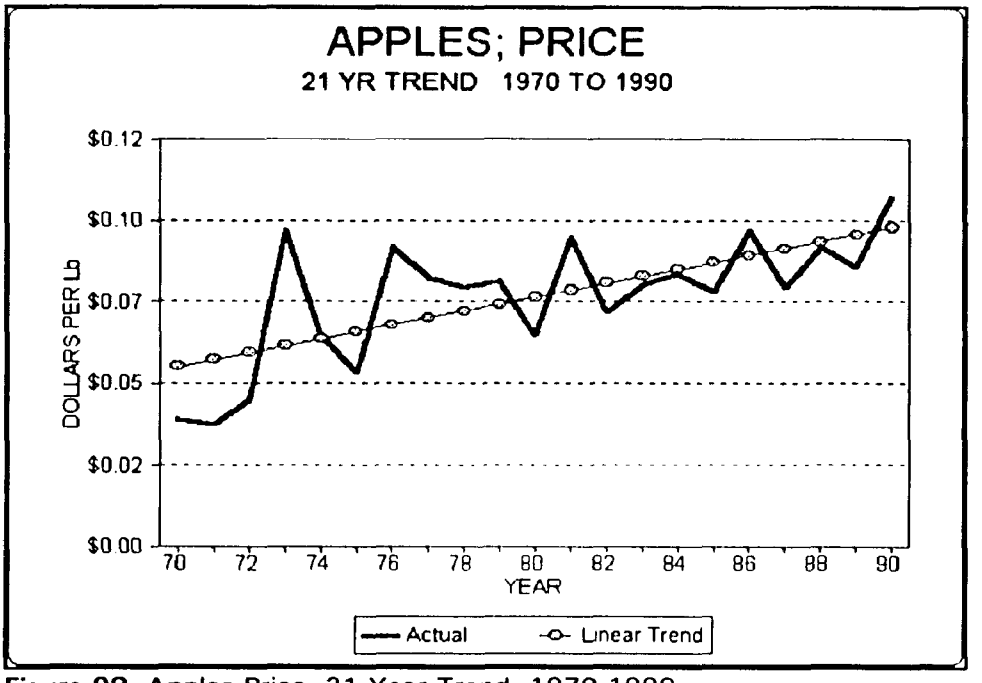


Figure 98 Apples Price, 21-Year Trend, 1970-1990

Grapes: During the last two decades, Michigan grape production[88] has trended slightly downward. Acres harvested fell an annual average of 2.20%. The number of vines of fruit bearing age also declined at a similar pace. Total fruit bearing vines decreased from 7.9 million in 1970 to 5.1 million in 1990, a drop of 35%, see Figure 101. Yields on the other hand showed modest increases. The 21 year trend for grape yields was an average annual increase of 2.05%. Even with the upward yield trend, yields fluctuated greatly in the 70's and 80's, ranging from a low of 0.97 million pounds per acre in 1976 to a high of 5.31 million pounds per acre in 1987, see Figure 103. The higher grape yields per acre helped to offset the declines in the

[88] Note: grape production can be highly variable do to it's sensitivity to weather changes.

acres harvested and total production trended slightly higher at an average annual rate of 0.36%. Production of grape varieties used for wine making increased steadily while production of grape varieties used for the juice processing sector experienced consistent shrinkage.[89] For the 21 year period Michigan has averaged 99 million pounds of grapes per year. Grape prices improved steadily, increasing at an average annual rate of 2.72%. The peak price for grapes was in 1989 when they sold for $1.325 per pound. The value of production climbed higher given the faster growth in prices compared to the slight decline in production, see Figure 99. Grape value of production grew at the fourth fastest rate of the fruits analyzed, see Table IV.

The southwest region of the state produced most of the grapes. Two counties in this region produced nearly all of the grapes, Berrien and Van Buren. In 1990 Michigan ranked 5th[90] in the country in tons of grapes produced, with a share of 8.3% of the total.

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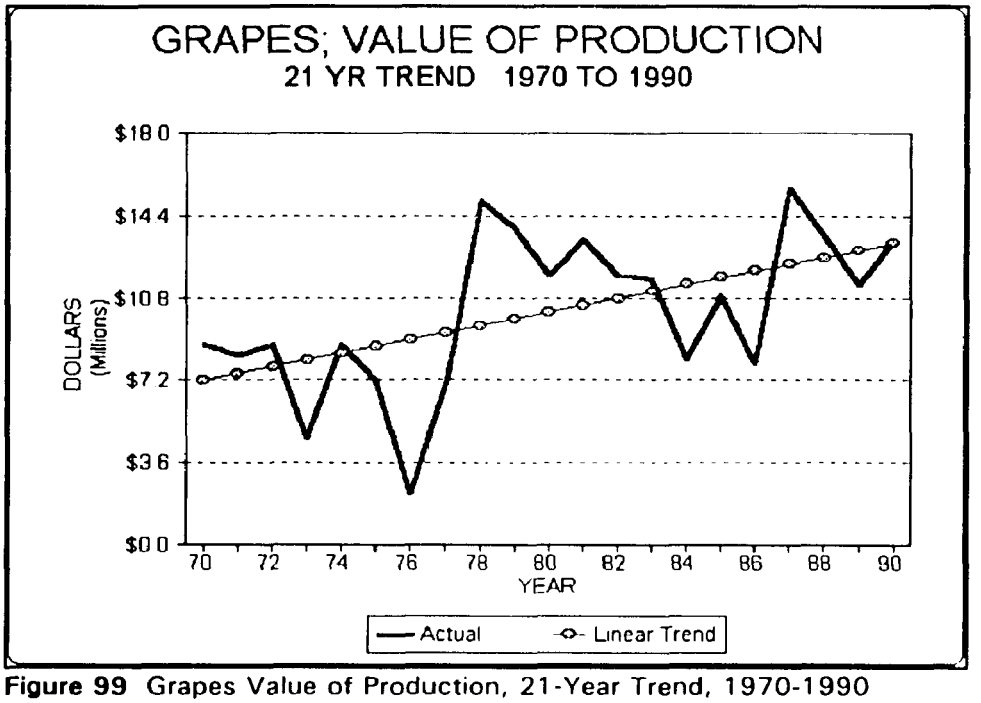
[89] Some production declines occurred for the Concord variety of grape which is used in grape juices.

[90] Michigan is 5th behind California, Washington, New York, and Pennsylvania.



VALUE OF PRODUCTION

21 - YEAR

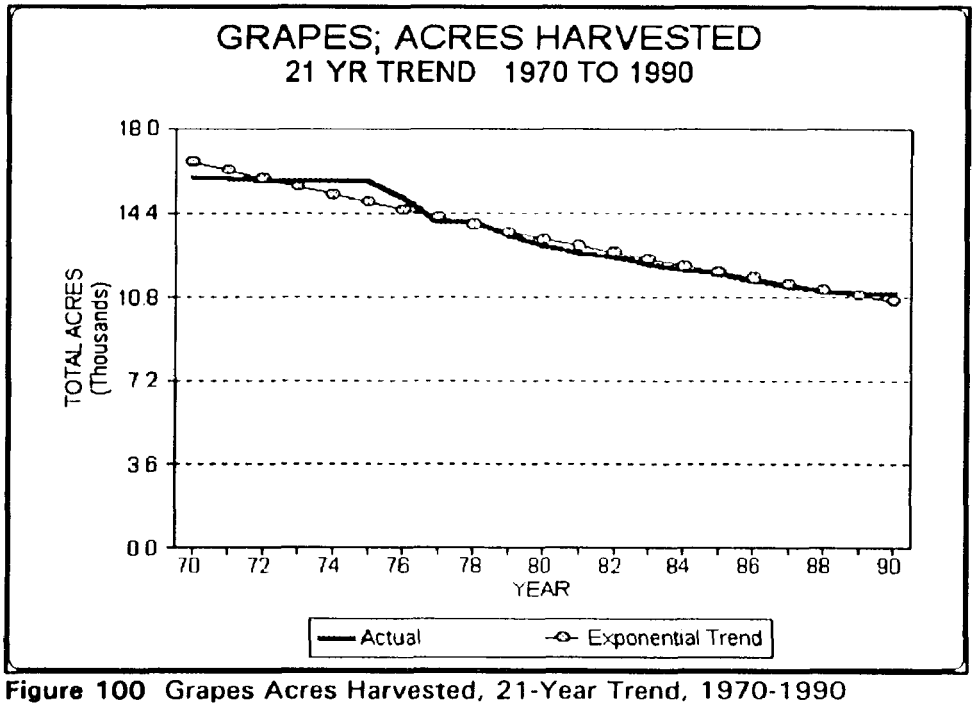
Average: $10,208,095

High: $15,609,000

Low: $2,219,000

Avg. Anl. Chg: 2.96%

Figure 99 Grapes Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

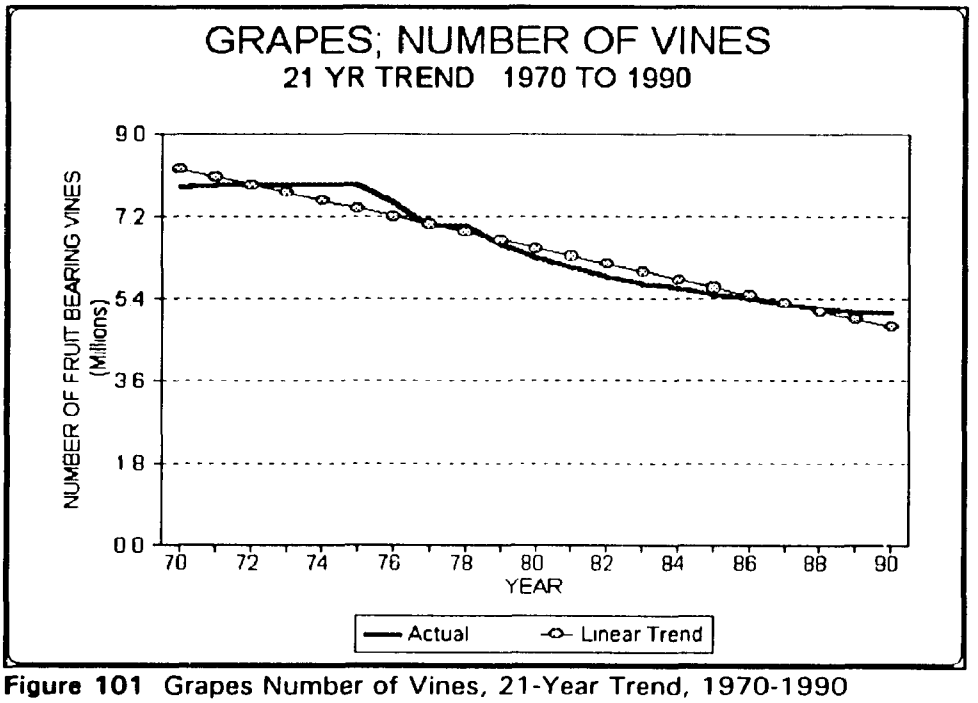
Average: 13,410

High: 15,900

Low: 11,000

Avg. Anl. Chg: -2.20%

Figure 100 Grapes Acres Harvested, 21-Year Trend, 1970-1990



NUMBER OF VINES

21 - YEAR

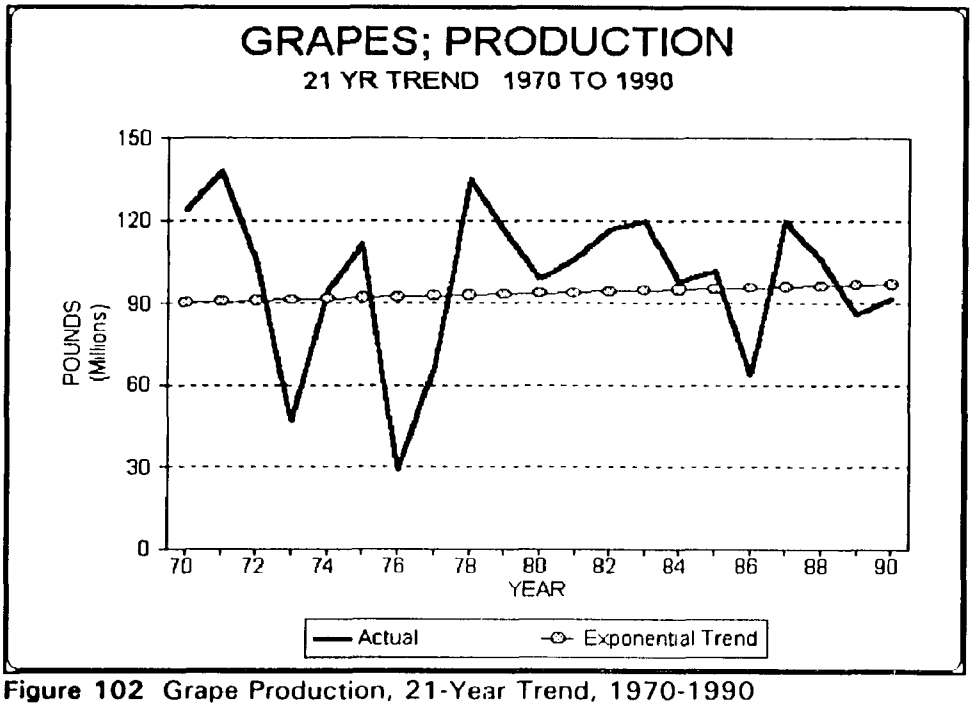
Average:
6,511,905

High:
7,900,000

Low:
5,100,000

Avg. Anl. Chg:
-2.66%

Figure 101 Grapes Number of Vines, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

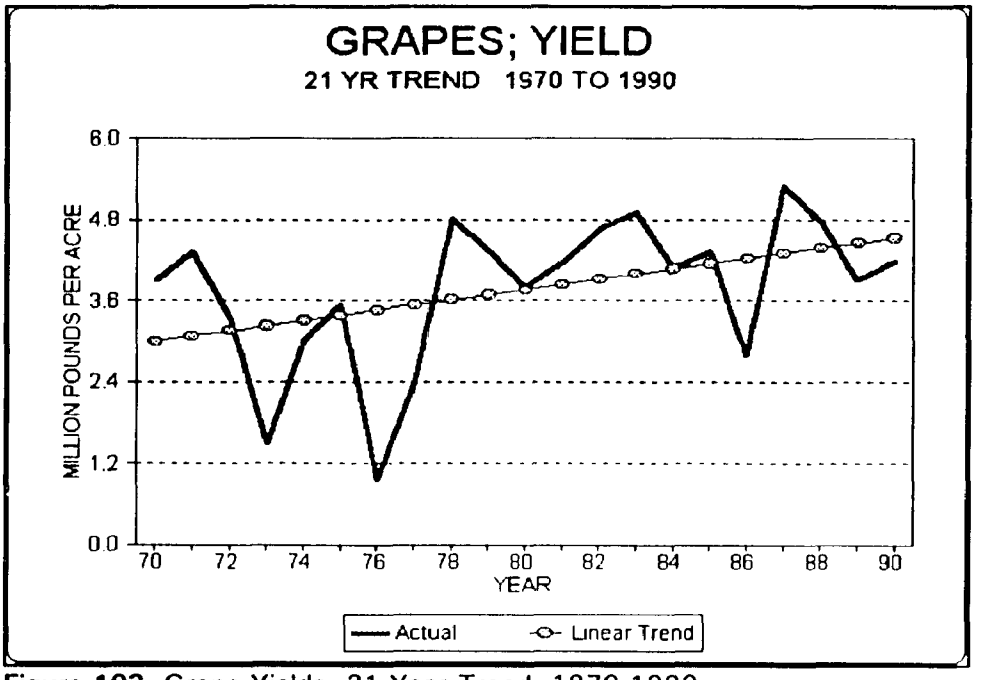
Average:
99,000,000

High:
138,000,000

Low:
29,000,000

Avg. Anl. Chg:
0.36%

Figure 102 Grape Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

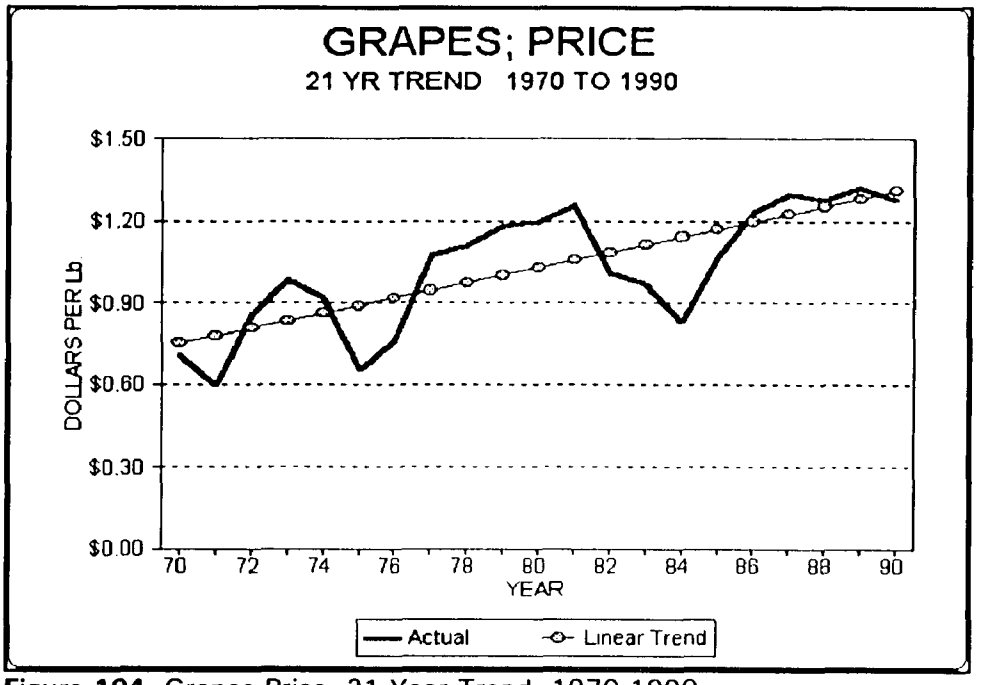
Average:
3.76

High:
5.31

Low:
0.97

Avg. Anl. Chg:
2.05%

Figure 103 Grape Yields, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$1.030

High:
$1.325

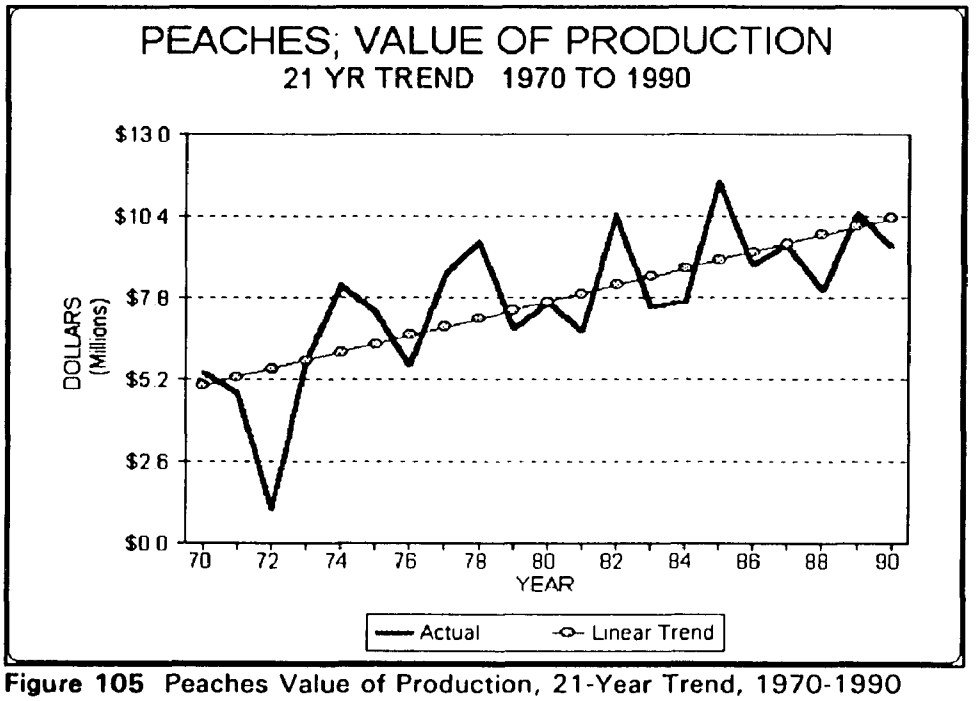
Low:
$0.600

Avg. Anl. Chg:
2.72%

Figure 104 Grapes Price, 21-Year Trend, 1970-1990

Peaches: Peaches have a similar trend pattern of acreage harvested as do apples. The trend can be broken into two discrete segments, see Figure 106. The first segment is a rapid decline during the 70's and the second segment is a recovery and an increase in acres harvested in the 80's. Acres harvested declined every year from a high of 16.5 thousand in 1971 to a low of 4.1 thousand in 1981, a drop of 75%. The trend then reverses with acreage climbing from the low of 4.1 thousand in 1981 to 8.0 thousand in 1990, an increase of almost 100%. For the past two decades, the trend for the number of fruit bearing trees follows a similar pattern to the acres harvested trend. The number of fruit bearing trees declined an average annual rate of 3.54%. Offsetting the decline in acres harvested is the solid rise in peach yields. Peach yields increased an average annual rate of 3.25%, second highest rate for all fruit crops. Peach production gradually fell at an average annual rate of 1.09%. For the 21 years total production averaged 50 million pounds. The price of peaches trended higher in the 70's and 80's, expanding at an average annual rate of 3.5%. The value of production increased similarly, increasing an average annual rate of 3.48%. In 1990 peach value of production equaled $9.4 million.

The major production region in the state is located in the southwest. The principal production counties are Berrien and Van Buren. The Red Haven and Harmony varieties account for most of the peaches grown. In 1990 Michigan ranked 6th in the country in total output of peaches in pounds, producing 2.0% of the U.S. total.



VALUE OF PRODUCTION

21 - YEAR

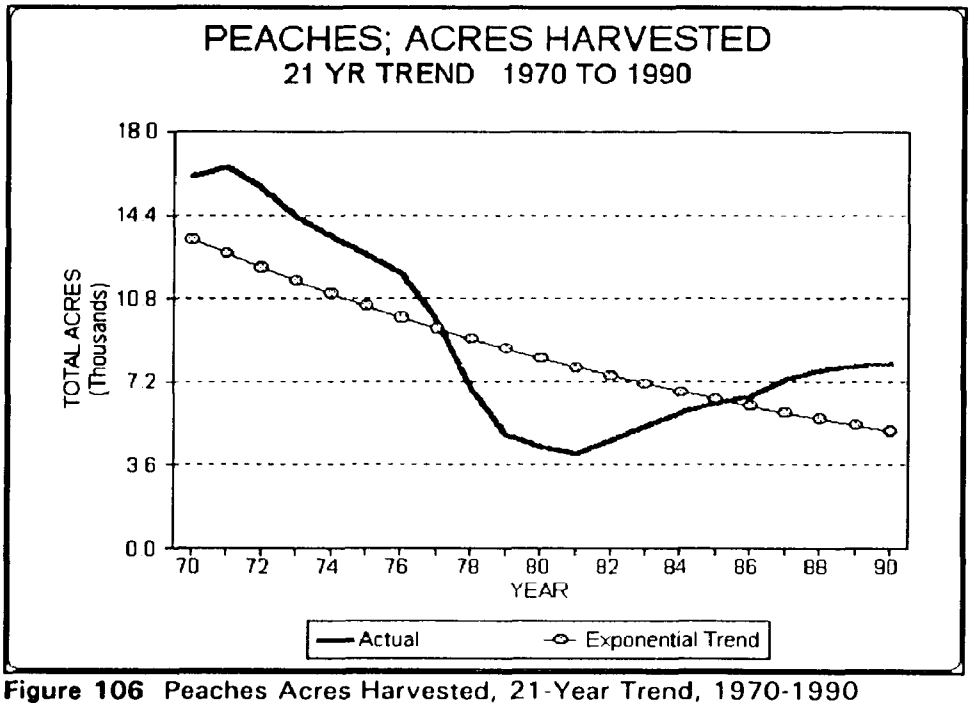
Average: $7,672,857

High: $11,515,000

Low: $1,070,000

Avg. Anl. Chg: 3.48%

Figure 105 Peaches Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

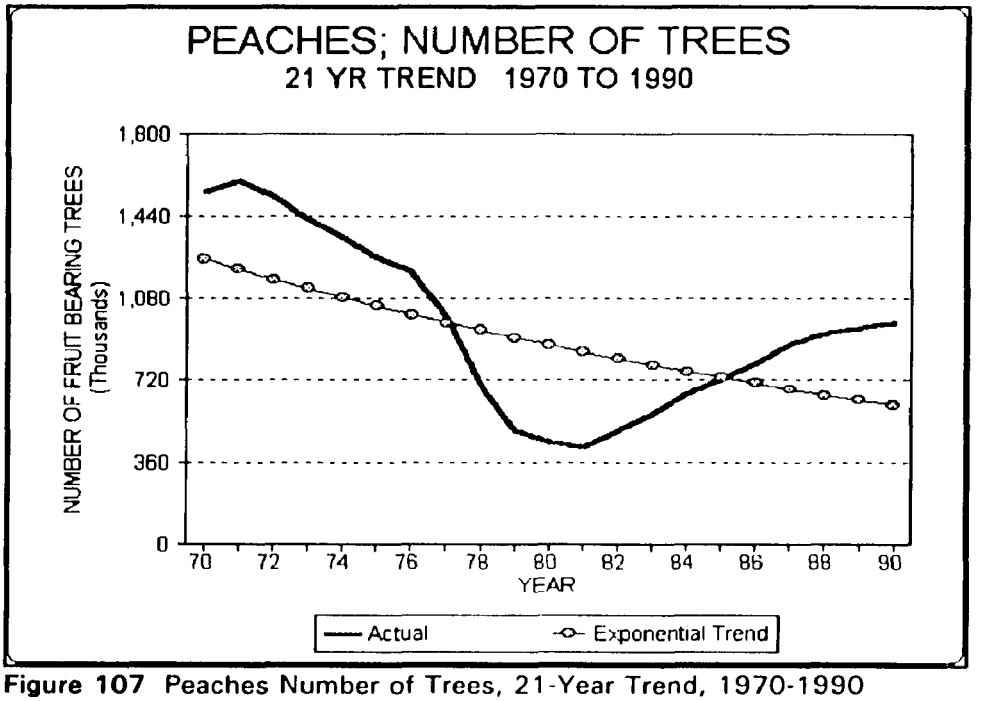
Average: 9,071

High: 16,500

Low: 4,100

Avg. Anl. Chg: -4.74%

Figure 106 Peaches Acres Harvested, 21-Year Trend, 1970-1990



NUMBER OF TREES

21 - YEAR

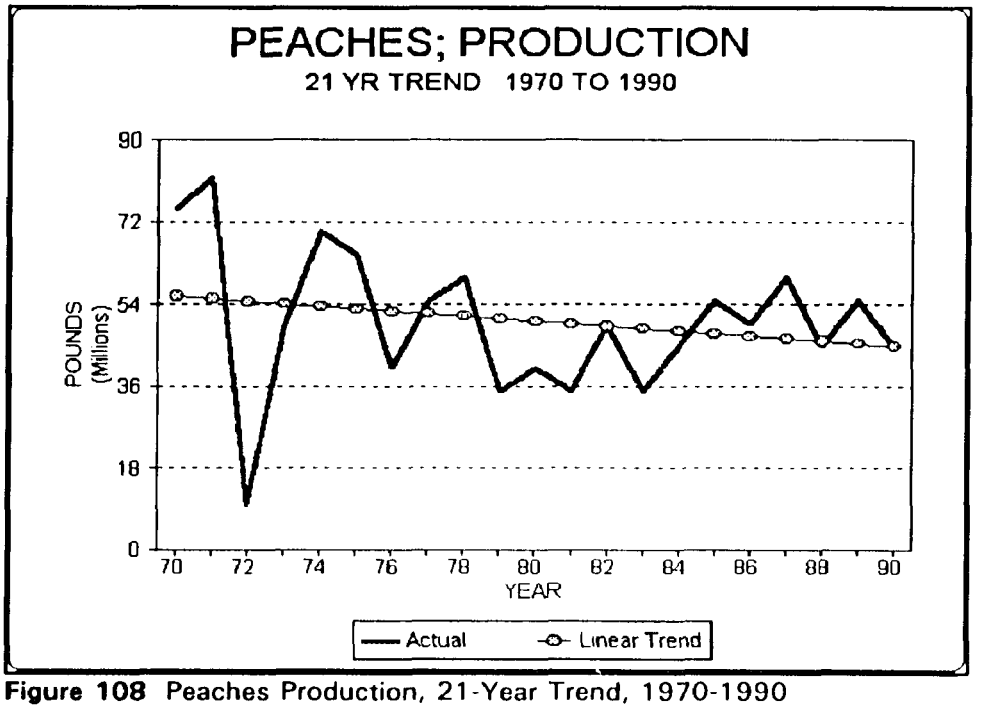
Average: 950,476

High: 1,600,000

Low: 425,000

Avg. Anl. Chg: -3.54%

Figure 107 Peaches Number of Trees, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

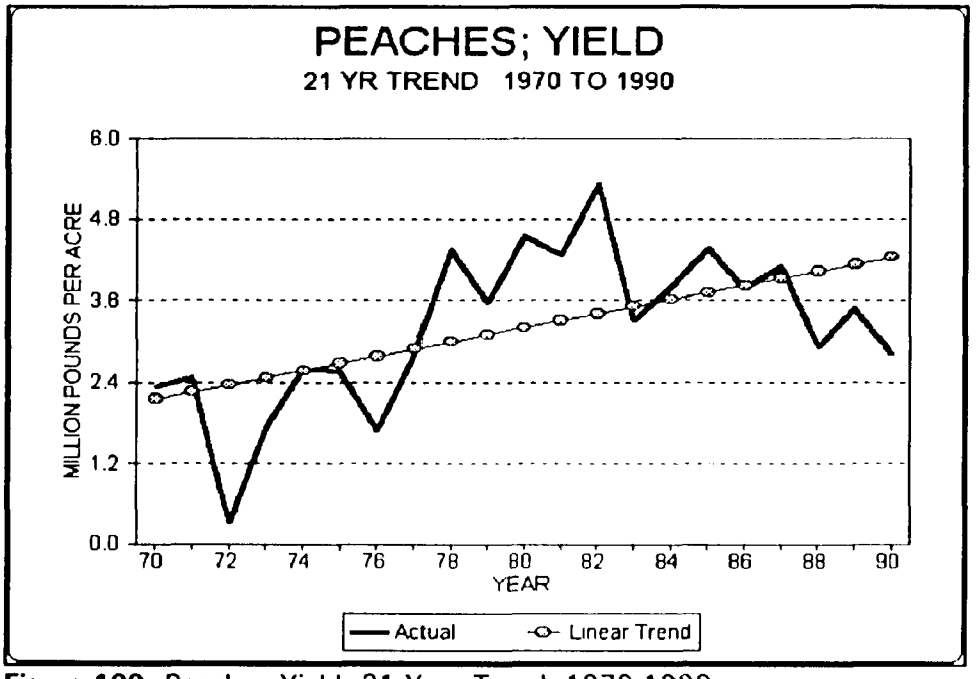
Average: 50,333,333

High: 82,000,000

Low: 10,000,000

Avg. Anl. Chg: -1.09%

Figure 108 Peaches Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

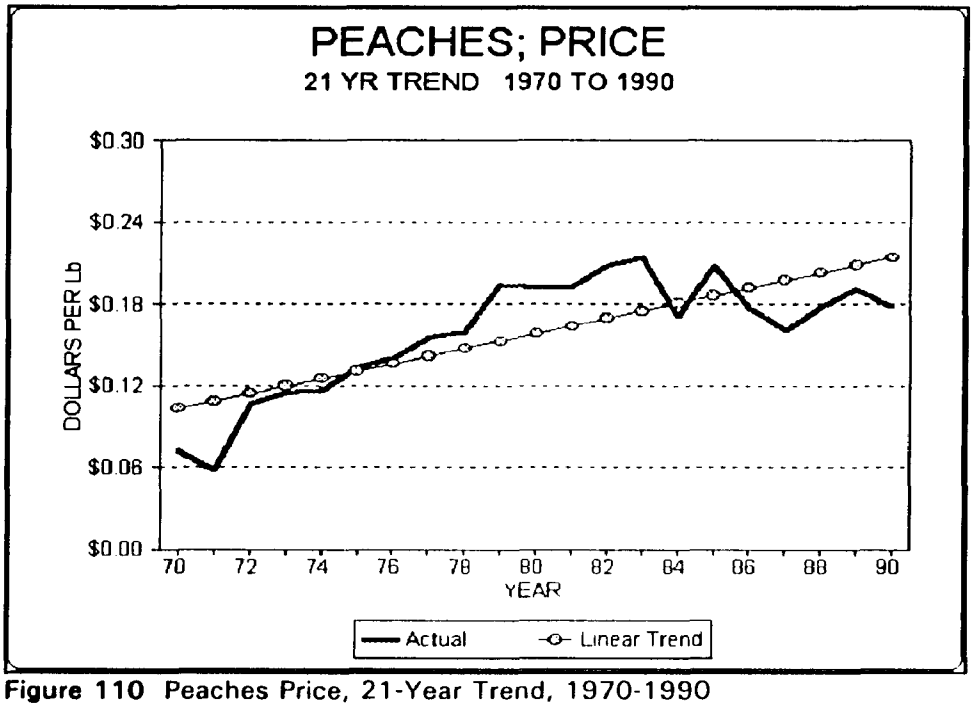
Average:
3.20

High:
5.32

Low:
0.32

Avg. Anl. Chg:
3.25%

Figure 109 Peaches Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$0.158

High:
$0.215

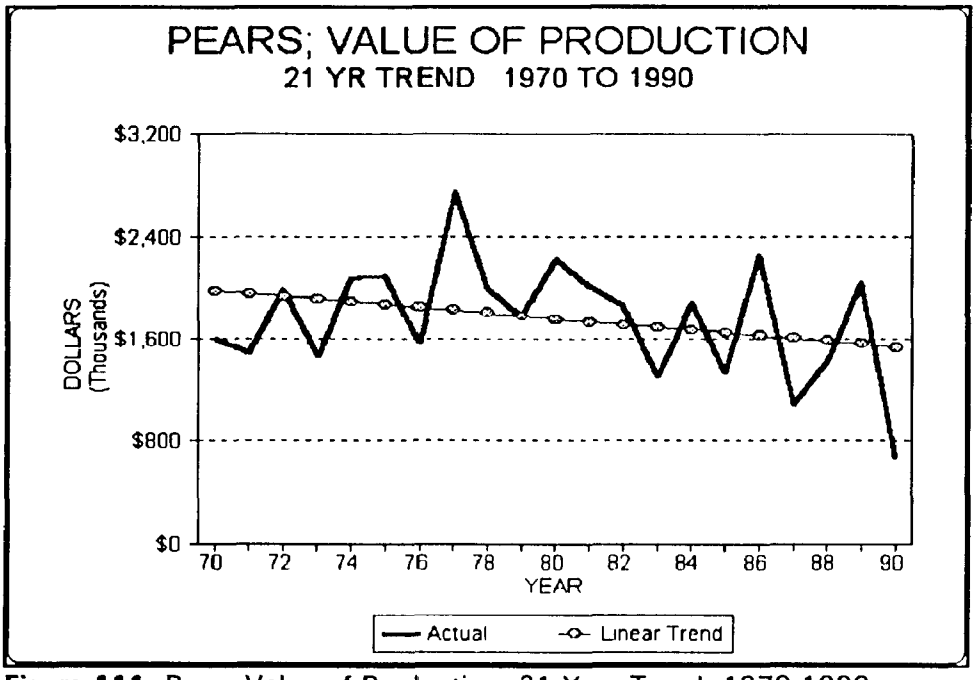
Low:
$0.058

Avg. Anl. Chg:
3.50%

Figure 110 Peaches Price, 21-Year Trend, 1970-1990

Pears: Pears showed the most significant declines for any of the fruit crops. Acres harvested plummeted from a high of 10.6 thousand in 1970, to a low of 1.4 thousand in 1990, a drop of 87%. The trend was an average annual decline of 11.44%, see Figure 112. The number of trees of fruit bearing age followed a similar downward pattern. The trend for pear trees was an average annual decline of 11.26%, last for all crops, see Table IV. Pear production declined rapidly but not as fast as the drop in tree numbers and acres harvested. Total production fell at an average annual decline of 6.11%. However, pears posted the largest trend increase for yields. Pear yields expanded at an average annual rate of 5.27%, see Figure 115. One explanation for the rising yield trend is the shifting away from marginal quality land. As the acres of pears harvested declines, the higher quality land remains in production, and yields improve. Pear prices tripled from 1970 to 1990, increasing to a high of $1.34 per pound in 1990. Pear prices increased at an average annual rate of 3.86%, tied with prunes and plums for the second highest growth rate. Even with the rise in pear prices, pears were the only fruit crop to have a negative average annual growth rate for the value of production, see Table IV. Pear value of production fell an average annual rate of 1.27% in the two decades analyzed.

The west side of the state produces most of the pears. Oceana, Allegan, and Berrien counties account for most of the production. The predominate variety is the Bartlett that accounts for approximately 83% of the state's pear acreage. In 1990 Michigan ranked 7th in the country in tonnage produced, producing 0.3% of the U.S. total.



VALUE OF PRODUCTION

21 - YEAR

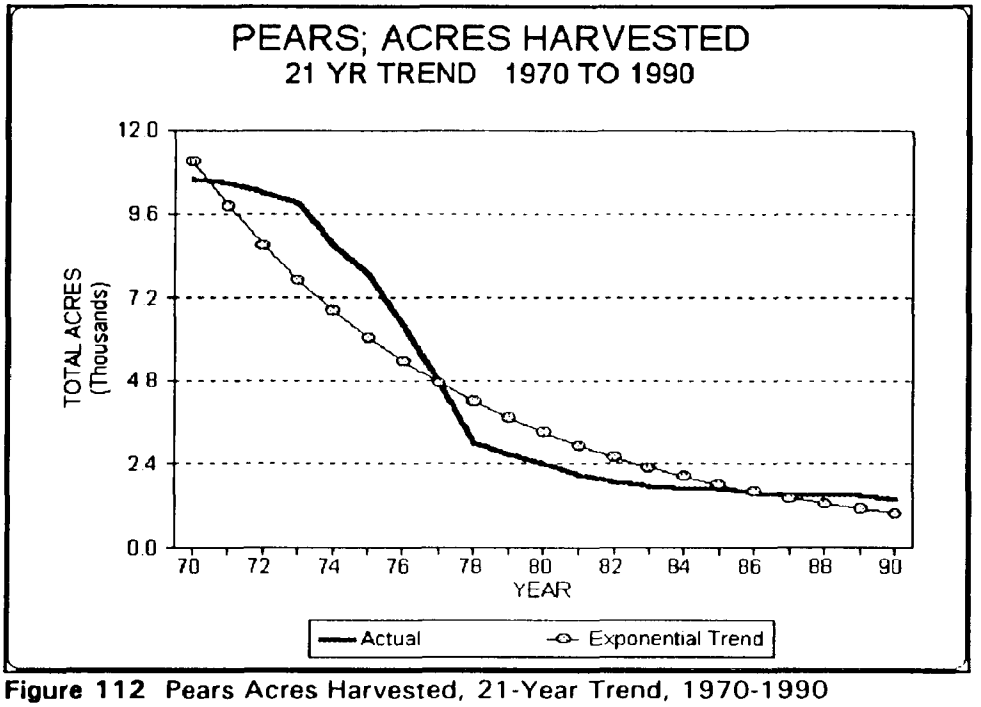
Average: $1,762,429

High: $2,760,000

Low: $668,000

Avg. Anl. Chg: -1.27%

Figure 111 Pears Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

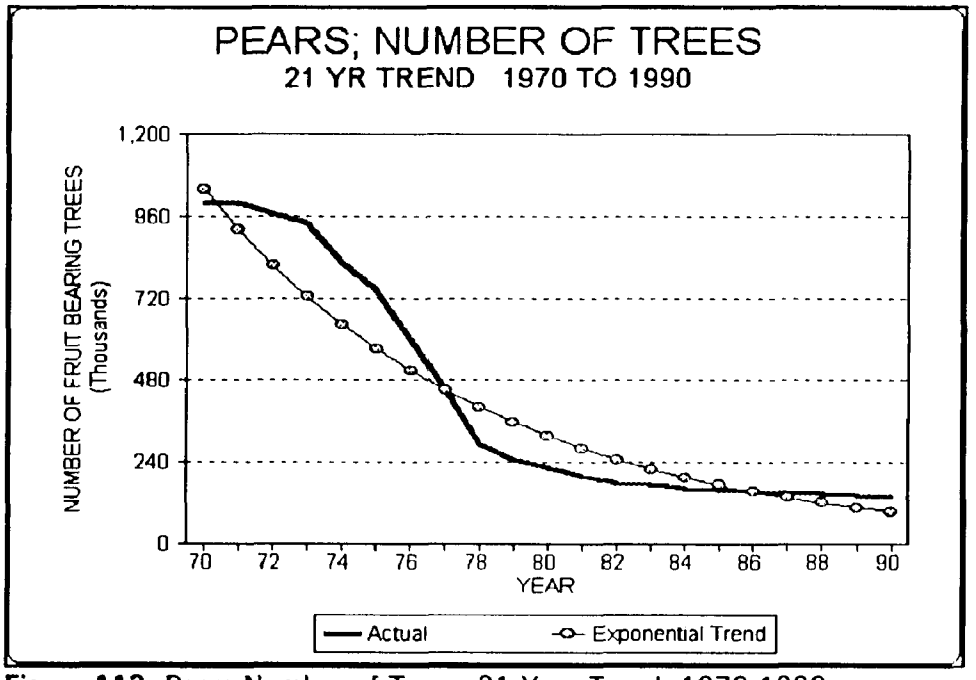
Average: 4,467

High: 10,600

Low: 1,400

Avg. Anl. Chg: -11.44%

Figure 112 Pears Acres Harvested, 21-Year Trend, 1970-1990



NUMBER OF TREES

21 - YEAR

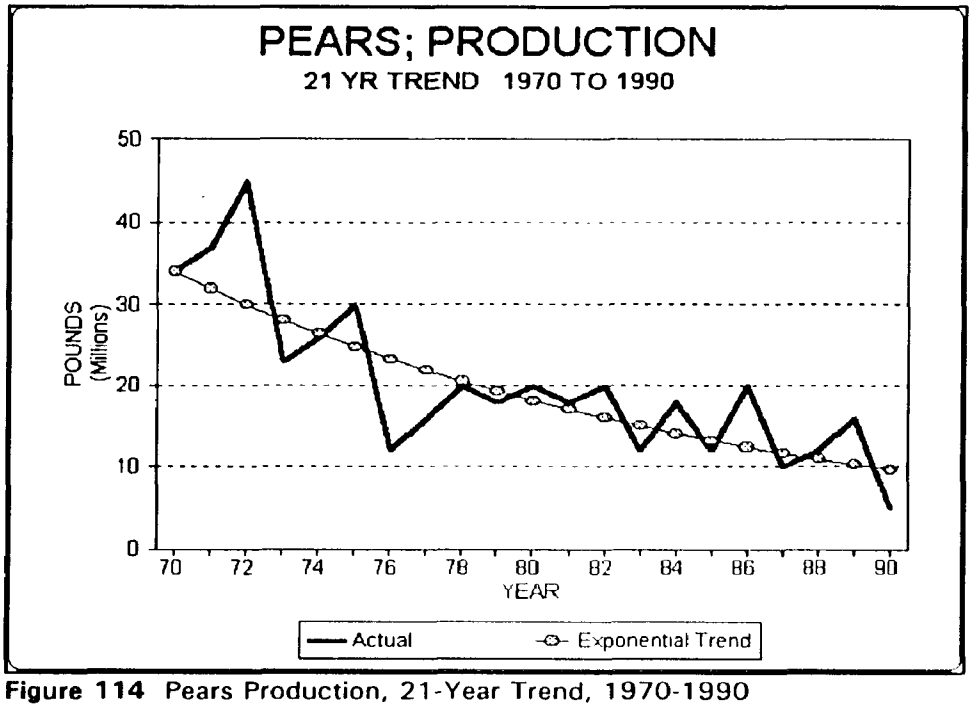
Average: 424,810

High: 1,000,000

Low: 140,000

Avg. Anl. Chg: -11.26%

Figure 113 Pears Number of Trees, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

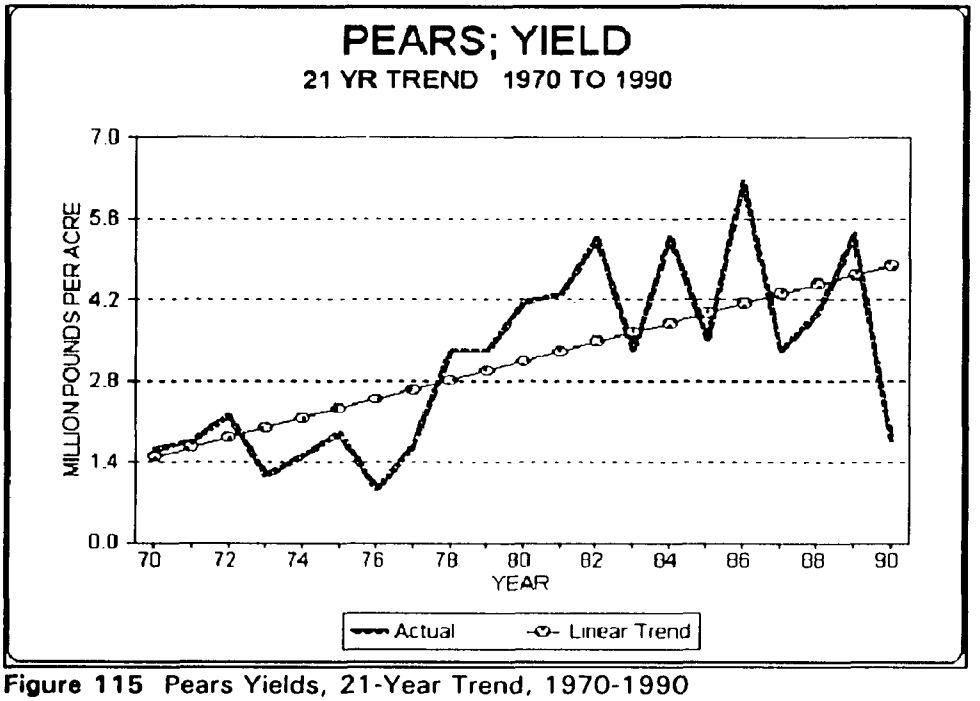
Average: 20,190,476

High: 45,000,000

Low: 5,000,000

Avg. Anl. Chg: -6.11%

Figure 114 Pears Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

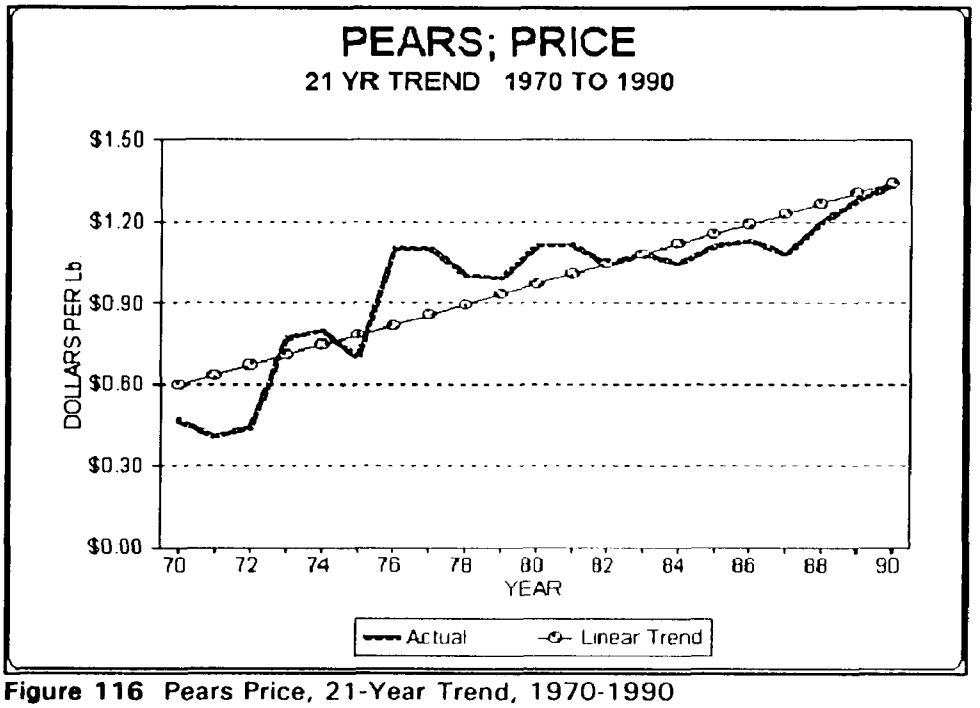
Average:
3.14

High:
6.25

Low:
0.94

Avg. Anl. Chg:
5.27%

Figure 115 Pears Yields, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$0.969

High:
$1.335

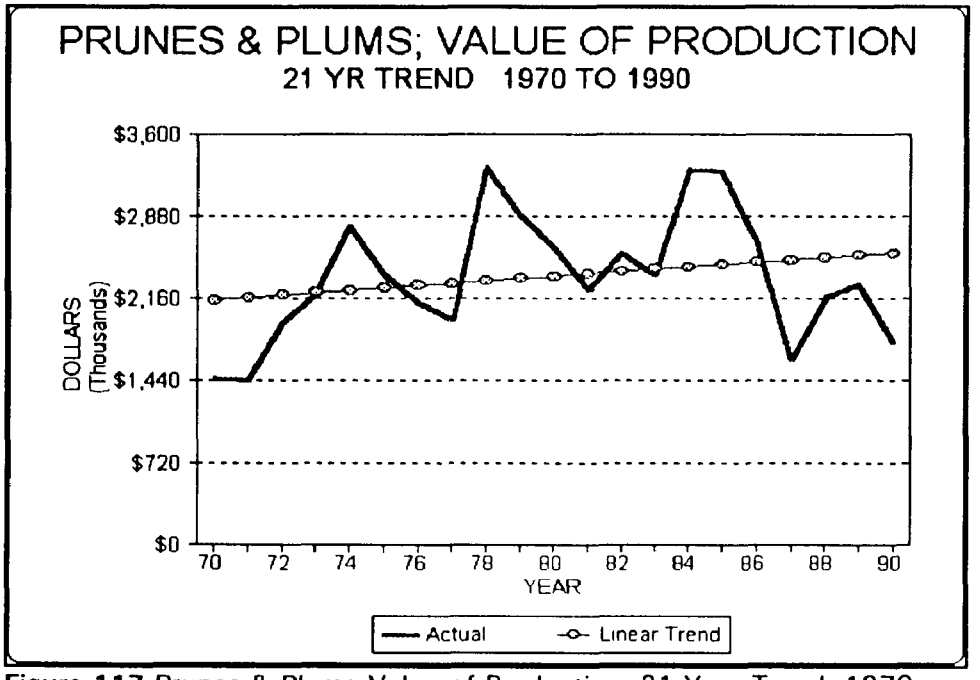
Low:
$0.405

Avg. Anl. Chg:
3.86%

Figure 116 Pears Price, 21-Year Trend, 1970-1990

Prunes and Plums: The production of prunes and plums fell throughout the 70's and 80's. The prune and plum declines were not as significant as pears, but they were enough to place them in second to last place in a number of categories. Acres harvested declined an average annual rate of 4.96%, see Figure 118. Prunes and plums showed a small recovery in acres harvested bouncing back from a low of 2.8 thousand acres in 1983 to reach 3.7 thousand acres in 1990. The trend for the number of fruit bearing trees moved in close tandem with the acres harvested trend, falling an average annual rate of 4.33%. Production also trended lower declining an average annual rate of 2.70%. For the 21 year period, Michigan's prune and plum sector averaged 28.2 million pounds a year. The crop yields increased slightly, up an average annual rate of 2.04%, see Figure 121. Price per pound fluctuated from a low of $0.36 in 1971 to a high of $1.50 in 1985. The long run price trend is an average annual increase of 3.86%, the second highest growth rate for fruit, see Table IV. The increase in prune and plum prices was enough to offset the declining trend for production and generate a small positive trend for the value of production. Michigan's prune and plum crop was valued at an average of $2.4 million a year for the 21 year period of analysis.

The west side of the state produced most of the prunes and plums in the 70's and 80's. The counties of Leelanau, Oceana, and Van Buren produce most of the fruit. The Stanley variety accounted for 85% of the total state acreage. In 1990 Michigan ranked 5th in the country in production, producing 2.2% of the total U.S. tonnage, California is the leading producer.



VALUE OF PRODUCTION

21 - YEAR

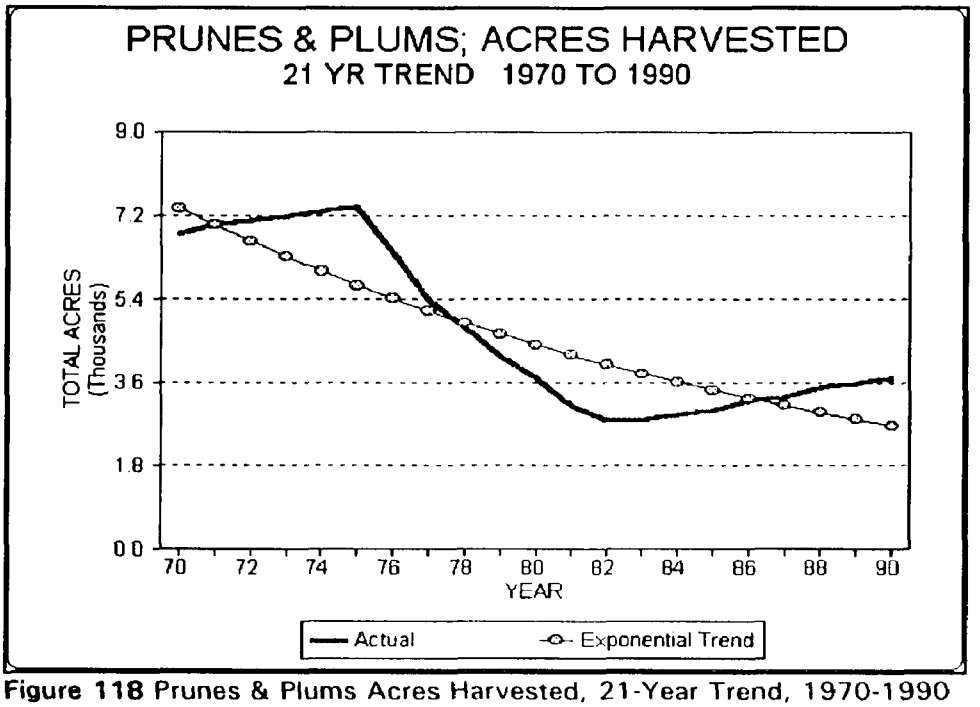
Average: $2,354,905

High: $3,312,000

Low: $1,440,000

Avg. Anl. Chg: 0.87%

Figure 117 Prunes & Plums Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

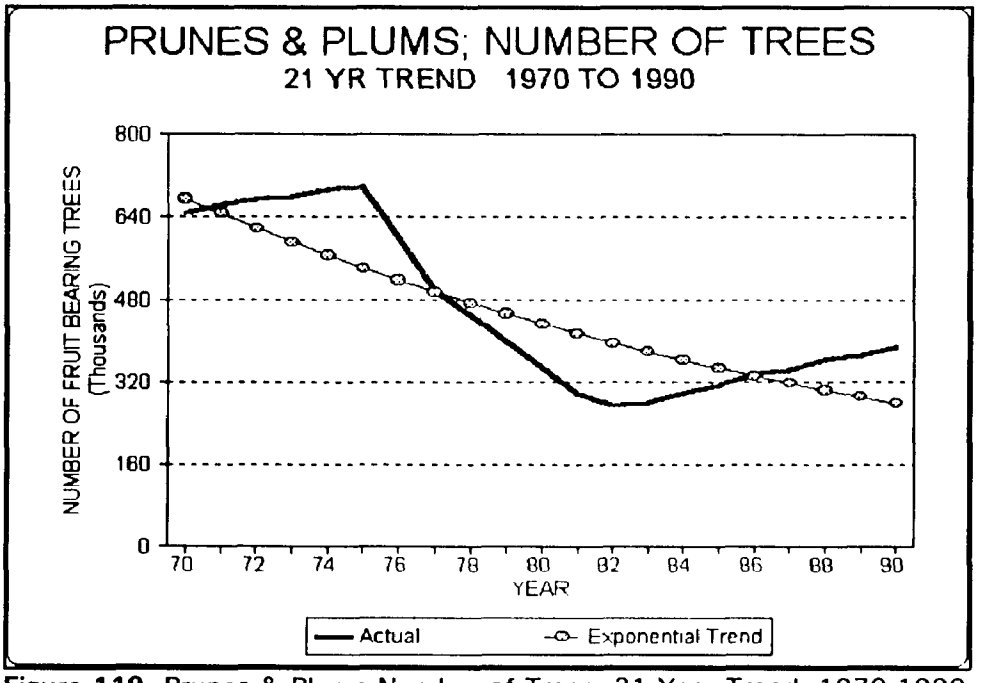
Average: 4,724

High: 7,400

Low: 2,800

Avg. Anl. Chg: -4.96%

Figure 118 Prunes & Plums Acres Harvested, 21-Year Trend, 1970-1990



NUMBER OF TREES

21 - YEAR

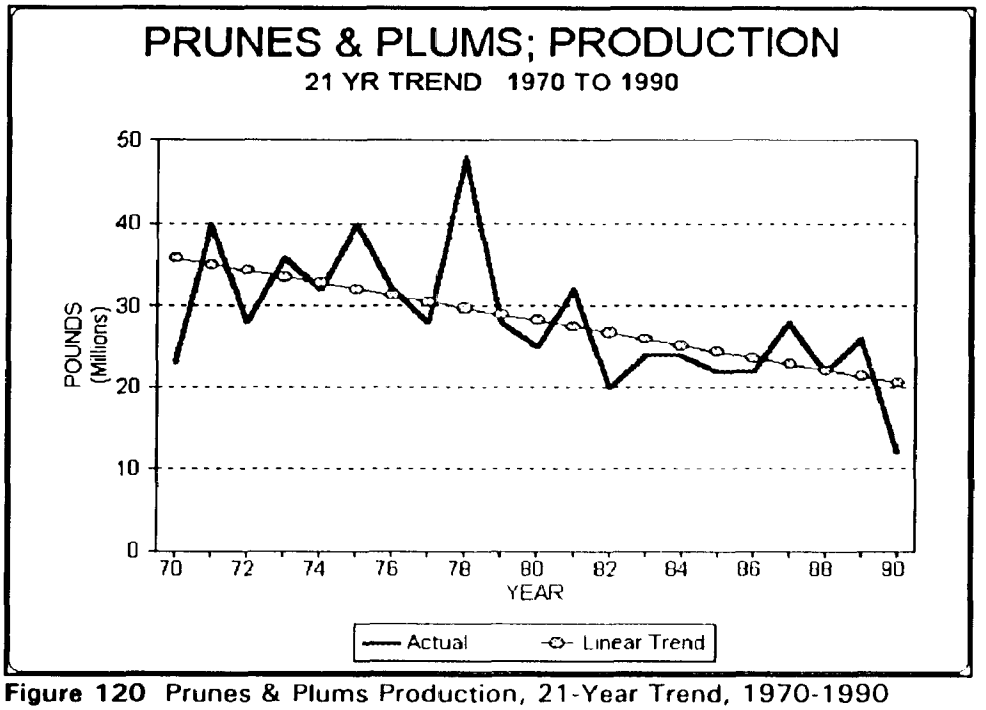
Average: 459,286

High: 700,000

Low: 275,000

Avg. Anl. Chg: -4.33%

Figure 119 Prunes & Plums Number of Trees, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

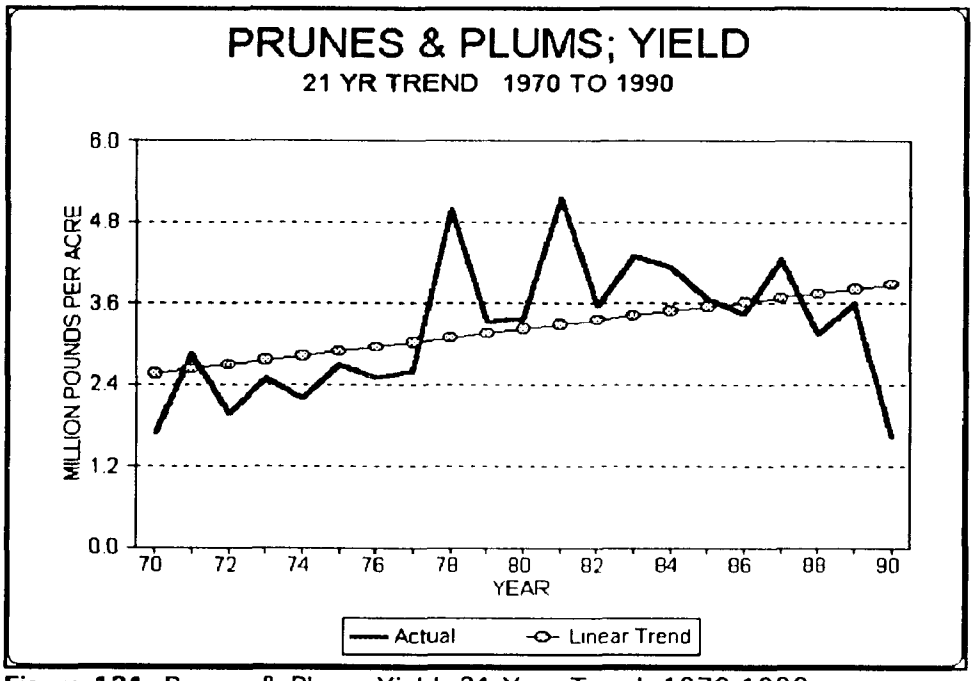
Average: 28,190,476

High: 48,000,000

Low: 12,000,000

Avg. Anl. Chg: -2.70%

Figure 120 Prunes & Plums Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

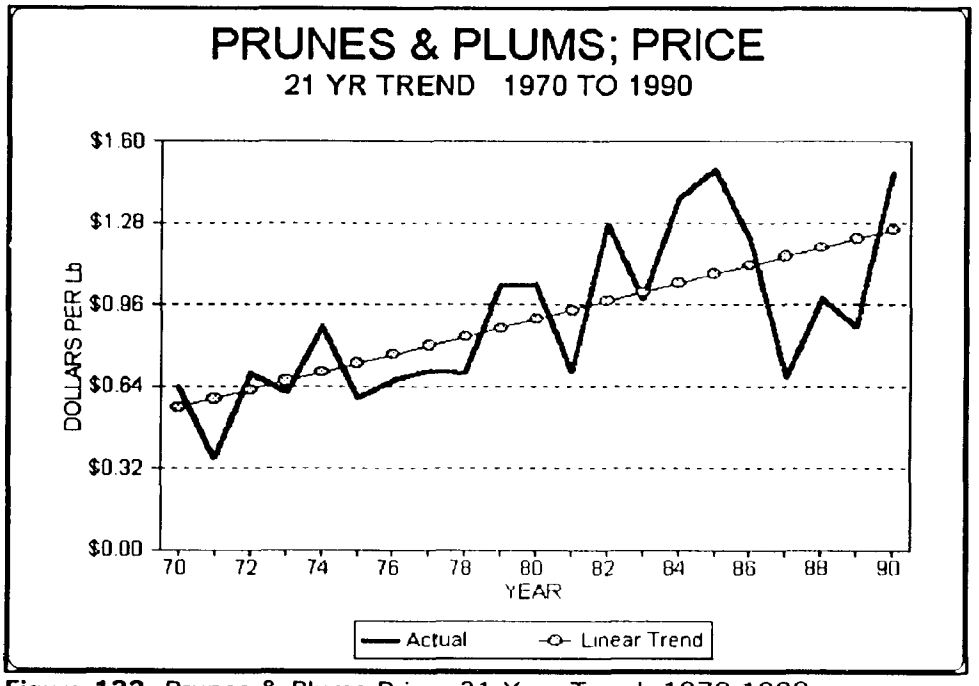
Average:
3.22

High:
5.16

Low:
1.62

Avg. Anl. Chg:
2.04%

Figure 121 Prunes & Plums Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$0.904

High:
$1.495

Low:
$0.360

Avg. Anl. Chg:
3.86%

Figure 122 Prunes & Plums Price, 21-Year Trend, 1970-1990

Sweet Cherries: Michigan sweet cherries acres harvested have trended lower during the decades of the 70's and 80's, falling at an average annual rate of 1.74%, see Figure 132. The path of the actual acres harvested however, can be broken into two different segments. The first segment declined from the level around 12 thousand acres in the early 70's, to a low of 7,500 acres in 1982, a drop of over 33%. The second segment is an increasing trend in acres harvested, acres harvested expanded every year from 1982 to 1990, up from 7,500 to 9,900 acres. The number of fruit bearing trees followed a similar trend progression as acres harvested, first declining and then recovering at the end of the 1980's. The 21 year trend for sweet cherry production was fairly flat,[91] increasing an average annual rate of 0.30%. The state averaged a crop of 51 million pounds a year for the two decades. Cherry yields per acres improved enough to offset the declines in acreage harvested to net the positive production trend. The yields increased an average annual amount of 1.95%, see Figure 127. Prices rose steadily from a low of $0.10 in 1971 to a high of $0.33 in 1988, and then moderated. The price trend persisted at an average annual rate of 4.60%, this was the highest calculated price trend for the fruit crops, see Table IV. The value of production trend was also highly positive, second in rank for percentage change. Value of production was extremely variable, ranging from a low of $4.2 million in 1970 to a high of $18.4 in 1987, the 21 year average was

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[91] Even though the production trend was a modest increase, sweet cherries were one of only four fruit crops posting positive gains (apples, grapes, and tart cherries were the others), see Table IV.

$10 million, see Figure 123.

More than 80% of Michigan's sweet cherry crop is grown in the northwest region of the state. Two counties alone, Leelanau and Grand Traverse, produce most of the cherry crops. In 1990 Michigan ranked 4th in the country in sweet cherries produced, Washington was first. Total Michigan pounds produced equaled an 8.6% share of the U.S. production.

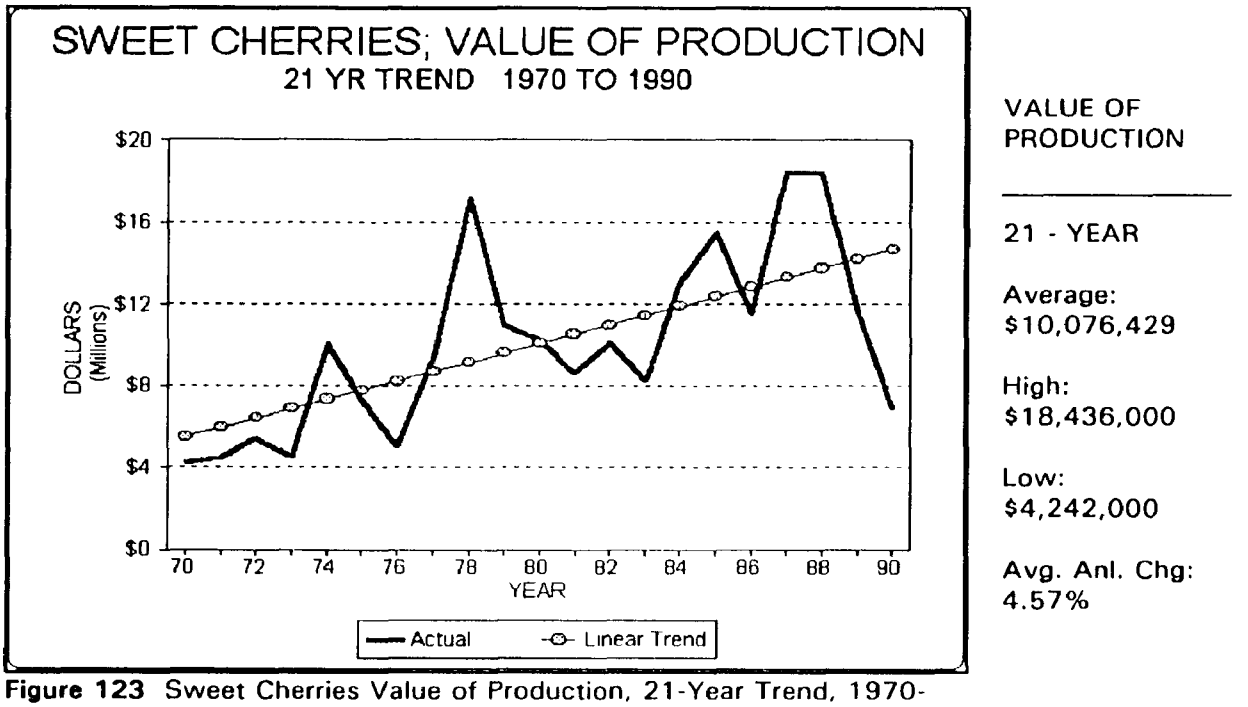
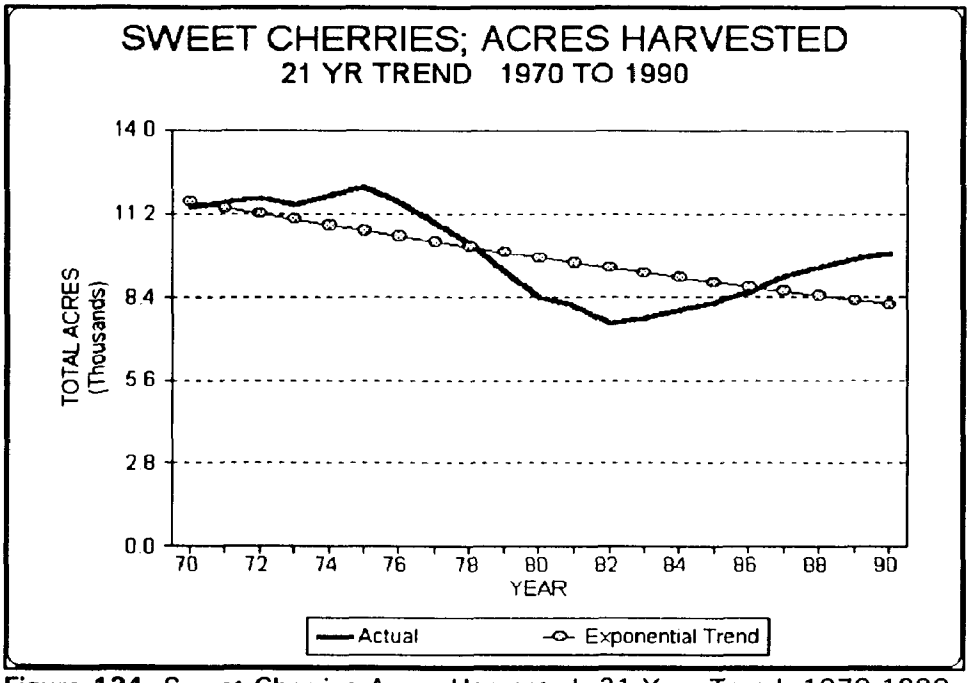


Figure 123 Sweet Cherries Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

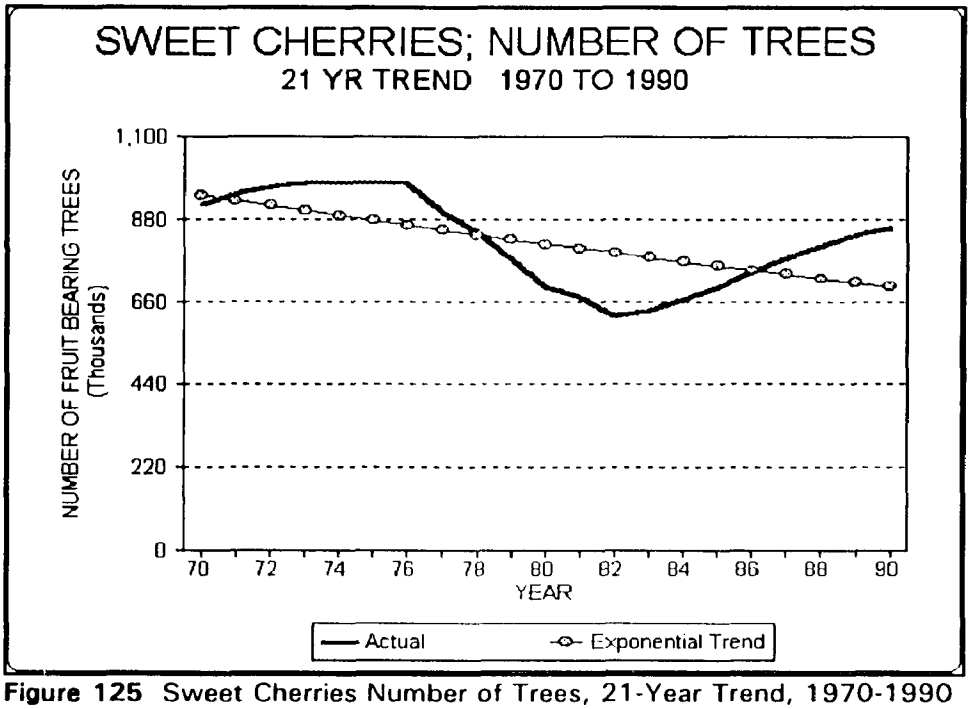
Average: 9,843

High: 12,100

Low: 7,500

Avg. Anl. Chg: -1.74%

Figure 124 Sweet Cherries Acres Harvested, 21-Year Trend, 1970-1990



NUMBER OF TREES

21 - YEAR

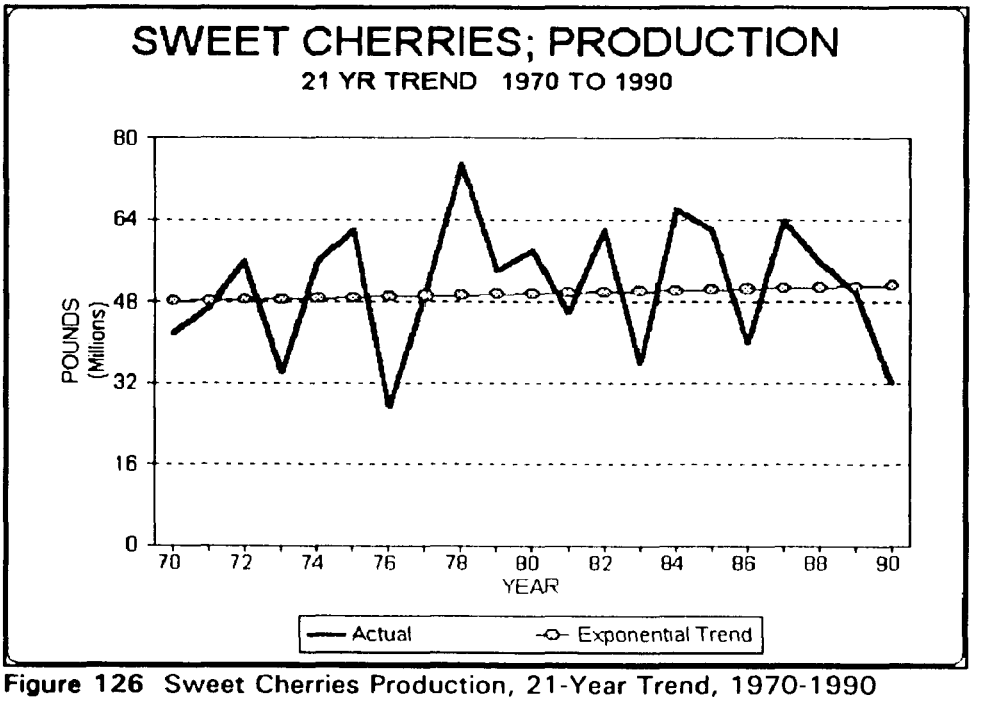
Average: 825,000

High: 980,000

Low: 625,000

Avg. Anl. Chg: -1.48%

Figure 125 Sweet Cherries Number of Trees, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

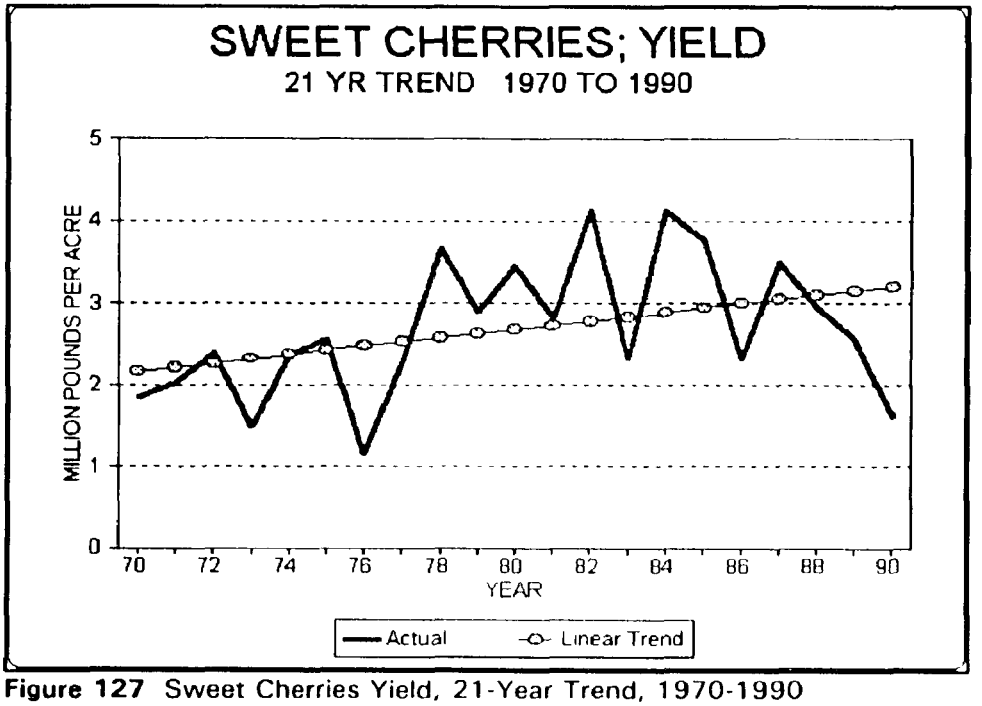
Average:
51,190,476

High:
75,000,000

Low:
27,000,000

Avg. Anl. Chg:
0.30%

Figure 126 Sweet Cherries Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
2.69

High:
4.13

Low:
1.16

Avg. Anl. Chg:
1.95%

Figure 127 Sweet Cherries Yield, 21-Year Trend, 1970-1990

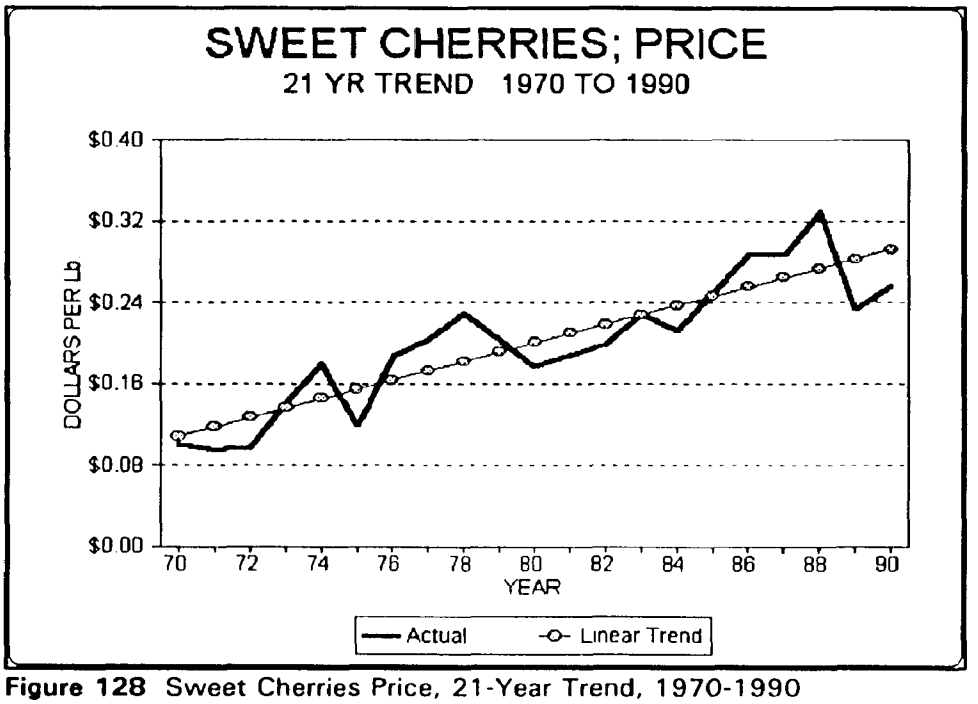


Figure 128 Sweet Cherries Price, 21-Year Trend, 1970-1990

Tart Cherries: Tart cherries are one of the state's most significant fruit crops in terms of value of production and national market share. The northwest sector of the state was the leading producer of tart cherries in the decades of the 70's and 80's. The primary producing counties in this area were Grand Traverse, Leelanau, and Oceana. In 1990 Michigan ranked 1st in the country in tart cherries produced, accounting for 76.6% of the U.S. total.

Acres harvested of tart cherries trended gradually downward in the decades of the 70' and 80's, falling at an average annual rate of 0.83%, this was the second smallest acreage decline for fruit, see Table IV. The high for acres harvested was 39.5 thousand in 1970 and the low was 27.0 thousand in 1982. Since 1982 acres harvested have recovered some of the lost ground by expanding above 32 thousand acres, see Figure 130. The trend for the

number of fruit bearing cherry trees was a positive average annual rate of 0.36%.[92] For the two decades the tart cherry trees averaged 3.1 million annually, in 1990 there were 3.45 million trees, just below the high of 3.6 million in 1987. Cherry yields improved gradually, increasing an average annual rate of 1.65%, last for all fruit crops, see Table IV. A typical harvested acre produced an average of 2.6 million pounds of tart cherries over the 21 year period. Total production trended higher while having quite a bit of variability, see Figure 132. Tart cherry production increased an average annual amount of 1.42 million pounds a year. Price per pound of tart cherries expanded an average annual amount of only 2.00%, ranking 7th for the fruit crops, see Table IV. The increases in both production and price trends generated a positive trend for the value of production. Tart cherries crop value of production increased an average annual rate of 1.92%, and averaged in dollar terms $32 million a year during the 70's and 80's.

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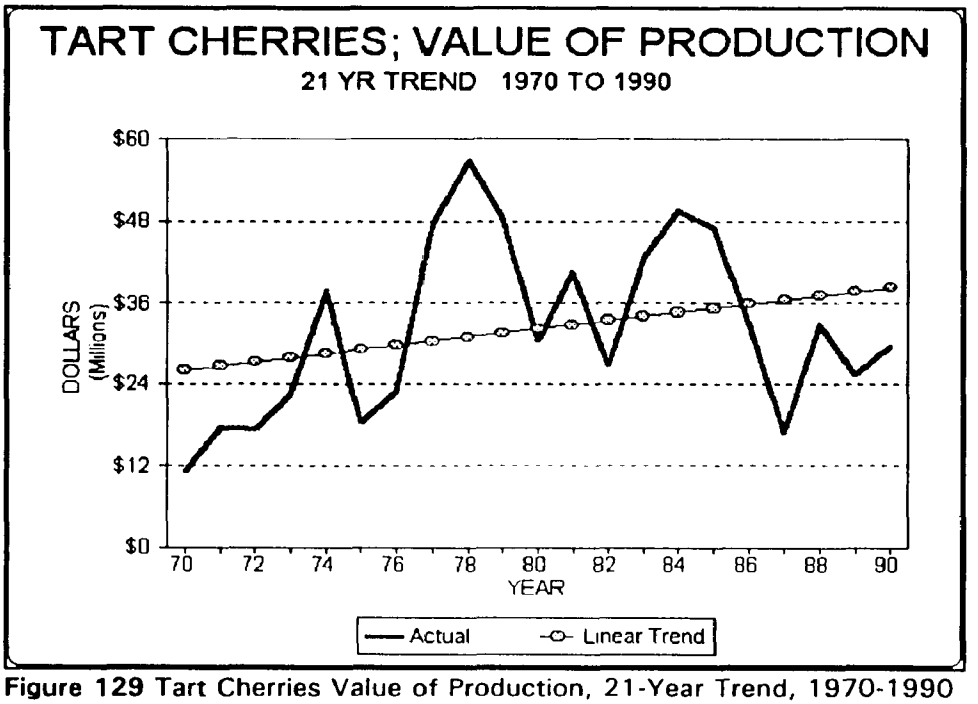
[92] The only other positive growth trend was calculated for apples.



VALUE OF PRODUCTION

21 - YEAR

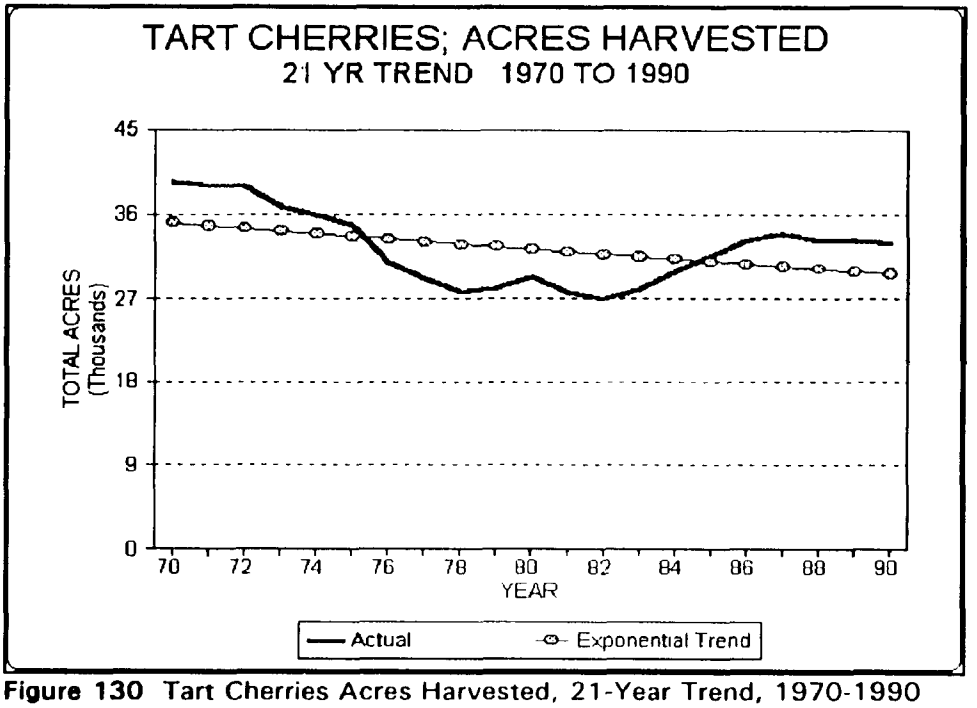
Average: $32,169,714

High: $56,832,000

Low: $11,297,000

Avg. Anl. Chg: 1.92%

Figure 129 Tart Cherries Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

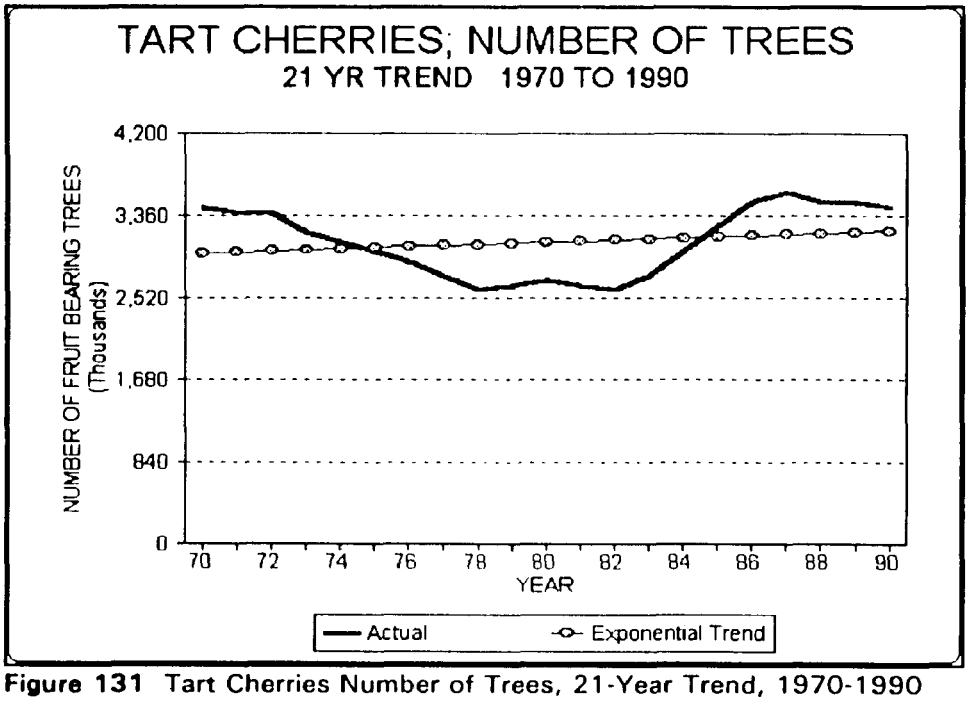
Average: 32,486

High: 39,500

Low: 27,000

Avg. Anl. Chg: -0.83%

Figure 130 Tart Cherries Acres Harvested, 21-Year Trend, 1970-1990



NUMBER OF TREES

21 - YEAR

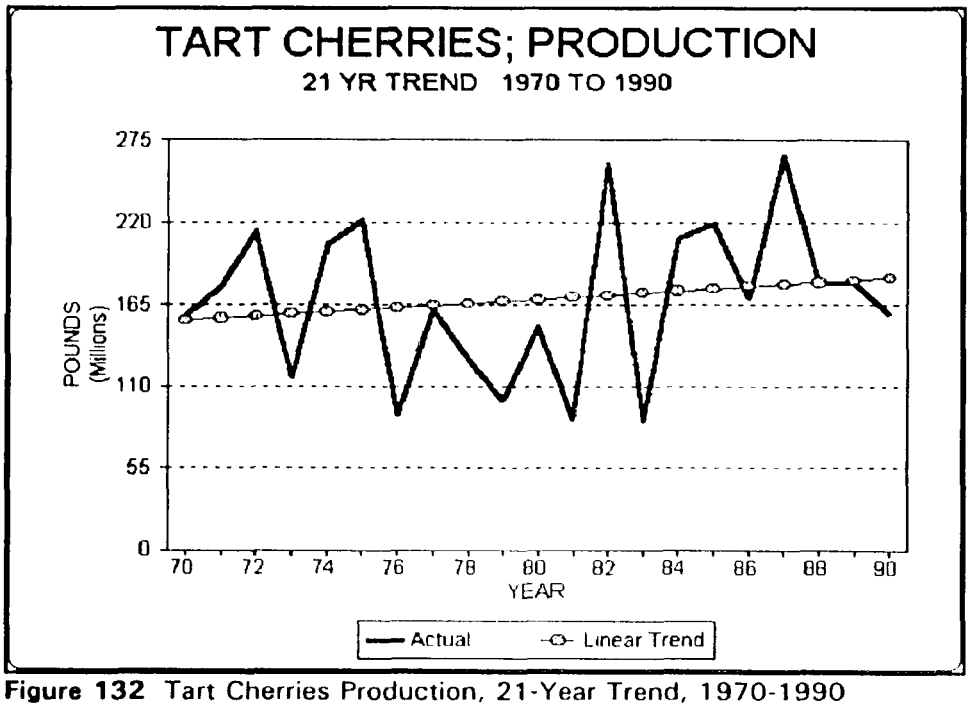
Average:
3,092,857

High:
3,600,000

Low:
2,600,000

Avg. Anl. Chg:
0.36%

Figure 131 Tart Cherries Number of Trees, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

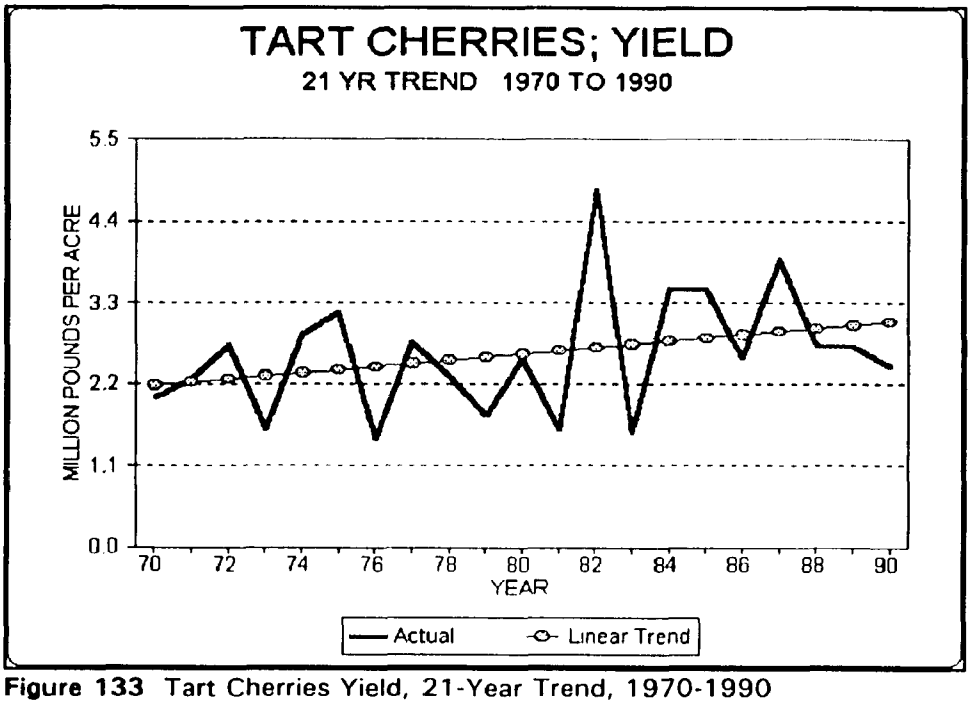
Average:
168,761,905

High:
265,000,000

Low:
87,000,000

Avg. Anl. Chg:
0.84%

Figure 132 Tart Cherries Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

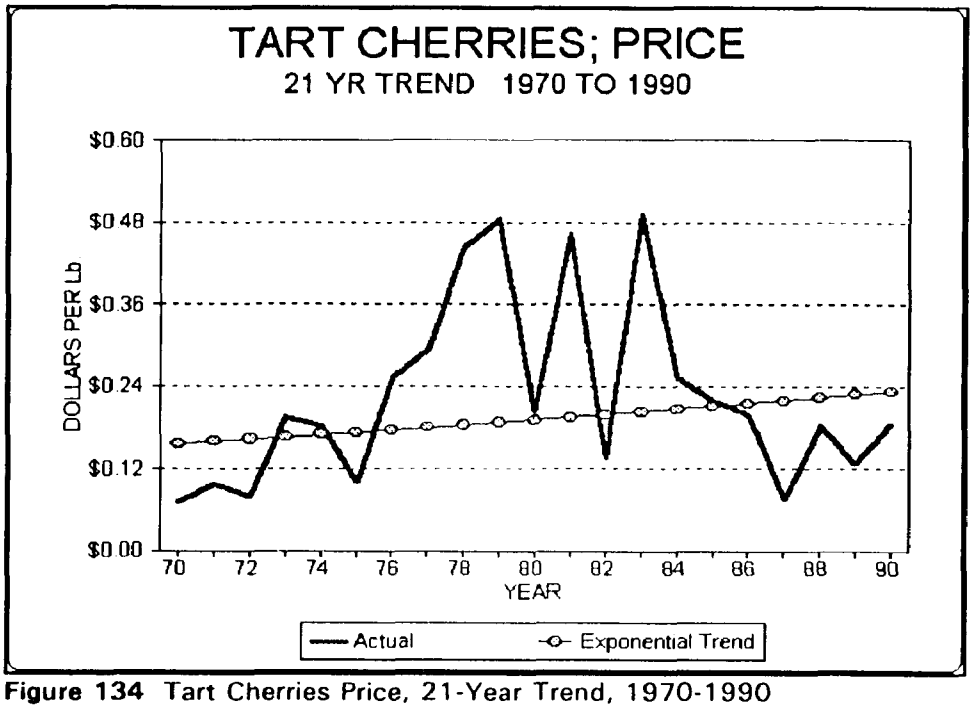
Average:
2.60

High:
4.81

Low:
1.46

Avg. Anl. Chg:
1.65%

Figure 133 Tart Cherries Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$0.226

High:
$0.491

Low:
$0.072

Avg. Anl. Chg:
2.00%

Figure 134 Tart Cherries Price, 21-Year Trend, 1970-1990

General Vegetable Overview

This section reviews the important crop trends of price, yield, acres harvested, quantity produced, and value of production, for each of Michigan's top thirteen vegetable crops.[93] Table V is a trend summary of vegetable crops ranked by the average annual percent changes for each category (yields, price, etc.). Figures 135 and 136 are the aggregation of all vegetable crops for the categories of value of production and acres harvested. Total Michigan vegetable crop acres harvested have trended higher during the last two decades, increasing at an average annual rate of 0.83%, see Figure 138. Acres harvested of vegetables stood at 88.1 thousand in 1970, and increased to 116.4 thousand acres in 1990, up 32%. The value of vegetable production rose throughout most of the 70's and 80's. Total crop value increased an average annual amount of $4.6 million or 4.29%. A high of $155 million was record in 1983 and the low occurred in 1970 at $48 million.

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[93] The selection of the top seven Michigan vegetable crops for the analysis is predicated on the value of production for each crop.

Table V Trend Summary for Vegetable Crops, Commodity Rank by Average Annual % Change for 21-Years, 1970-1990

TREND SUMMARY FOR Vegetable CROPS
COMMODITY RANK BY
AVERAGE ANNUAL % CHANGE FOR
21-YearS FROM 1970 - 90

Acres Harvested

Rank	Commodity	% Chg.
1	Snap Beans	2.83%
2	Tomatoes, process	2.49%
3	Asparagus	2.41%
4	Celery	1.84%
5	Cauliflower	1.35%
6	Carrots	1.18%
7	Onions	0.78%
8	Sweet Corn	-0.33%
9	Cucumbers	-0.58%
10	Lettuce	-2.31%
11	Tomatoes, fresh	-2.53%
12	Strawberries	-3.48%
13	Mushrooms	-5.04%
	Average	-0.11%

Production

Rank	Commodity	% Chg.
1	Tomatoes, process	5.62%
2	Snap Beans	3.61%
3	Cauliflower	2.14%
4	Cucumbers	1.98%
5	Carrots	1.98%
6	Celery	1.79%
7	Mushrooms	1.17%
8	Asparagus	0.92%
9	Onions	0.53%
10	Sweet Corn	-0.68%
11	Lettuce	-1.24%
12	Tomatoes, fresh	-2.35%
13	Strawberries	-2.62%
	Average	0.99%

Yield

Rank	Commodity	% Chg.
1	Mushrooms	5.99%
2	Tomatoes, process	3.53%
3	Cucumbers	2.43%
4	Lettuce	1.00%
5	Carrots	0.82%
6	Cauliflower	0.80%
7	Snap Beans	0.80%
8	Strawberries	0.71%
9	Tomatoes, fresh	0.04%
10	Celery	0.02%
11	Onions	-0.23%
12	Sweet Corn	-0.35%
13	Asparagus	-1.58%
	Average	1.01%

Price

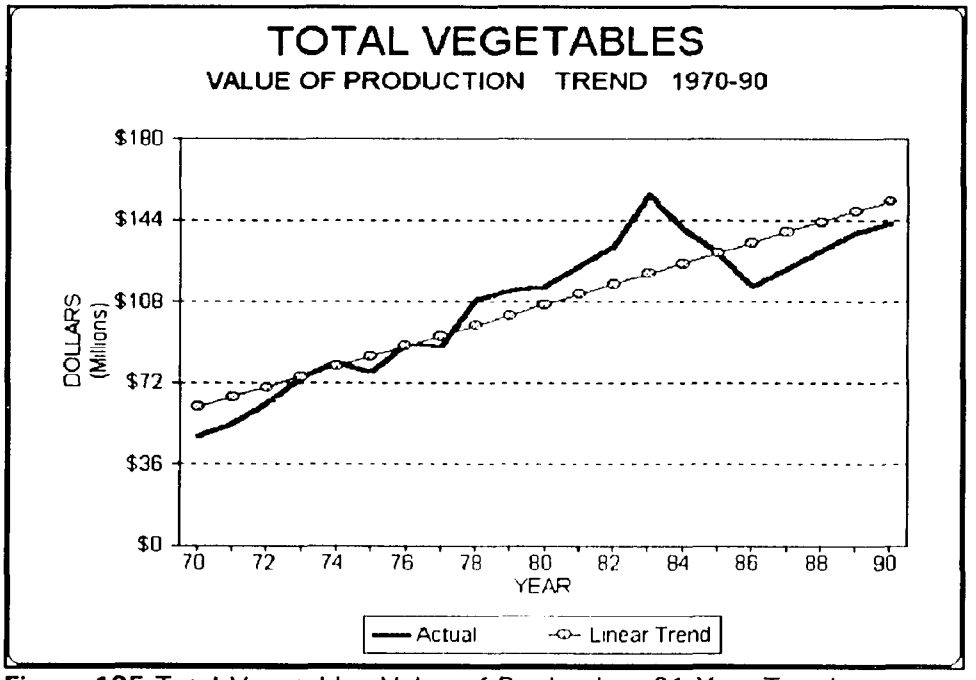
Rank	Commodity	% Chg.
1	Sweet Corn	6.18%
2	Cauliflower	5.77%
3	Lettuce	5.33%
4	Asparagus	4.41%
5	Tomatoes, fresh	3.65%
6	Onions	3.53%
7	Strawberries	3.51%
8	Celery	3.23%
9	Cucumbers	2.87%
10	Tomatoes, process	2.79%
11	Mushrooms	2.77%
12	Snap Beans	2.59%
13	Carrots	1.80%
	Average	3.73%

Table V (Continued) Trend Summary for Vegetable Crops, Commodity Rank by Average Annual % Change for 21-Years, 1970-1990

TREND SUMMARY FOR Vegetable CROPS
COMMODITY RANK BY
AVERAGE ANNUAL % CHANGE FOR
21-YearS FROM 1970 - 90

Value of Production

Rank	Commodity	% Chg.
1	Cauliflower	7.35%
2	Tomatoes, process	7.35%
3	Snap Beans	6.52%
4	Sweet Corn	6.22%
5	Asparagus	5.13%
6	Cucumbers	5.05%
7	Celery	4.57%
8	Lettuce	3.99%
9	Mushrooms	3.97%
10	Carrots	3.53%
11	Onions	3.31%
12	Tomatoes, fresh	1.29%
13	Strawberries	1.15%
	Average	4.57%



VALUE OF PRODUCTION

21 - YEAR

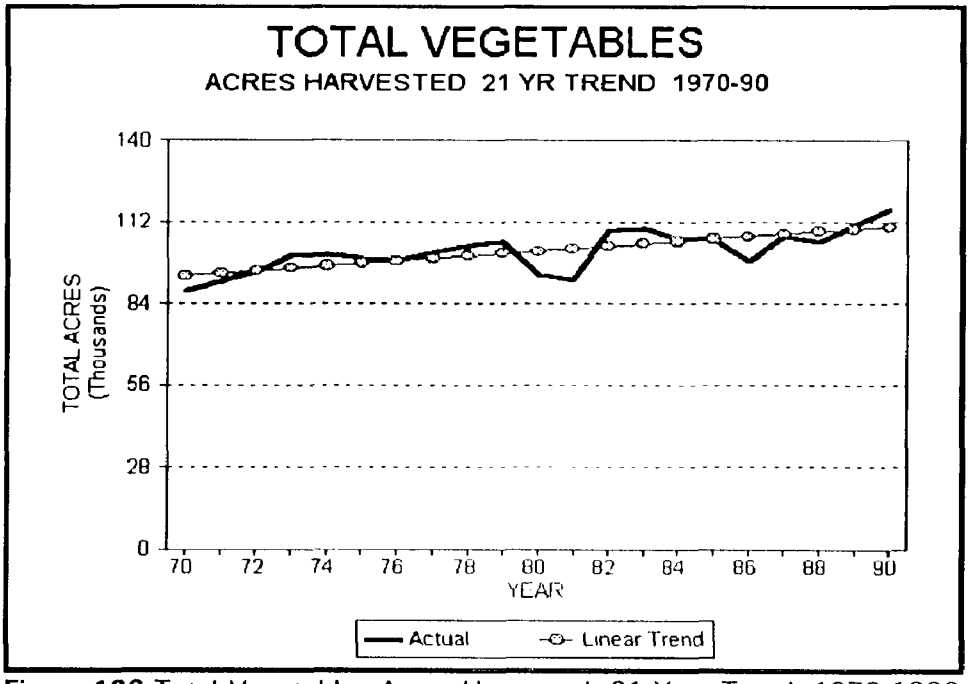
Average: $106,685,954

High: $155,125,372

Low: $48,089,995

Avg. Anl. Chg: 4.29%

Figure 135 Total Vegetables Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

Average: 101,941

High: 116,400

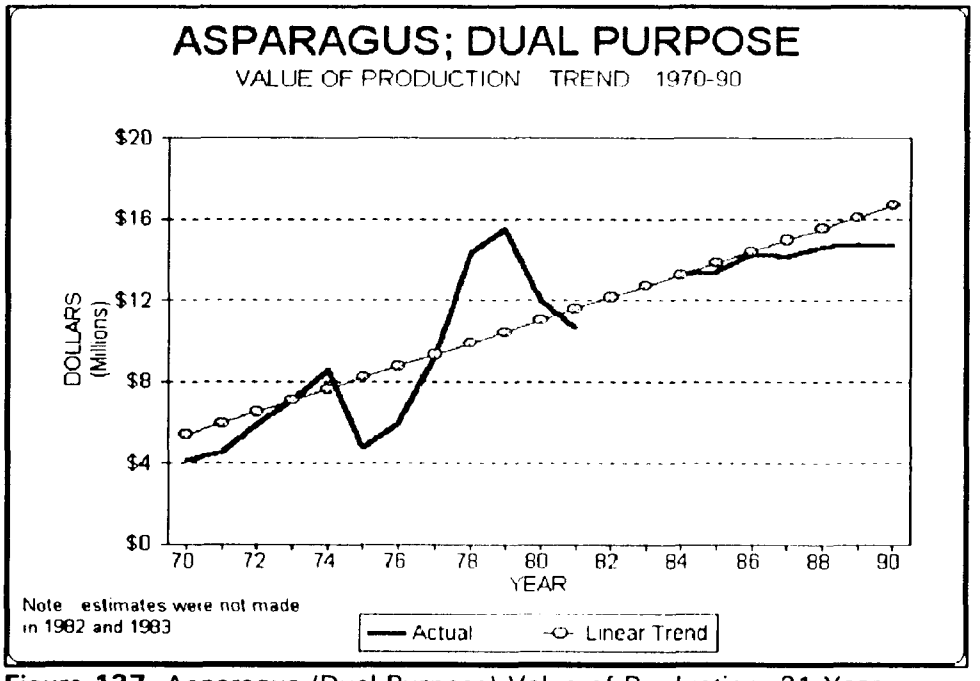
Low: 88,100

Avg. Anl. Chg: 0.83%

Figure 136 Total Vegetables Acres Harvested, 21-Year Trend, 1970-1990

Asparagus (Dual Purpose): Asparagus showed noticeable increases in acres harvested and production during the 70's and 80's. Acres harvested increased an average annual rate of 2.41%, third highest for all vegetables, see Table V. In 1970 12.4 thousand acres were harvested in Michigan, by 1990, acres harvested had risen to a state record of 23.5 thousand acres, see Figure 138. Production trended higher with an average annual growth rate of 0.96%. In 1990 the state produced a record harvest of 259,000 Cwt. Asparagus yields trended down in the 70's and improved in the 80's. Yields per acre in hundredweight declined an average annual rate of 1.58%, last for all vegetable crops. The price of asparagus moved from the low $20's per Cwt. to the high $50's per Cwt. in the 80's. Given the increase in both the trend for price and production, the trend for the value of production also increased. The value of production rose at an average annual rate of 5.13%.

Michigan produces more processing asparagus than fresh market asparagus. In 1990, 10.4 tons of processed asparagus were harvested compared to 51,000 hundredweight of fresh market asparagus. In 1990 Michigan ranked 3rd in the country in asparagus output based on poundage, with a share 10.6%, California is the leading producer.



VALUE OF PRODUCTION

21 - YEAR

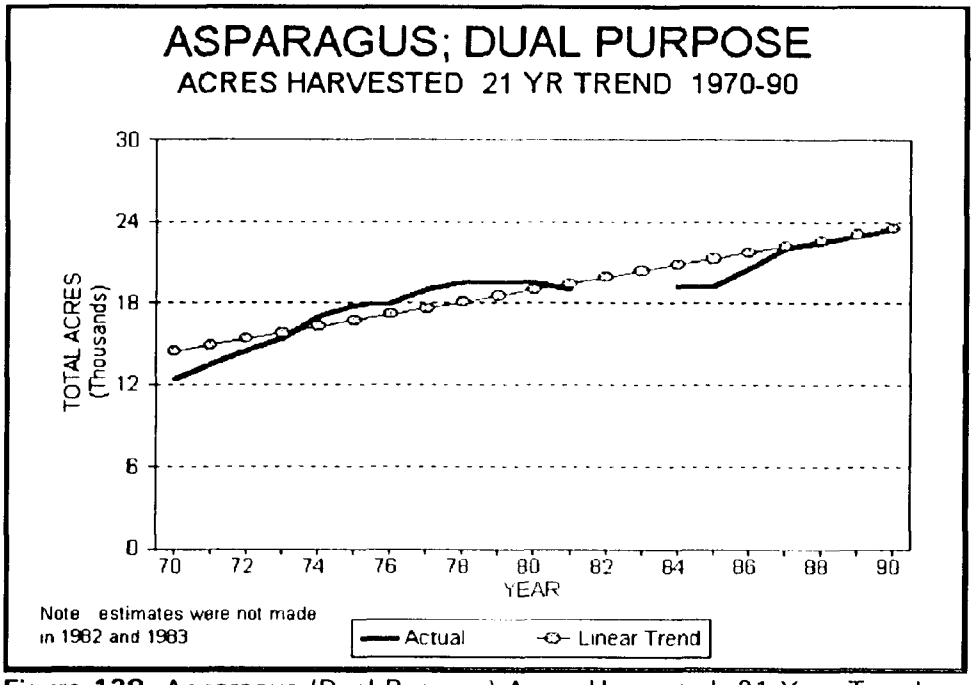
Average: $11,025,496

High: $15,544,800

Low: $4,158,000

Avg. Anl. Chg: 5.13%

Figure 137 Asparagus (Dual Purpose) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

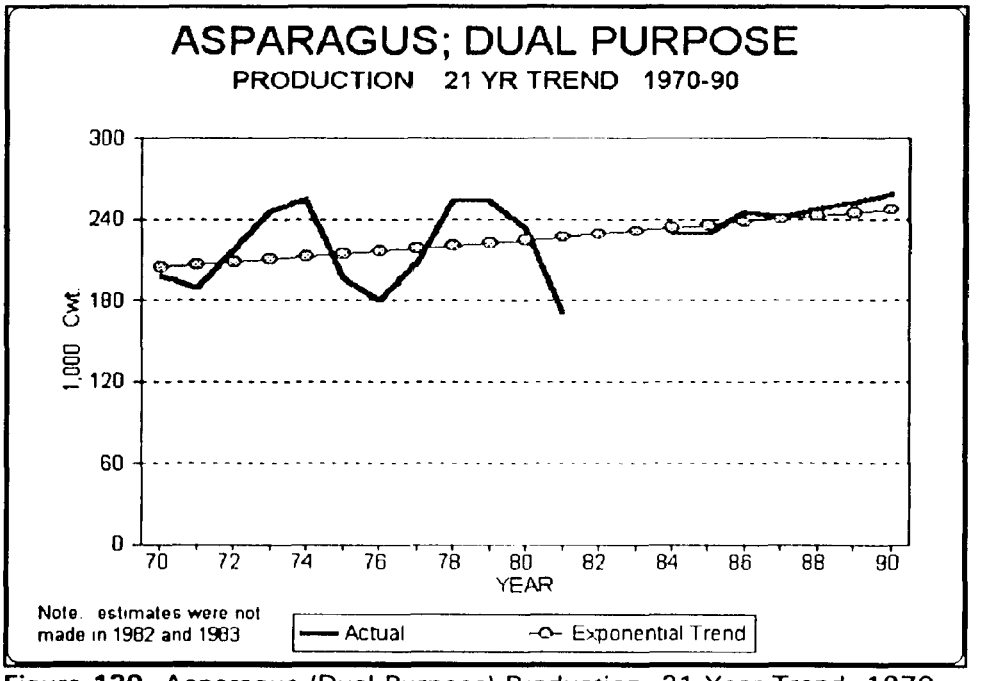
Average: 18,971

High: 23,500

Low: 12,400

Avg. Anl. Chg: 2.41%

Figure 138 Asparagus (Dual Purpose) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

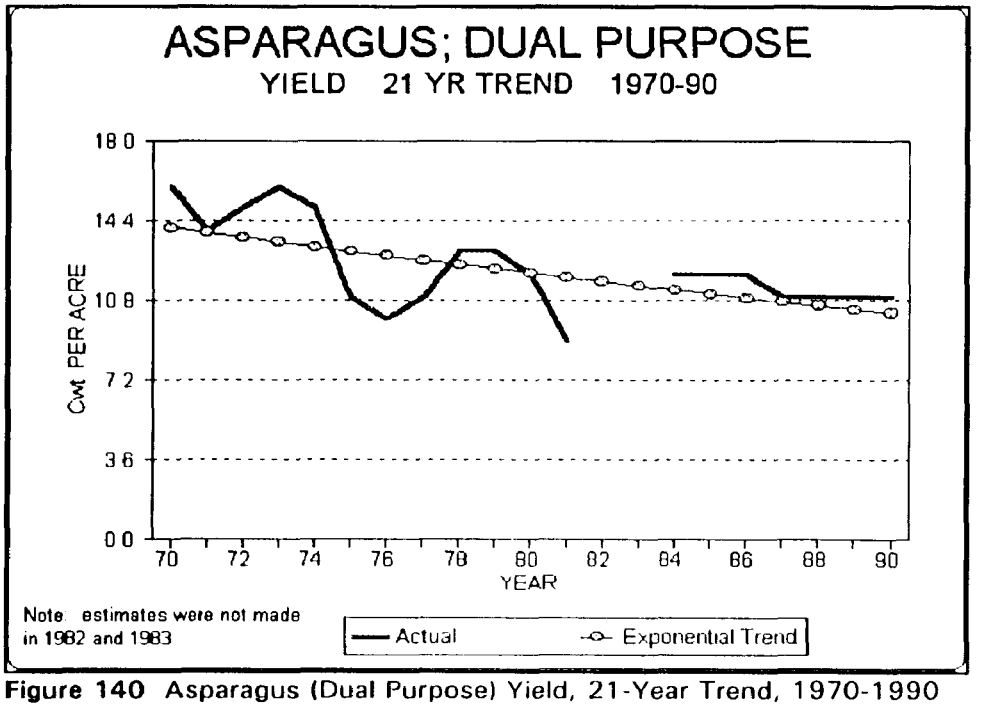
Average:
227

High:
259

Low:
171

Avg. Anl. Chg:
0.96%

Figure 139 Asparagus (Dual Purpose) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
12.2

High:
16.0

Low:
9.0

Avg. Anl. Chg:
-1.58%

Figure 140 Asparagus (Dual Purpose) Yield, 21-Year Trend, 1970-1990

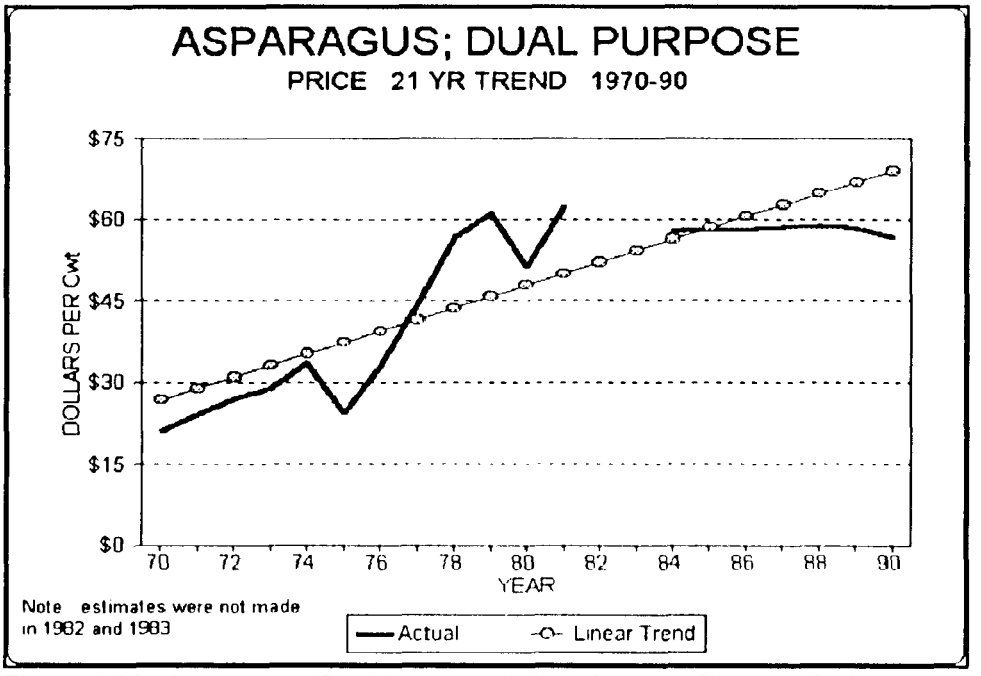


Figure 141 Asparagus (Dual Purpose) Price, 21-Year Trend, 1970-1990

Carrots (Dual Purpose): Carrot acreage harvested trended higher during the 70' and 80's. Acres expanded at an average annual rate of 1.18%, see Figure 143. In 1984 two state records were set, (1) 7,500 acres harvested and (2) production of 2.03 million Cwt. Following the record year of production, two years of significant declines occurred due to adverse weather conditions. From 1986 to 1990, however, acres harvested resumed the earlier upward trend. Production in hundredweight expanded at an average annual rate of 1.98%, or 29,600 Cwt. a year, the 5th fastest vegetable production trend, see Table V. Yield per acre moved consistently higher, increasing at an average annual rate of 0.82%. The 21 year yield high was set in 1990 at 280 Cwt. per acre. Carrot price per Cwt. trended higher at an average annual rate

of 1.80%.[94] The combination of expanding carrot output and higher carrot prices generated increased value of production. The value of production trended higher at an average annual rate of 3.53%, ranked 10th for the vegetable crops analyzed. Michigan ranked 3rd in the country in total carrot output in 1990, producing 6.5% of the U.S. total harvest, California was the leading producer.

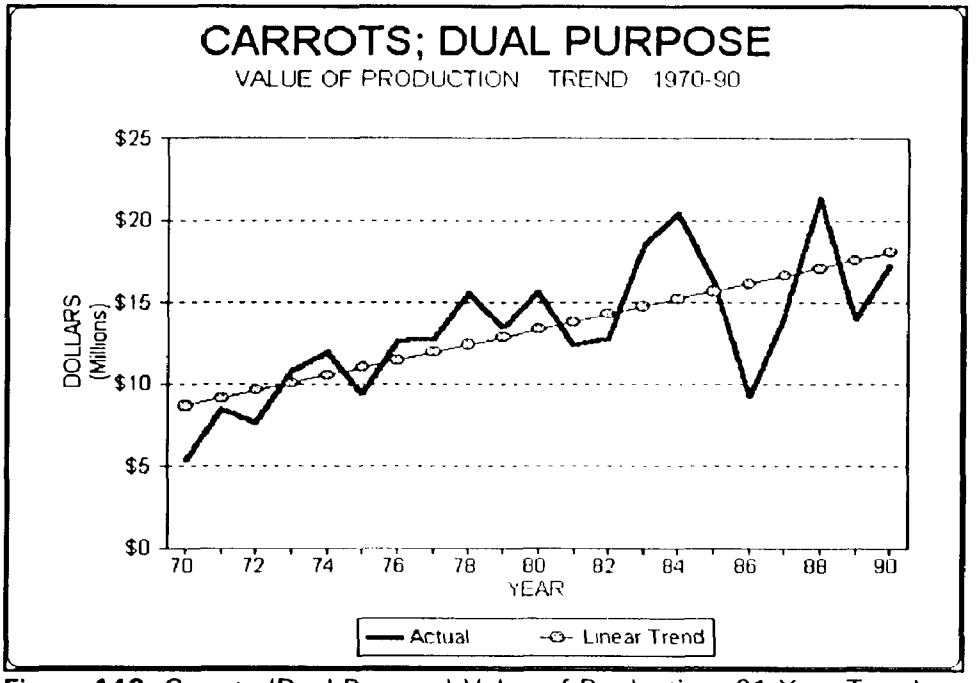
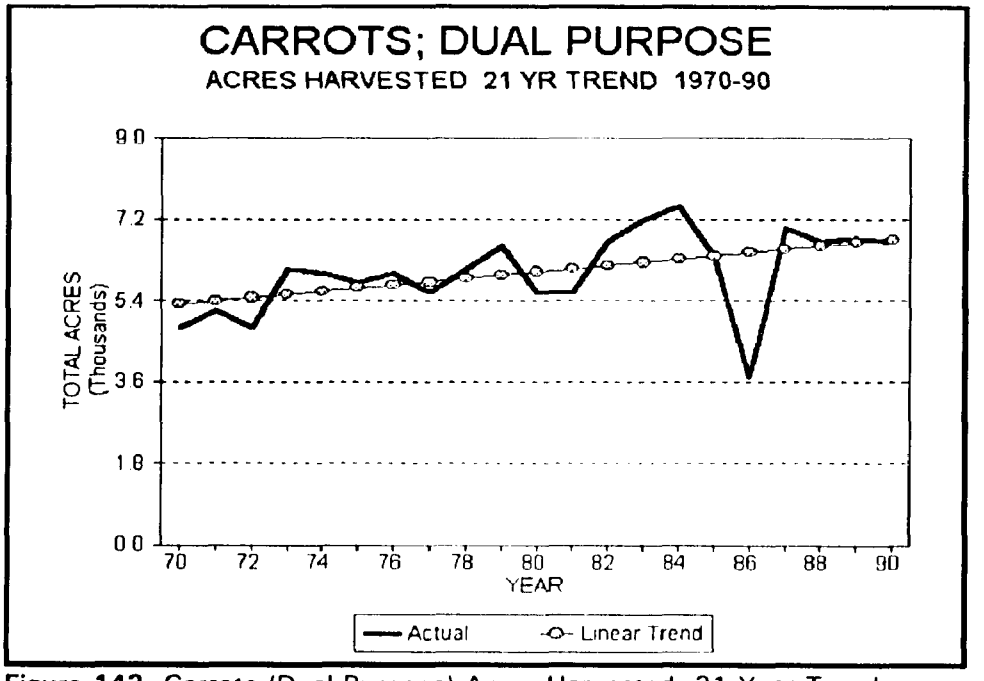


Figure 142 Carrots (Dual Purpose) Value of Production, 21-Year Trend, 1970-1990

[94] The smallest trend growth for vegetable prices, see Table V.



ACRES HARVESTED

21 - YEAR

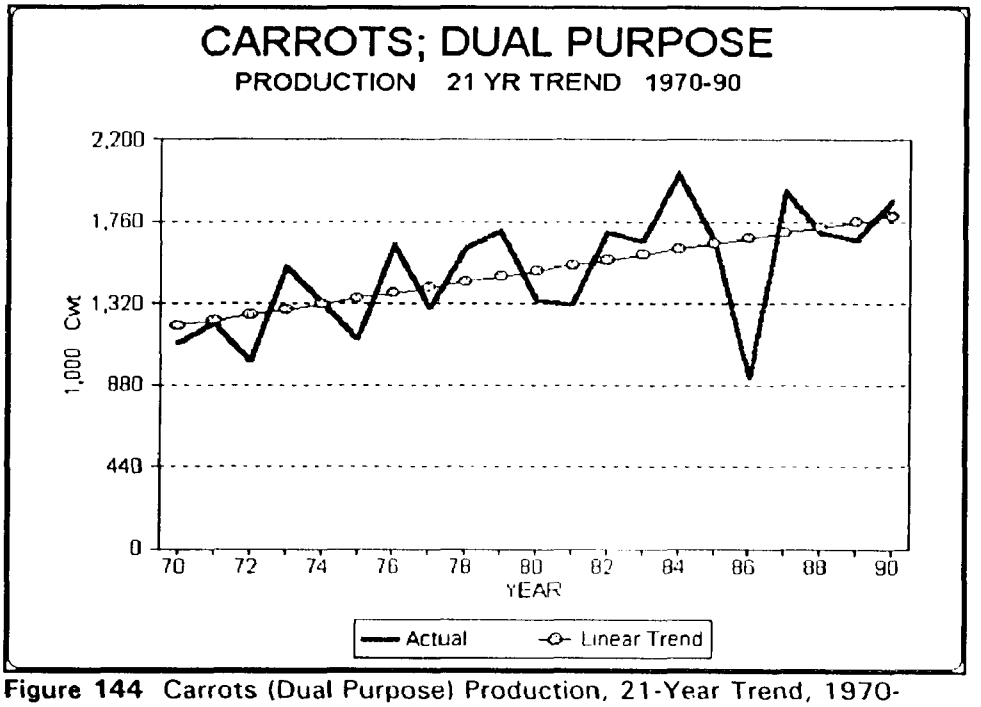
Average: 6,043

High: 7,500

Low: 3,700

Avg. Anl. Chg: 1.18%

Figure 143 Carrots (Dual Purpose) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

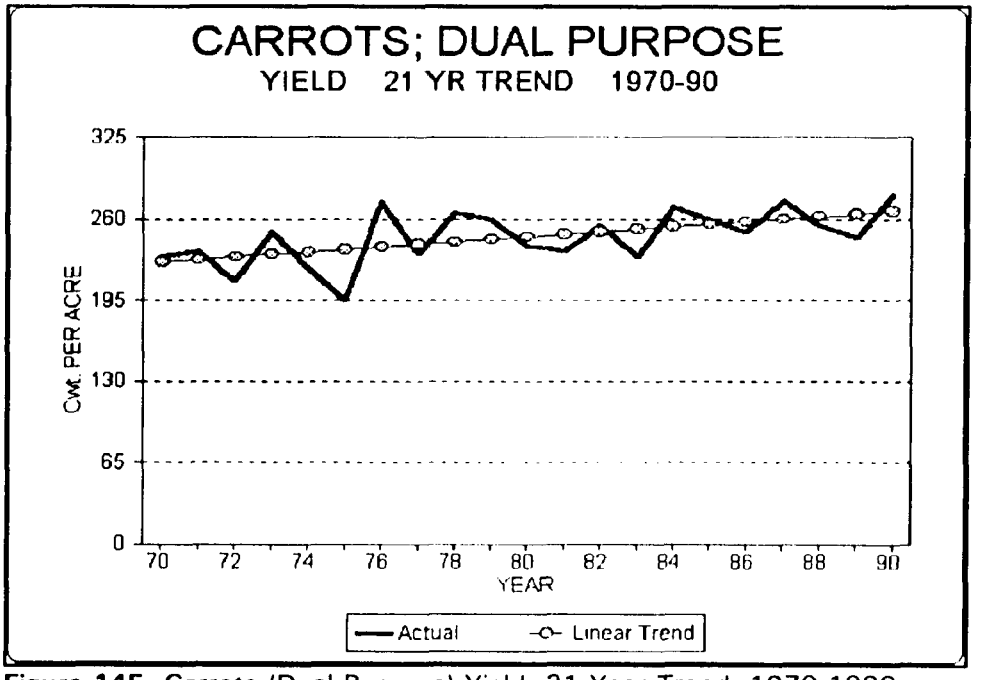
Average: 1,495

High: 2,025

Low: 925

Avg. Anl. Chg: 1.98%

Figure 144 Carrots (Dual Purpose) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

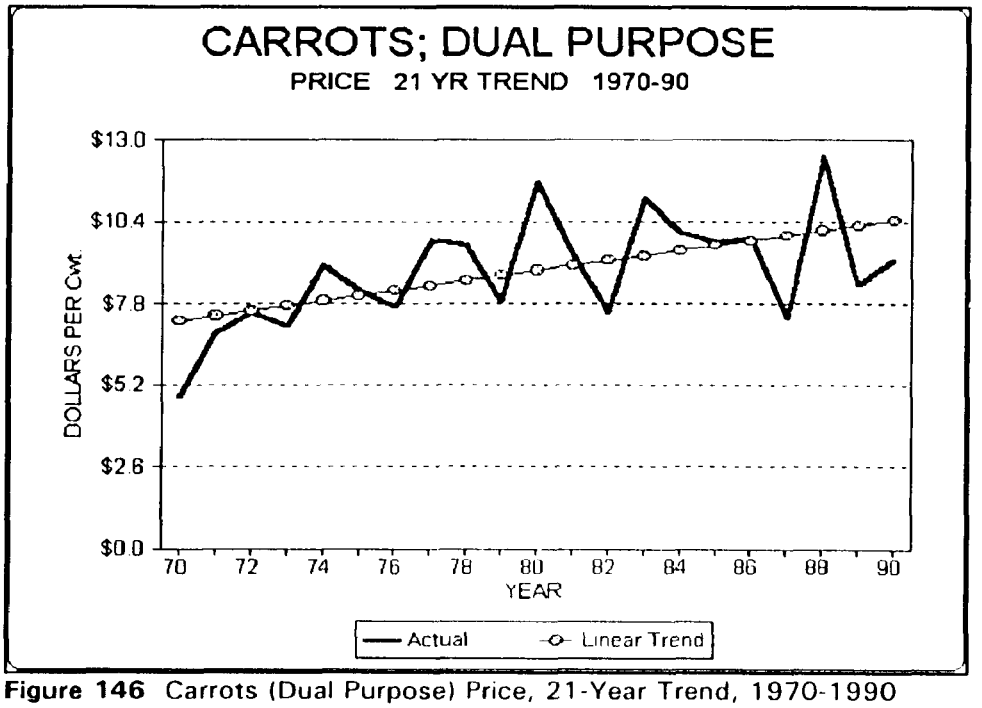
Average:
246

High:
280

Low:
195

Avg. Anl. Chg:
0.82%

Figure 145 Carrots (Dual Purpose) Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$8.85

High:
$12.50

Low:
$4.83

Avg. Anl. Chg:
1.80%

Figure 146 Carrots (Dual Purpose) Price, 21-Year Trend, 1970-1990

Cauliflower (Dual Purpose): For the decades of the 70's and 80's the state averaged 1,097 acres harvested of dual purpose cauliflower. The 21 -year trend for acres harvested was gradually higher with an average annual increase of 1.35%, 5th for all vegetables. Cauliflower yields also improved steadily, climbing from a low of 41 Cwt. per acre in 1973 to a high of 70 Cwt. per acre in 1990.[95] The higher yields coupled with expanded acres harvested led to an increase in total production. Cauliflower production trended higher, expanding at an annual average rate of 2.14%, see Figure 149. Total output averaged 63,300 Cwt. a year. Figure 151 shows the significant rise in the price of cauliflower per hundredweight in the last 21 years. The price of cauliflower increased at an average annual rate of 5.77%, second highest rate for all vegetables, and traded in a range between $6.70 and $39.50 per Cwt. The trend of rising prices and increased production yielded higher cauliflower value of production. The value of production trend expanded at an average annual rate of 7.35%, tied for 1st for all vegetable crops, see Table V. In the 80's, the value of cauliflower production averaged over $2.5 million a year. Michigan was ranked 5th in the country in cauliflower output in 1990, producing 0.9% of the U.S. total, California and it's multiple growing seasons was the leading state.

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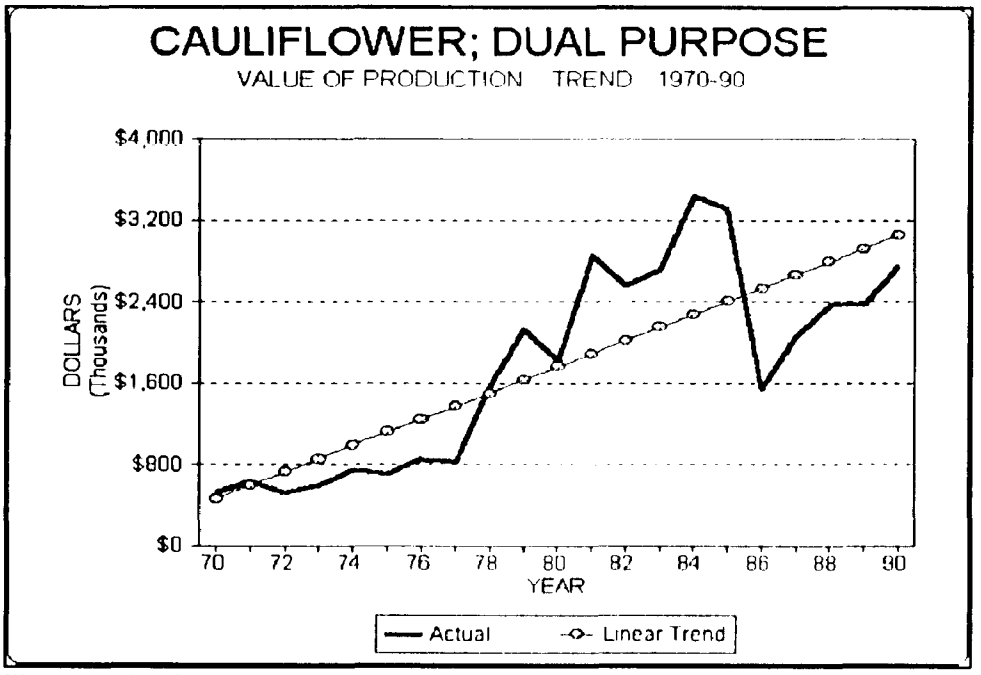
[95] The state record yield was 141 Cwt. per acre set in 1949.



VALUE OF PRODUCTION

21 - YEAR

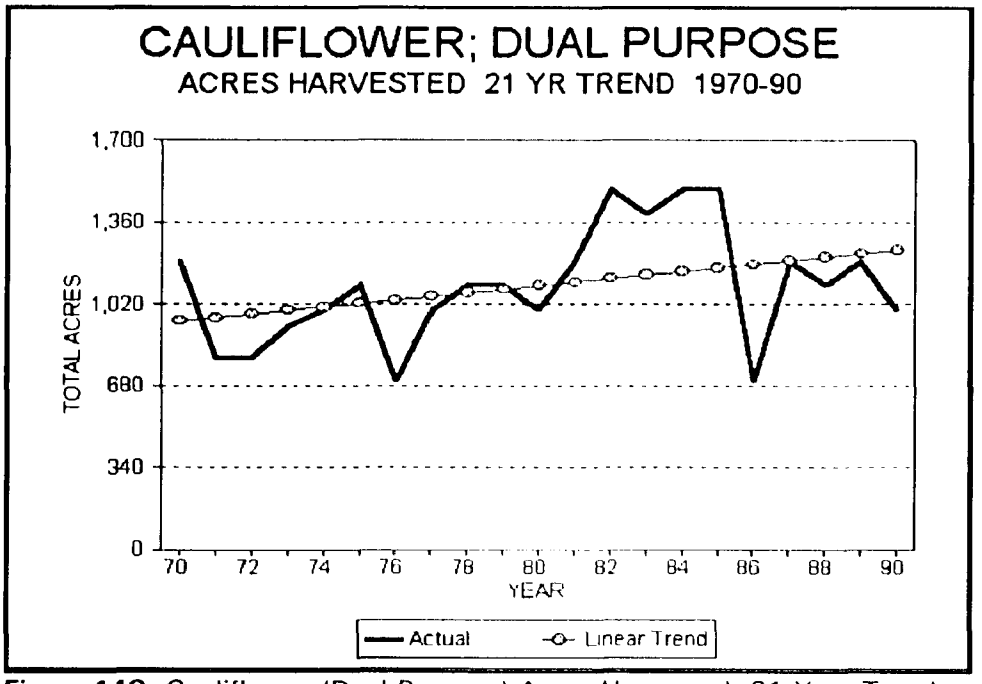
Average: $1,761,106

High: $3,439,800

Low: $517,000

Avg. Anl. Chg: 7.35%

Figure 147 Cauliflower (Dual Purpose) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

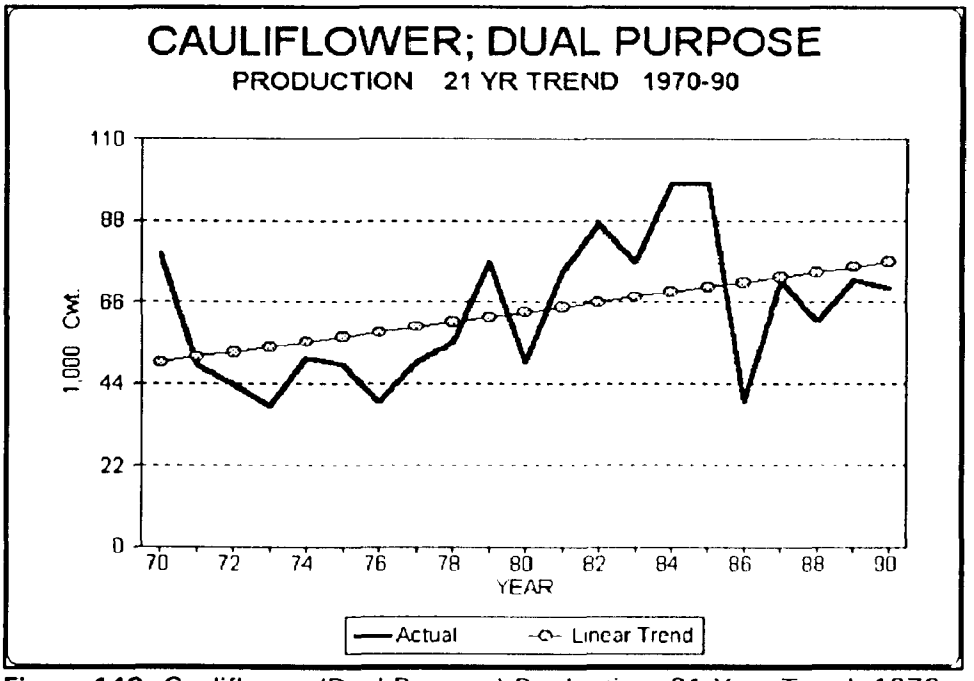
Average: 1,097

High: 1,500

Low: 700

Avg. Anl. Chg: 1.35%

Figure 148 Cauliflower (Dual Purpose) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

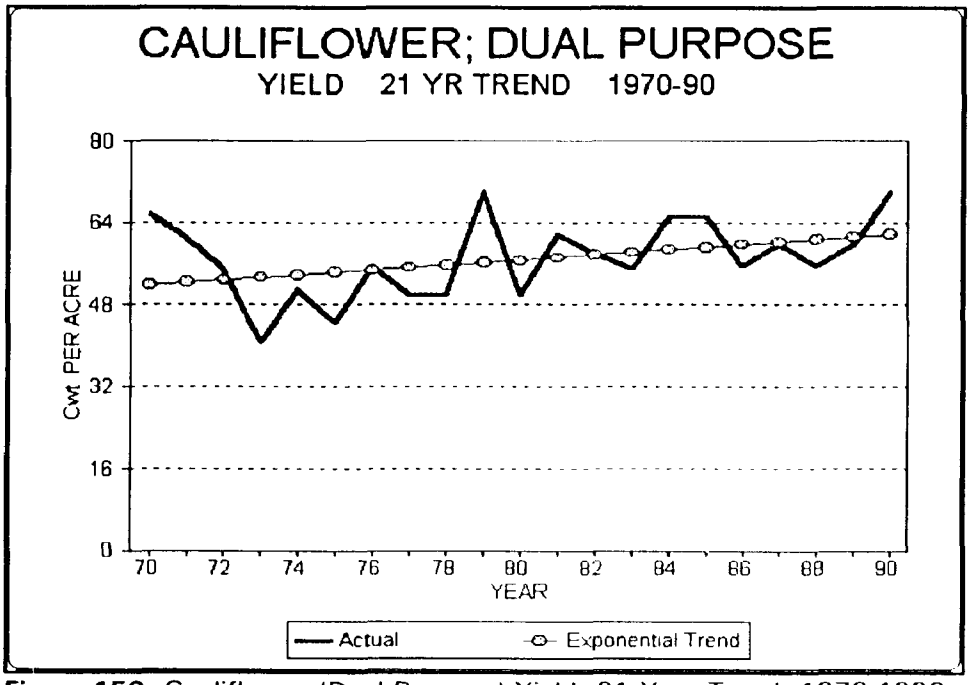
Average:
63.3

High:
98.0

Low:
38.0

Avg. Anl. Chg:
2.14%

Figure 149 Cauliflower (Dual Purpose) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
57.2

High:
70.0

Low:
40.9

Avg. Anl. Chg:
0.88%

Figure 150 Cauliflower (Dual Purpose) Yield, 21-Year Trend, 1970-1990

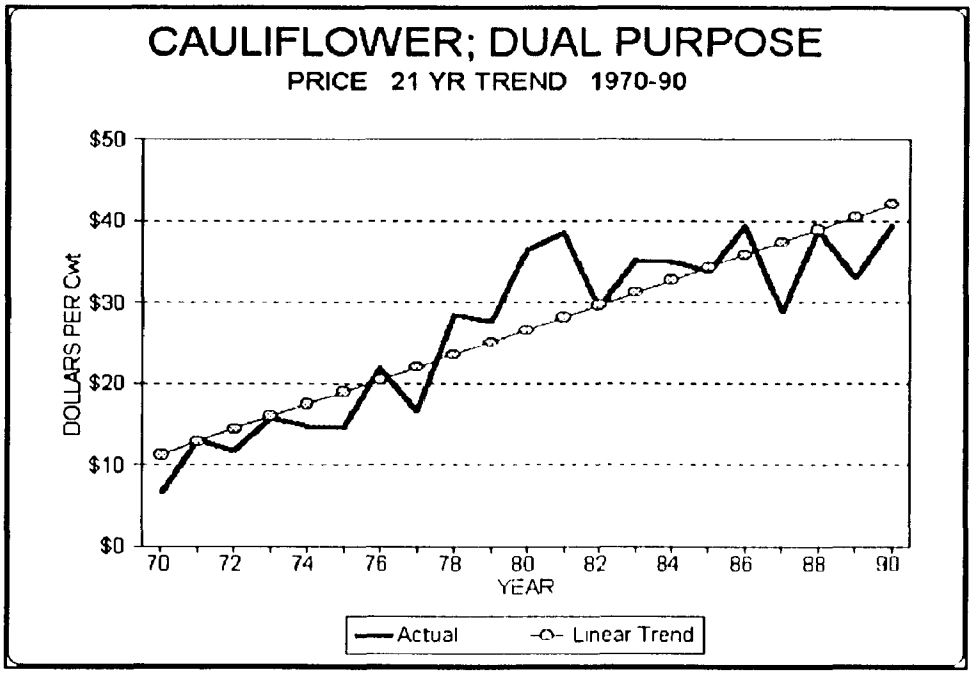


Figure 151 Cauliflower (Dual Purpose) Price, 21-Year Trend, 1970-1990

Celery (Dual Purpose): The number of celery acres harvested showed modest gains in the decades of the 70's and 80's, ranging from a low 2,300 acres to a high of 3,900 acres. The acres harvested trend was an increase of an average annual rate of 1.84%, see Figure 153. This growth rate was the 4th fastest for all vegetable crops, see Table V. The yield per acre remained flat, with an average annual rate of 0.00%. From 1970 to 1990, celery output per acre averaged 410 Cwt. per year.[96] Production trended higher, increasing at an average annual rate of 1.79%. Based on the trend analysis, the rise in production is primarily a function of the increase in acres harvested, given the flat yield trend. Celery price per Cwt. trended persistently higher, increasing at an average annual rate of 3.23%, see Figure 156. For the 21 year period

[96] In 1982 a state record average yield of 470 Cwt. per acre was set.

the price of celery ranged from a low of $5.98 to a high of $14.10, and averaged $9.97 per Cwt. The value of production trended higher, increasing at an average annual rate of 4.57%, 7th for all vegetables. In the 80's celery value of production averaged approximately $15 million a year. Michigan ranked 3rd in the country in hundredweight production, producing 6.3 % of the U.S. total in 1990, California was the leading producer.

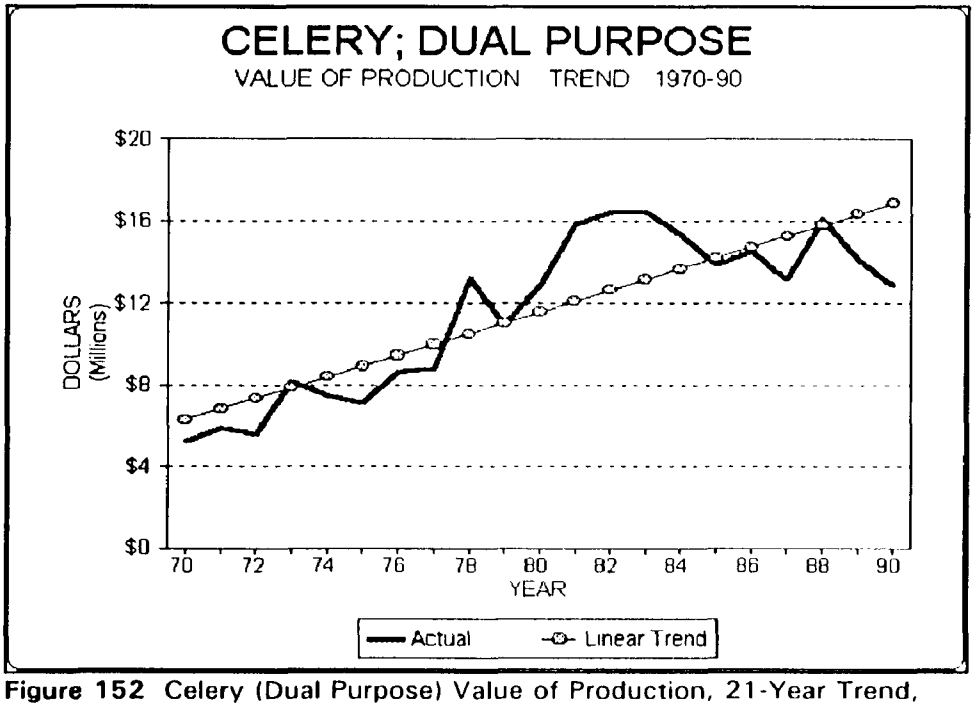
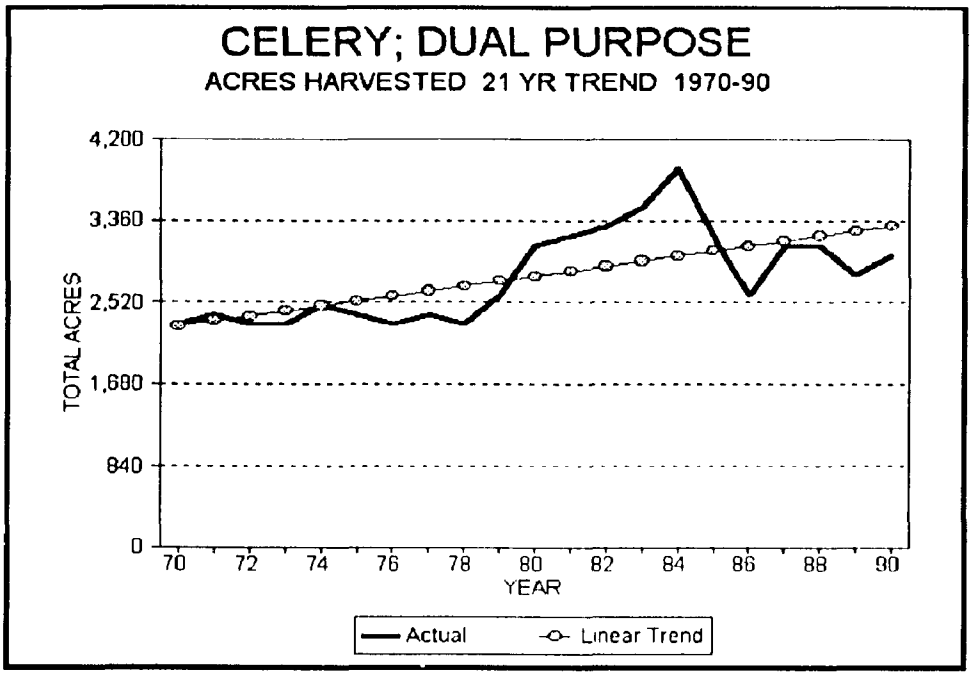


Figure 152 Celery (Dual Purpose) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

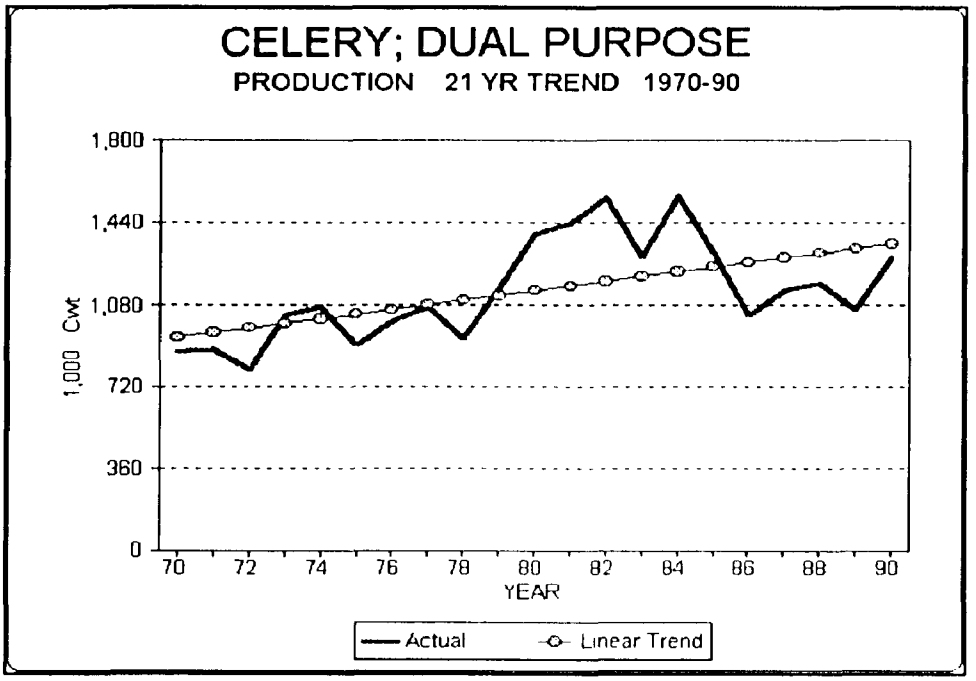
Average:
2,790

High:
3,900

Low:
2,300

Avg. Anl. Chg:
1.84%

Figure 153 Celery (Dual Purpose) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

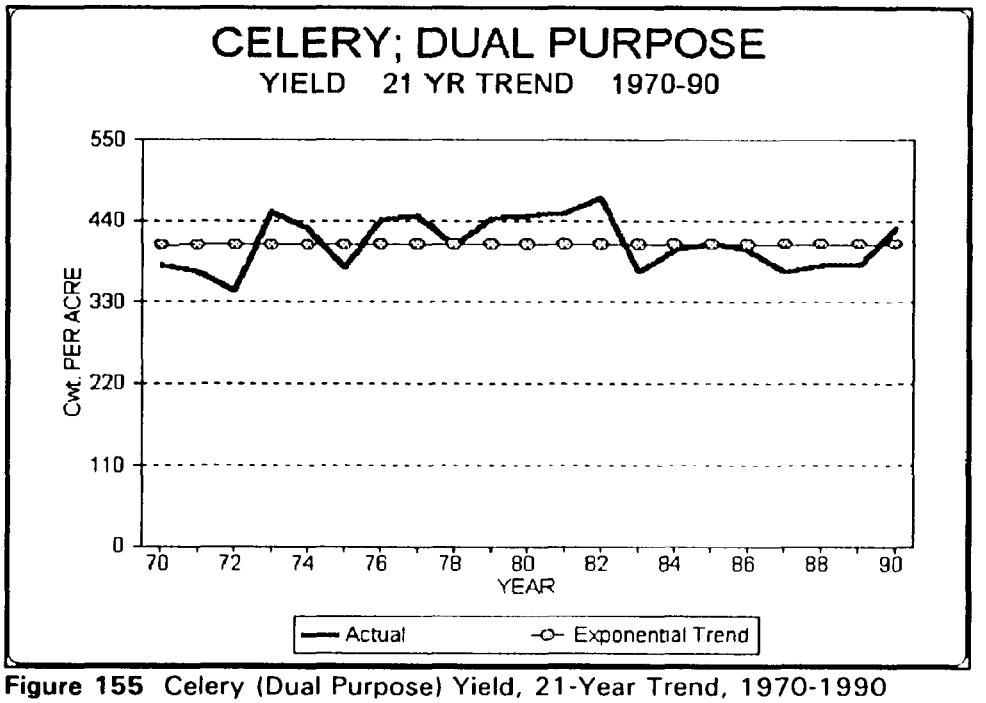
Average:
1,144

High:
1,560

Low:
794

Avg. Anl. Chg:
1.79%

Figure 154 Celery (Dual Purpose) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

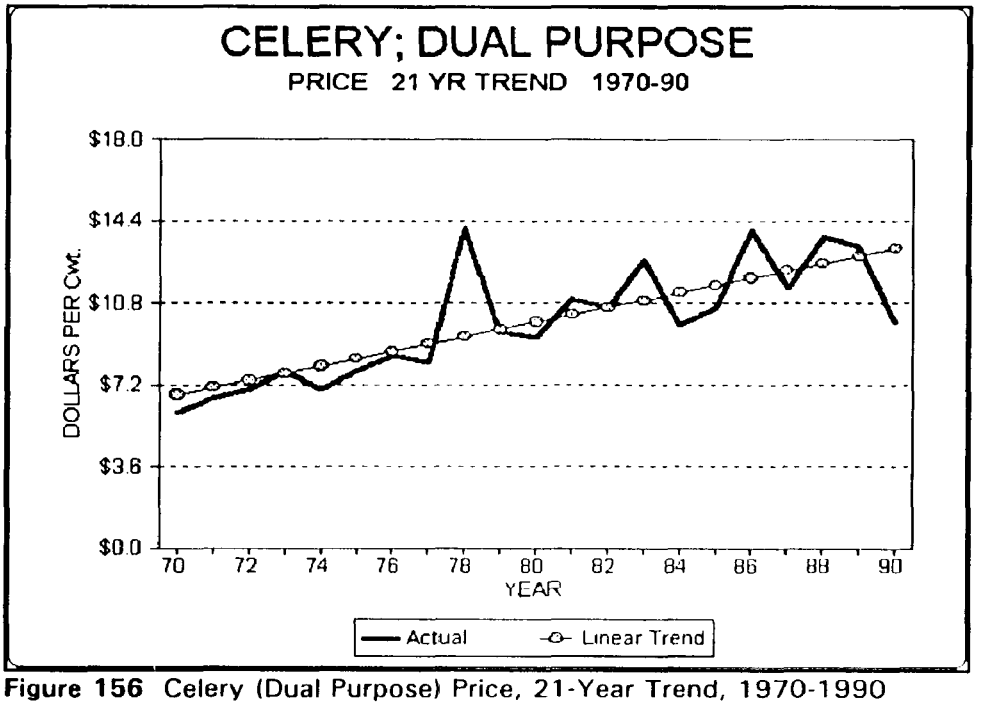
Average:
410

High:
470

Low:
345

Avg. Anl. Chg:
0.02%

Figure 155 Celery (Dual Purpose) Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$9.97

High:
$14.10

Low:
$5.98

Avg. Anl. Chg:
3.23%

Figure 156 Celery (Dual Purpose) Price, 21-Year Trend, 1970-1990

Cucumbers (Processing):[97] Michigan is the nation's leader in the production of cucumbers for processing. In 1990 while ranking number one, Michigan produced 21.6% of the total U.S. production. The trend for acres harvested was down during the 70's and 80's. Acres harvested trended downward an average annual rate of 0.58%, an average decline of 139 acres a year, see Figure 158. The amount of cucumbers produced rose consistently, increasing an average annual rate of 1.98%.[98] In 1987 production reached a state record of 161,000 tons. The increasing production trend is closely linked to the rise in yields per acre. From 1971 to 1990 yields increased an average annual rate of 2.43%,[99] the 3rd highest for all vegetables. In 1987 an all time high was set of 6.7 tons per acre, see Figure 160. Prices trended steadily higher for the two decades, expanding annually an average of 2.87%. The price per ton ranged from a low of $86 in 1973 to a high of $168 in 1989. The trend increases for production and prices lifted the cucumber value of production higher. Value of production more than doubled, rising from the $10 million level in the early 70's to consistently above $20 million in the 80's, with an average annual growth rate of 5.05%, see Figure 157.

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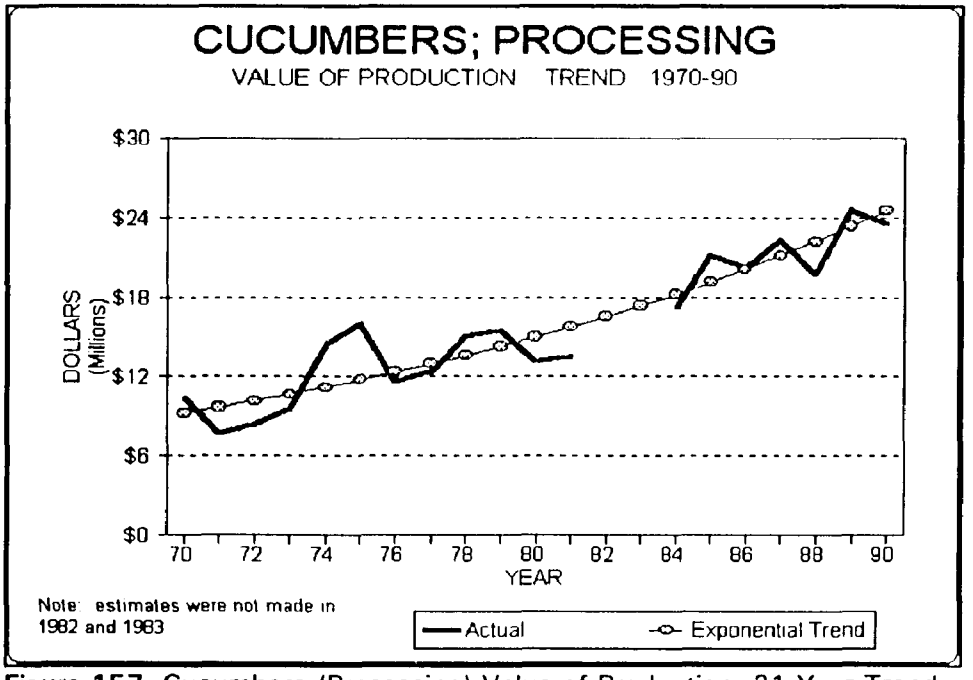
[97] Note: the Michigan Agricultural Statistics Service did not estimate cucumber production data during 1982 and 1983. The missing years are taken into consideration for the analysis and noted in each accompanying Figure.

[98] The cucumber production growth rate was the 4th fastest, tied with carrots, see Table V.

[99] An average annual increase of 246 pounds of cucumbers per acre.



VALUE OF PRODUCTION

21 - YEAR

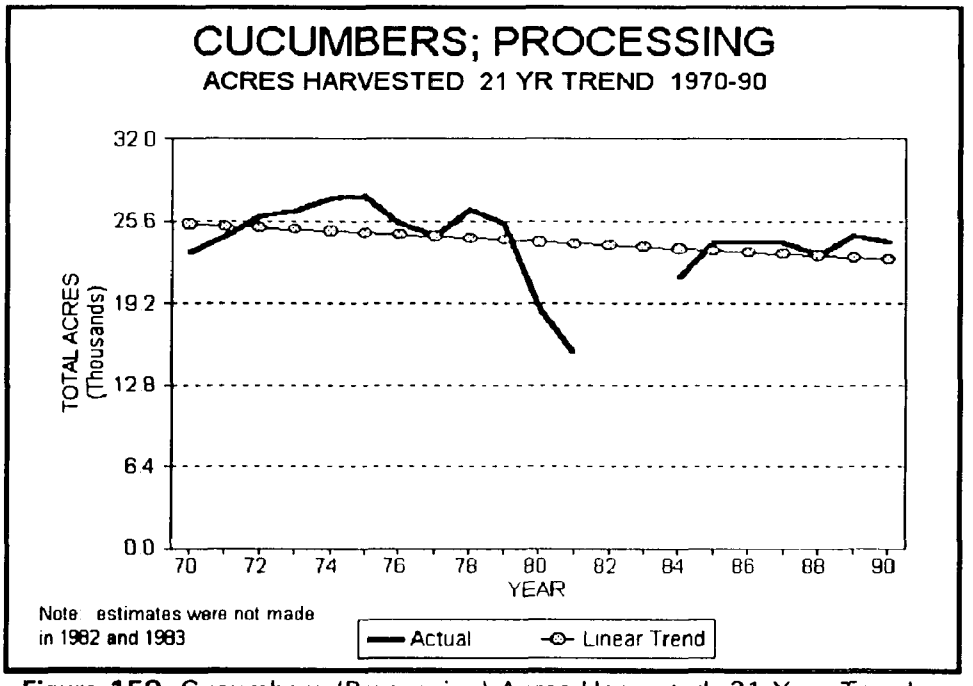
Average: $15,796,956

High: $24,696,000

Low: $7,617,600

Avg. Anl. Chg: 5.05%

Figure 157 Cucumbers (Processing) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

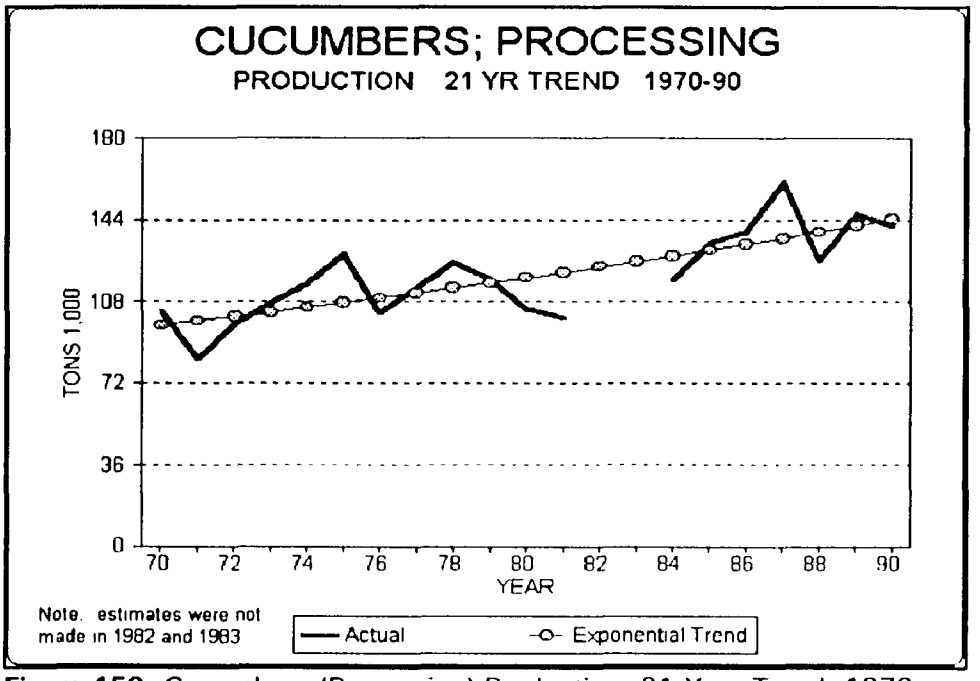
Average: 23,977

High: 27,600

Low: 15,500

Avg. Anl. Chg: -0.58%

Figure 158 Cucumbers (Processing) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

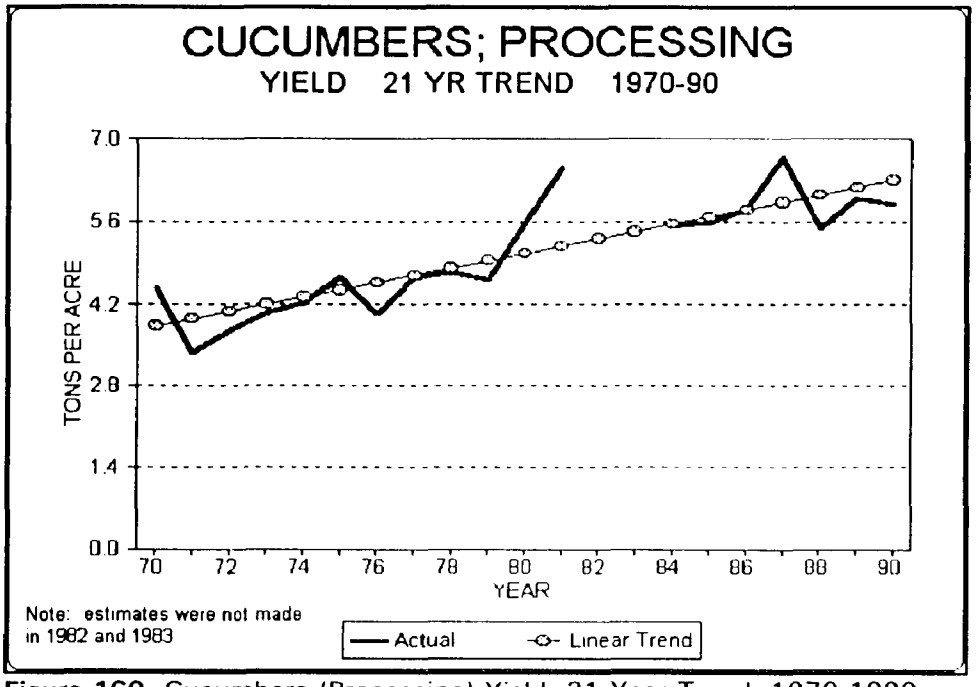
Average:
120

High:
161

Low:
83

Avg. Anl. Chg:
1.98%

Figure 159 Cucumbers (Processing) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
5.06

High:
6.70

Low:
3.38

Avg. Anl. Chg:
2.43%

Figure 160 Cucumbers (Processing) Yield, 21-Year Trend, 1970-1990

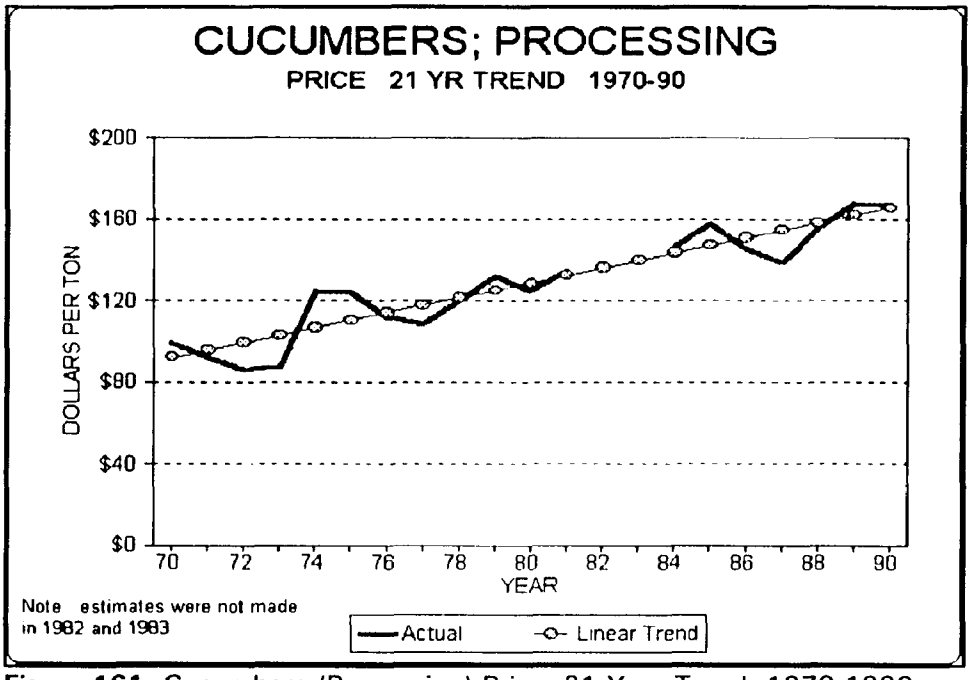


Figure 161 Cucumbers (Processing) Price, 21-Year Trend, 1970-1990

Lettuce (Fresh Market): Fresh lettuce production in the 70's and 80's trended significantly downward. Acres harvested fell an average annual rate of 2.31%, or 29 acres a year. In 1970 the state harvested 1,500 acres of lettuce, by 1988 total acreage had dropped to 800 an all time record low, see Figure 163. Production also declined but at a slower rate, falling an average of 1.24% a year. The negative production trend for lettuce ranked it 11th out of 13 vegetable crops, see Figure 164. For the 21 year period, the state averaged 254,000 Cwt. a year in production. Lettuce yields per acre showed steady improvement, increasing annually an average of 1.00%.[100] In 1982 and 1985 all time record yields were set of 250 Cwt. per acre. The price of lettuce per hundredweight trended rapidly higher. Increasing at an annual

[100] This was the 4th fastest yield growth rate, see Table V.

average rate of 5.33%, the 3rd fastest growth trend, see Table V. The 21 year high price was set in 1990 at $22.30 per Cwt. Prices rose at a fast enough rate to offset the declines in output and expand lettuce crop values. The value of crop production trended upward at an average annual rate of 3.99%, 8th for vegetable crops. Michigan ranked 9th in the country in the production of fresh lettuce, producing only 0.3% of the total U.S. output in 1990, California lead production.

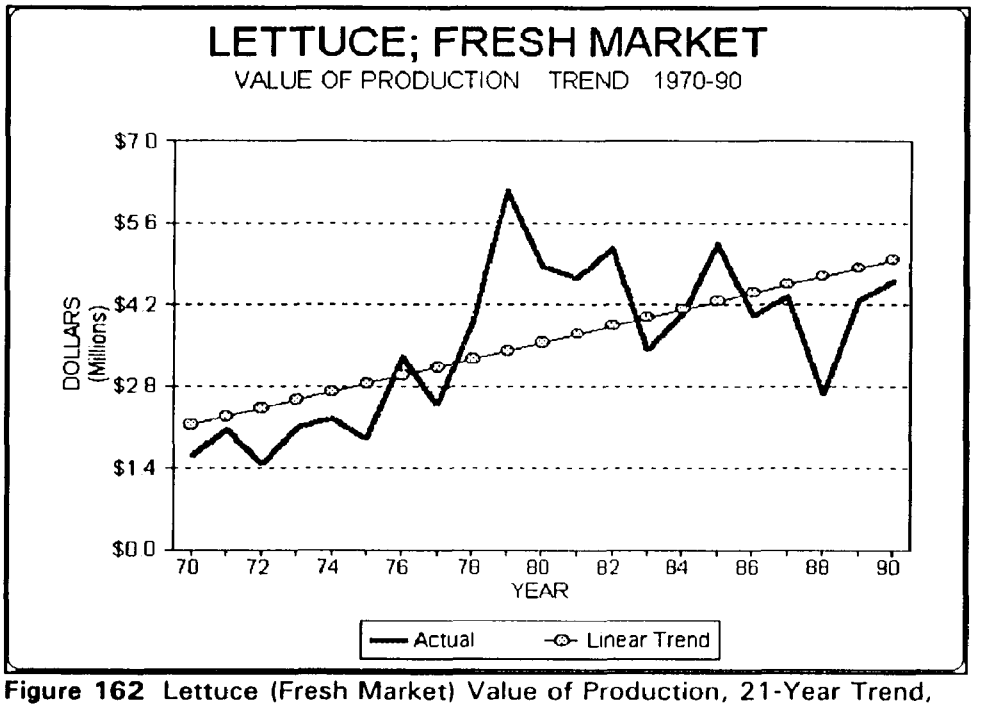
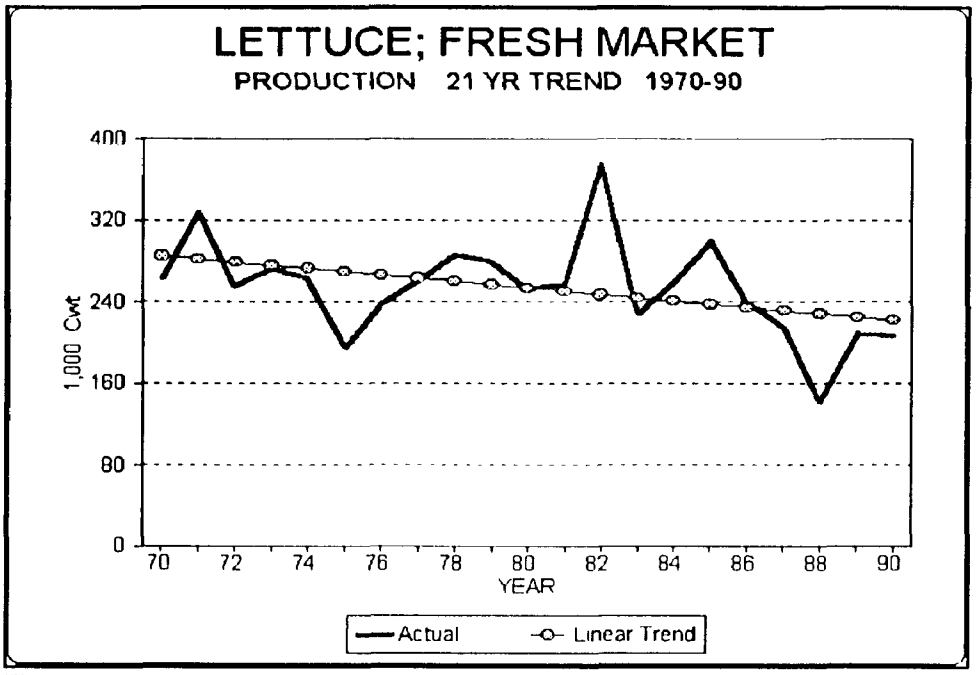


Figure 162 Lettuce (Fresh Market) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

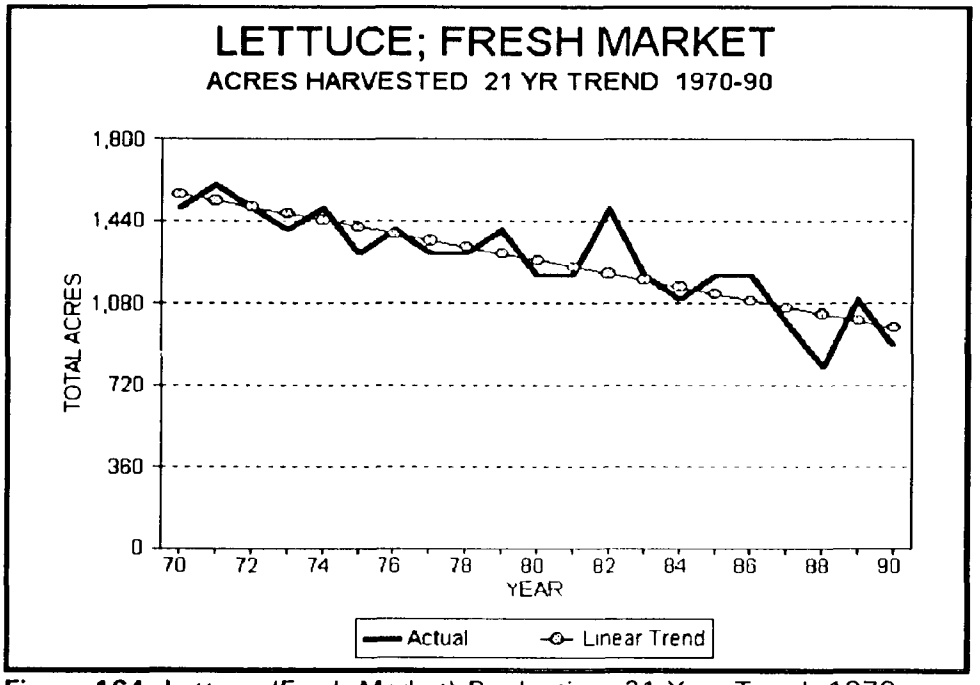
Average:
1,267

High:
1,600

Low:
800

Avg. Anl. Chg:
-2.31%

Figure 163 Lettuce (Fresh Market) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

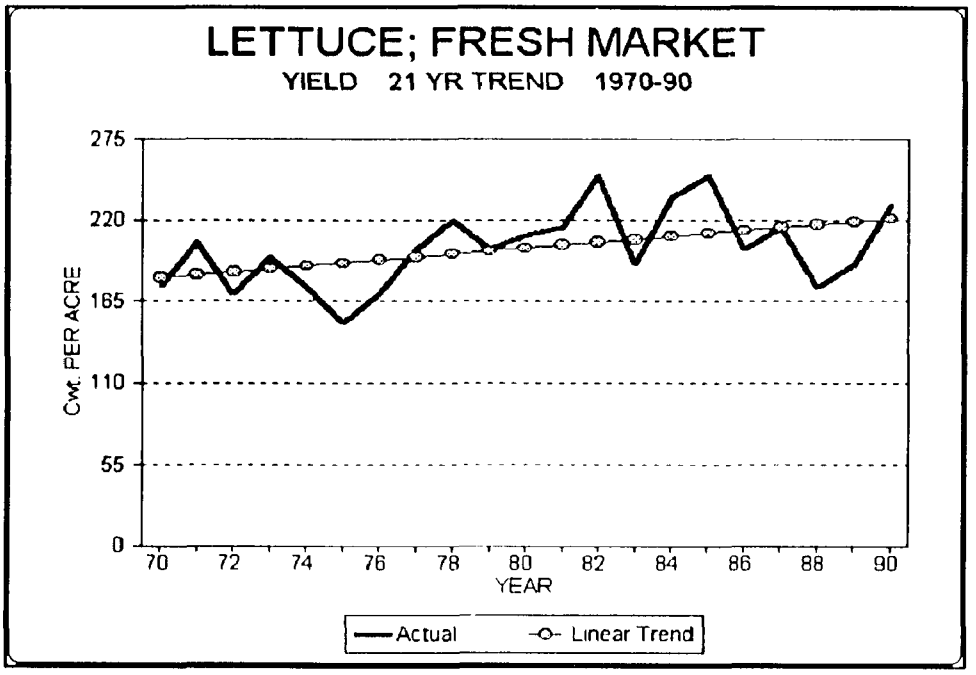
Average:
254

High:
375

Low:
140

Avg. Anl. Chg:
-1.24%

Figure 164 Lettuce (Fresh Market) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

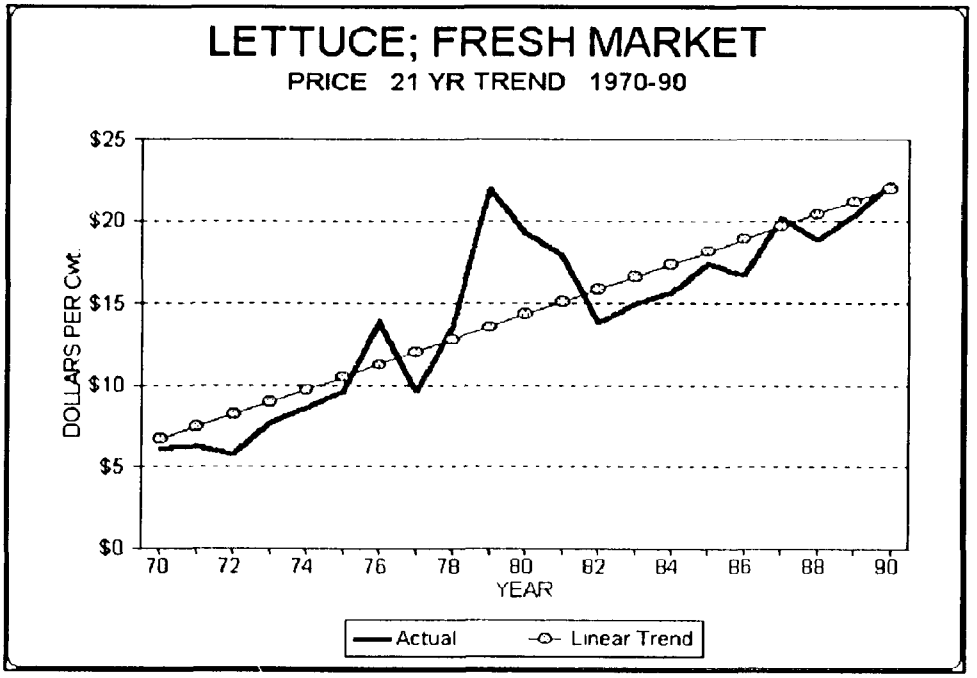
Average:
201

High:
250

Low:
150

Avg. Anl. Chg:
1.00%

Figure 165 Lettuce (Fresh Market) Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$14.3

High:
$22.3

Low:
$5.8

Avg. Anl. Chg:
5.33%

Figure 166 Lettuce (Fresh Market) Price, 21-Year Trend, 1970-1990

Mushrooms:[101] Mushrooms and their area of production, declined significantly from 7,363,000 square ft. in 1981 to 4,010,000 square ft. in 1990, a decline of 45.5%, see Figure 168. Production in pounds however, trended slightly higher, increasing at an average annual rate of 1.17%. For the decade of the 80's the state averaged over 20,000 pounds of mushrooms a year. In 1990 Michigan produced 19,900 pounds, enough to rank 3rd in the country, accounting for 2.7% of total U.S. output, Pennsylvania was the leading state. The state's production is predominantly the Button mushroom and the Shiitake varieties. Improved yields helped push output higher in the eighties. Yields per square ft. trended higher at an average annual rate of 5.99%, see Figure 170 and Table V. The yield growth rate was clearly the largest for any of the vegetable crops. A square foot of mushroom production area expanded its yield an annual average of 0.26 pounds a year. The price of mushrooms per pound also increased.[102] The ten-year low was $0.71 a pound in 1981 and the high was $1.02 pound in 1990. The trend toward higher prices and output, led to an expansion of the value of crop production. Total crop value reached over $20 million twice in the 80's, in 1988 and 89.

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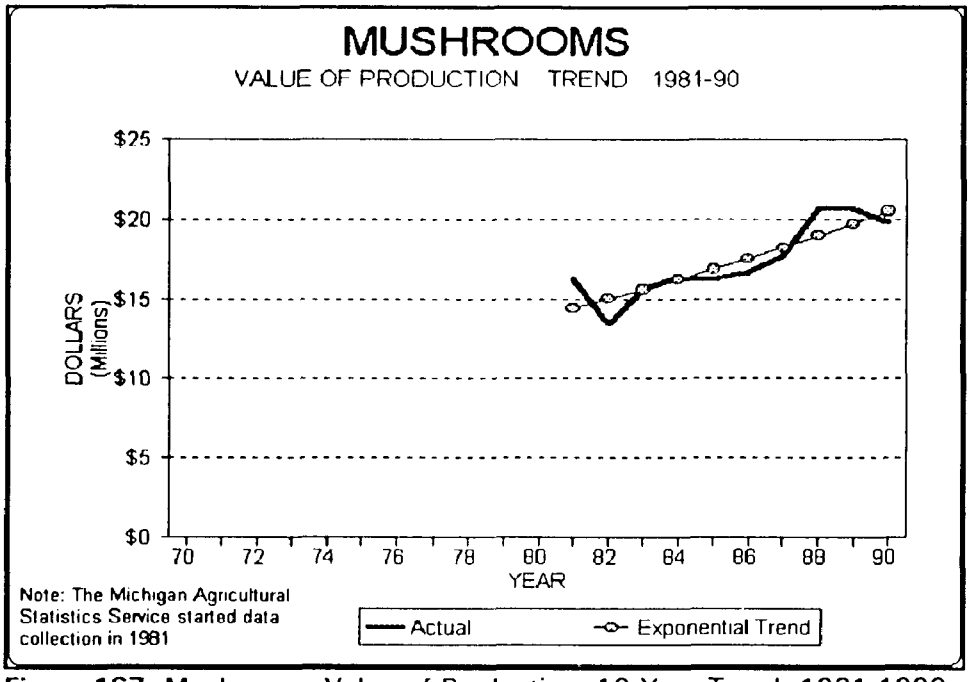
[101] Note: The Michigan Agricultural Statistics Service started data collection in 1981.

[102] The average annual trend rate for mushroom prices was 2.77%, ranking it 11th for all vegetables.



VALUE OF PRODUCTION

10 - YEAR

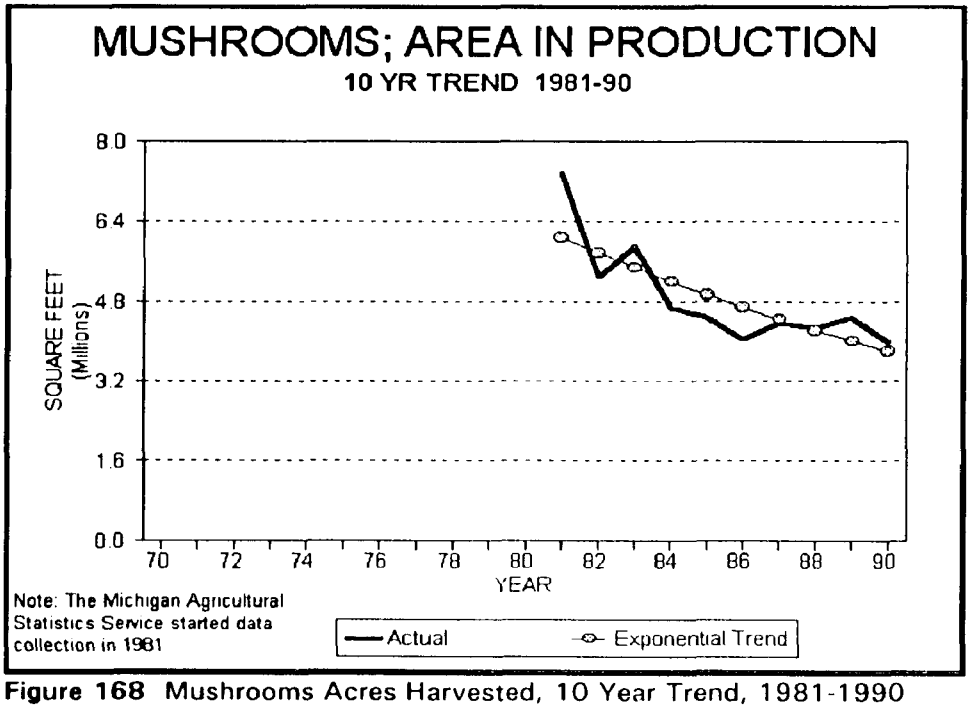
Average: $17,374,426

High: $20,719,433

Low: $13,445,064

Avg. Anl. Chg: 3.97%

Figure 167 Mushrooms Value of Production, 10 Year Trend, 1981-1990



ACRES HARVESTED

10 - YEAR

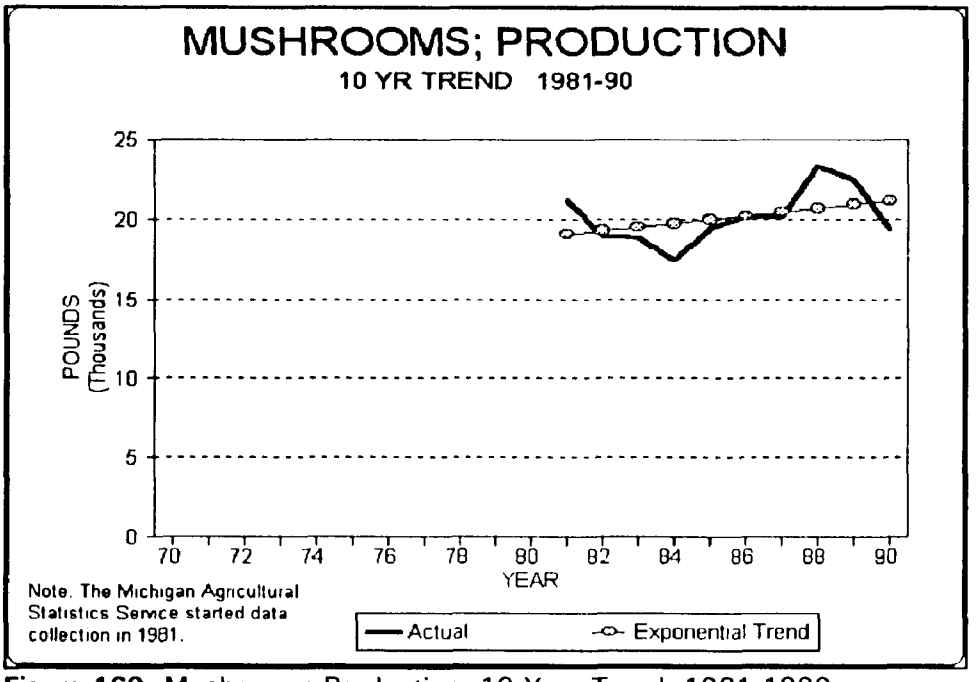
Average: 4,902,600

High: 7,363,000

Low: 4,010,000

Avg. Anl. Chg: -5.04%

Figure 168 Mushrooms Acres Harvested, 10 Year Trend, 1981-1990



PRODUCTION

10 - YEAR

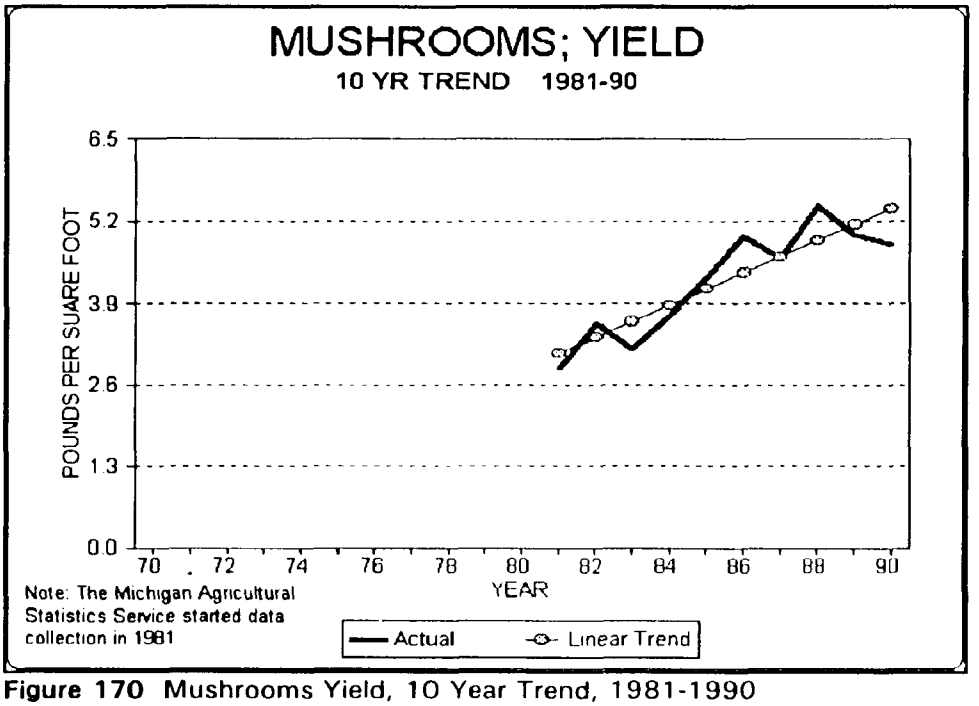
Average:
20,189

High:
23,359

Low:
17,506

Avg. Anl. Chg:
1.17%

Figure 169 Mushrooms Production, 10 Year Trend, 1981-1990



YIELD

10 - YEAR

Average:
4.26

High:
5.46

Low:
2.88

Avg. Anl. Chg:
5.99%

Figure 170 Mushrooms Yield, 10 Year Trend, 1981-1990

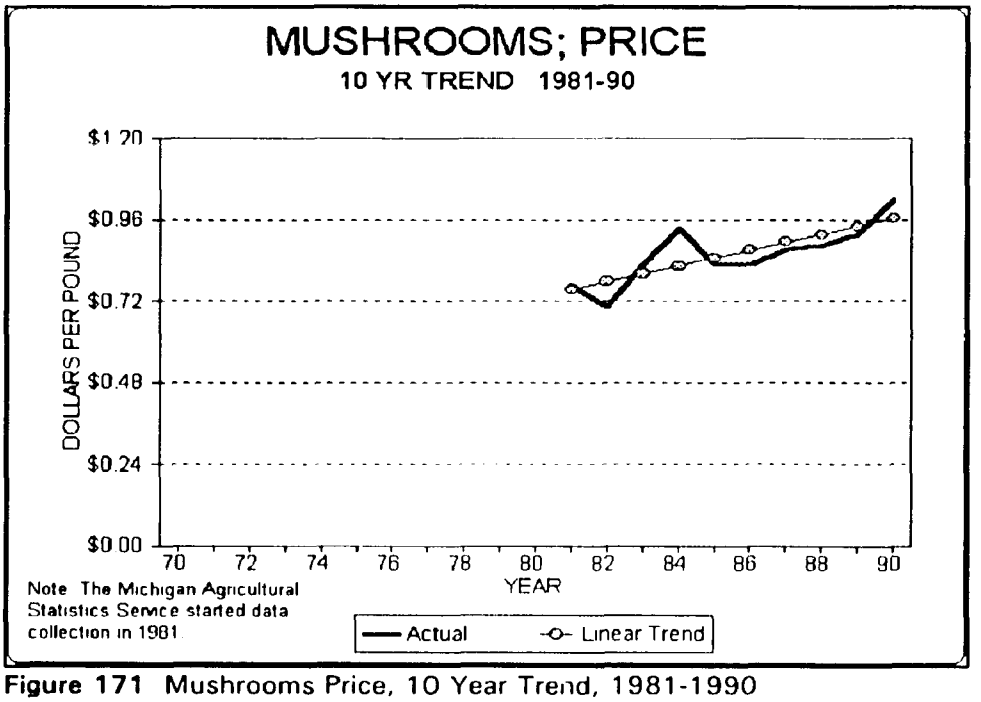


Figure 171 Mushrooms Price, 10 Year Trend, 1981-1990

Onions (Fresh Market): Fresh market onion acres harvested trended moderately higher in the 70's and 80's, increasing at an average annual rate of 0.78%. For the 21 year period the state harvested an average of 7,300 acres a year. During the last four years, 1987 to 1990 the yearly average acres harvested expanded above the 21 year trend to 7,725 acres. Total production also trended higher, increasing at moderate average annual rate of 0.53%. Two noticeable years of production were in 1984 and 1986, see Figure 174. Within a three-year time period production dropped 43.7%, from the all time high of 2.93 million Cwt. in 1984 down to only 1.65 million Cwt. during the flood related stress of 1986. Yields per acre trended gradually downward at an average annual rate of 0.23%, this was one of

three vegetable crops with a negative yield trend, see Table V. Onions averaged 303 Cwt. per acre for the 70's and 80's. Prices were extremely variable ranging from a high of $14.30 per Cwt. in 1983 down to a low of $2.84 Cwt. in 1970. The two-decade price trend was an average annual increase of 3.53%, 6th for all vegetable crops. Crop value edged higher given the positive trends for prices and production. The value of production trend was an average annual increase of 3.31%. For the last four years of the 80's, 1987 to 1990, onion value of production averaged $17.3 million a year. Michigan ranked 9th in the country in fresh onion production, producing 4.6 % of total U.S. production in 1990, California ranked number 1.

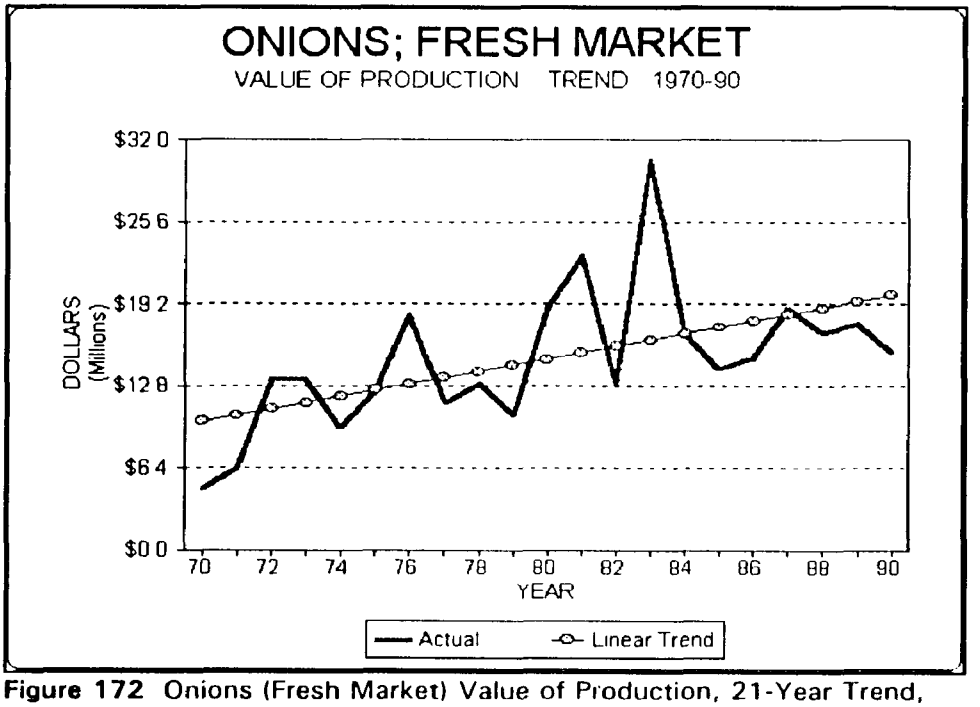
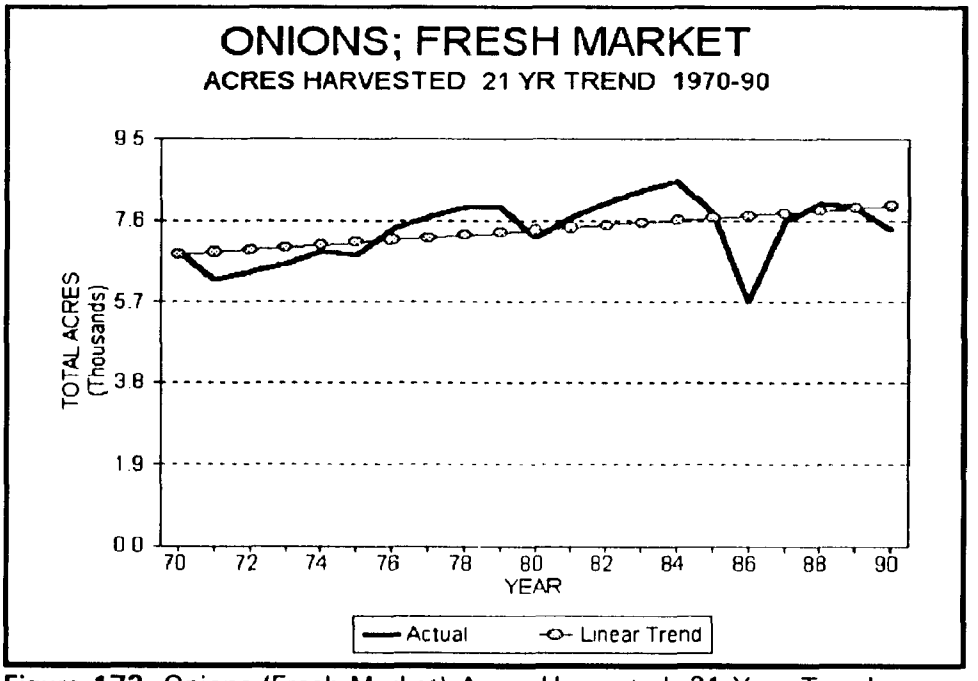


Figure 172 Onions (Fresh Market) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

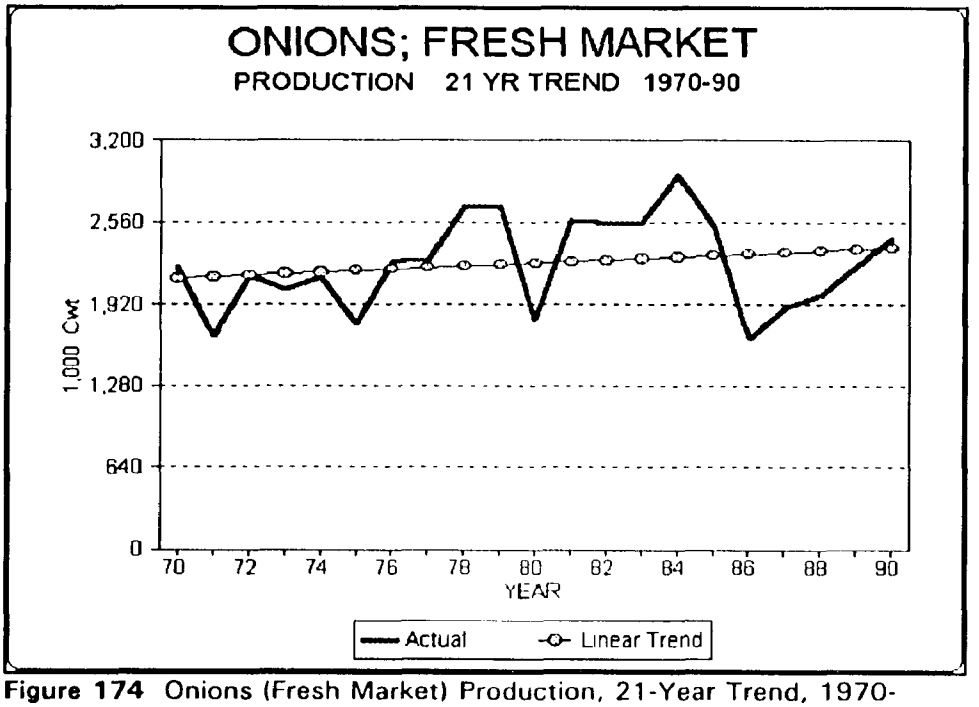
Average: 7,371

High: 8,500

Low: 5,700

Avg. Anl. Chg: 0.78%

Figure 173 Onions (Fresh Market) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

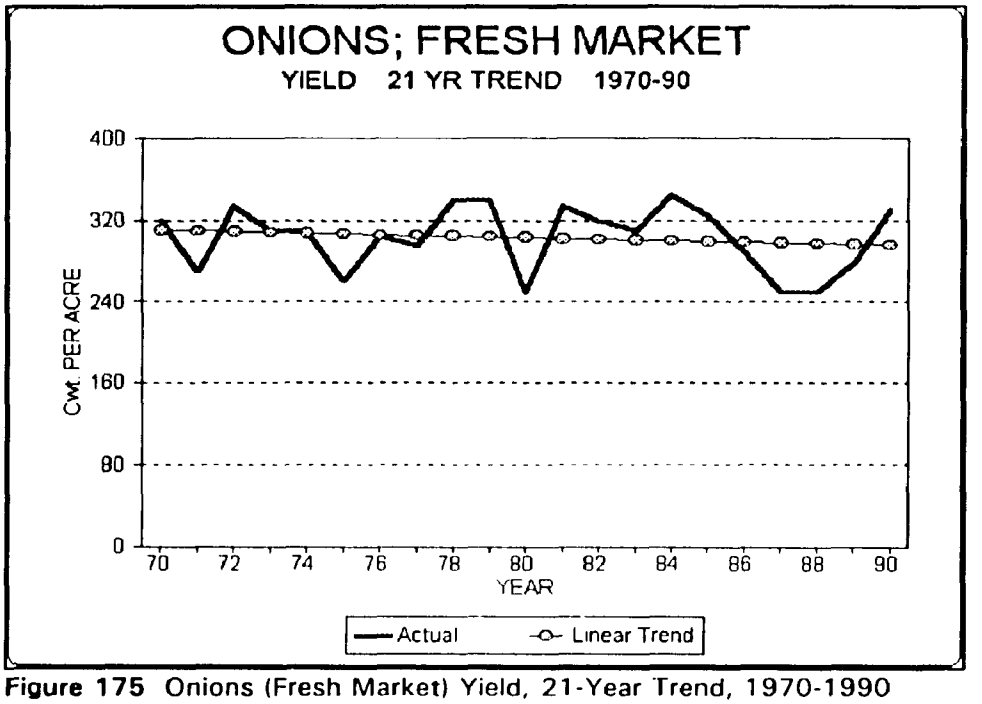
Average: 2,241

High: 2,933

Low: 1,653

Avg. Anl. Chg: 0.53%

Figure 174 Onions (Fresh Market) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

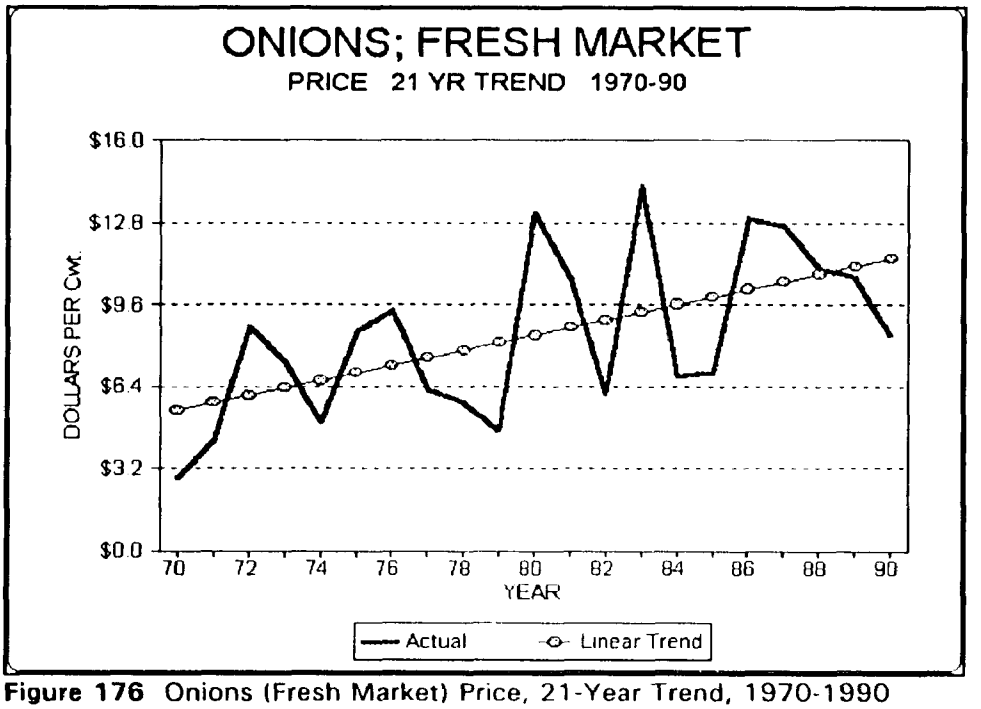
Average:
303

High:
345

Low:
250

Avg. Anl. Chg:
-0.23%

Figure 175 Onions (Fresh Market) Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$8.42

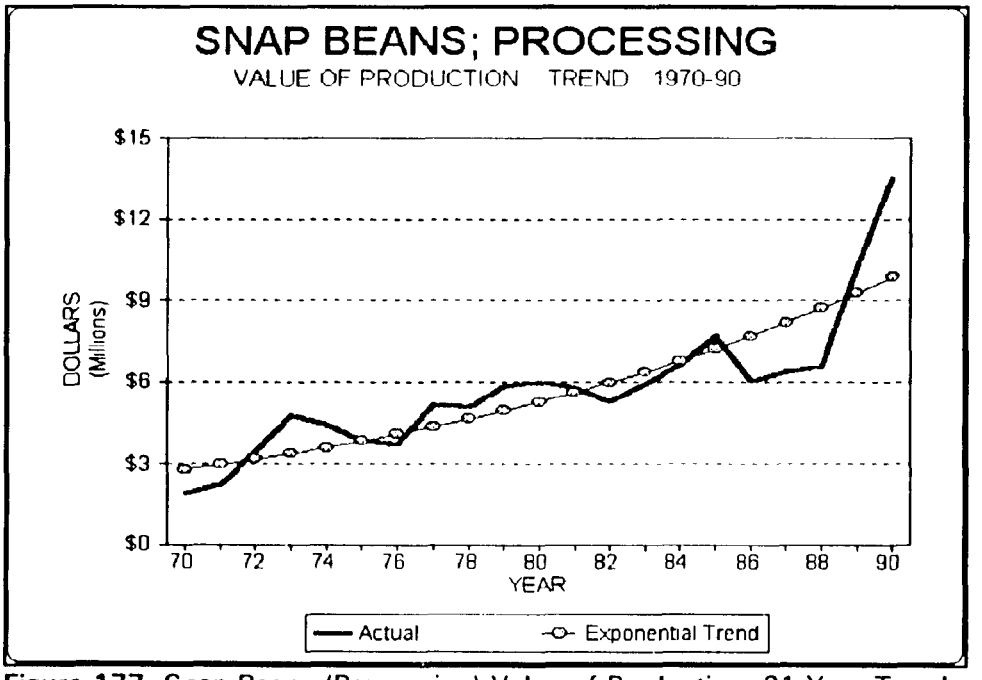
High:
$14.30

Low:
$2.84

Avg. Anl. Chg:
3.53%

Figure 176 Onions (Fresh Market) Price, 21-Year Trend, 1970-1990

Snap Beans (Processing): Snap bean production increased substantially in the 70's and 80's. All time state records were set in 1990 for the amount of acres harvested, highest one year yield, and the largest one year quantity of snap beans produced. The increase in output was a function of both higher yields and an expansion in acres harvested. Acres harvested increased at an average annual rate of 2.83%, the highest for all vegetable crops, see Table V and Figure 178. From 1970 to 1990 snap beans acres increased from 10,100 acres to a state record of 27,000 acres, a rise of 167%. Yields also rose but not and significantly as acres harvested. The trend for yields was an average annual rate of 0.80%, 7th for all vegetable crops. In 1990 an all time record was set of 2.95 tons of snap beans per acre. Production trended higher, expanding at an average annual rate of 3.61%, 2nd for all vegetable crops. In 1970 the state produced 20,000 Cwt. of snap beans, by the record year of 1990, 79,700 Cwt. had been produced, an increase of almost 300%. The price per of snap beans fluctuated within a range of $136 per ton to $175 per ton. Price trended upward but more slowly than the other crops, increasing at an average annual rate of 2.59%. The value of production increased commensurately with the significant rise in production. Value of production expanded at an average annual rate of 6.52%, 3rd for vegetable crops. In 1970 total crop value equaled $1.89 million. By 1990 the value of snap bean production had risen 615% to $13.54 million. Michigan ranked 3rd in the nation in processing snap beans and accounted for 9.7% of U.S. production in 1990, Wisconsin was first.



VALUE OF PRODUCTION

21 - YEAR

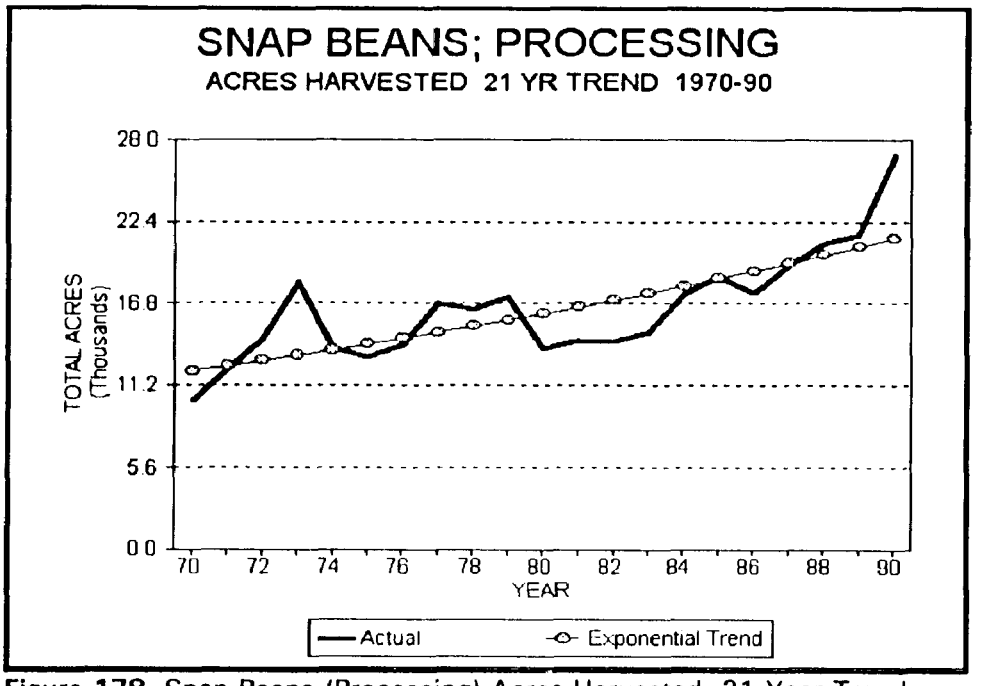
Average: $5,752,233

High: $13,540,500

Low: $1,894,000

Avg. Anl. Chg: 6.52%

Figure 177 Snap Beans (Processing) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

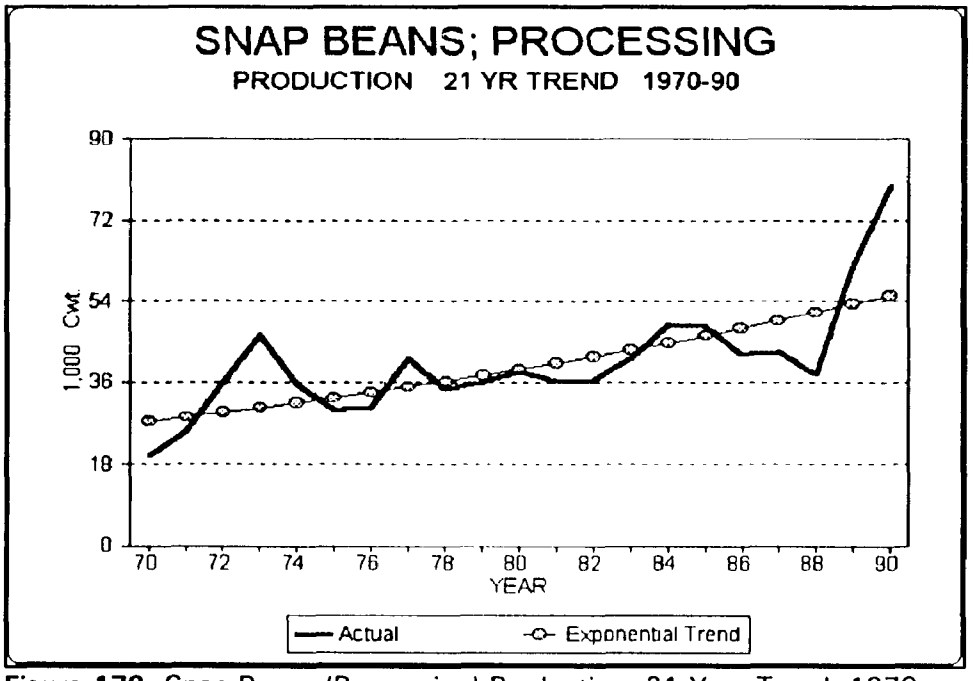
Average: 16,495

High: 27,000

Low: 10,100

Avg. Anl. Chg: 2.83%

Figure 178 Snap Beans (Processing) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

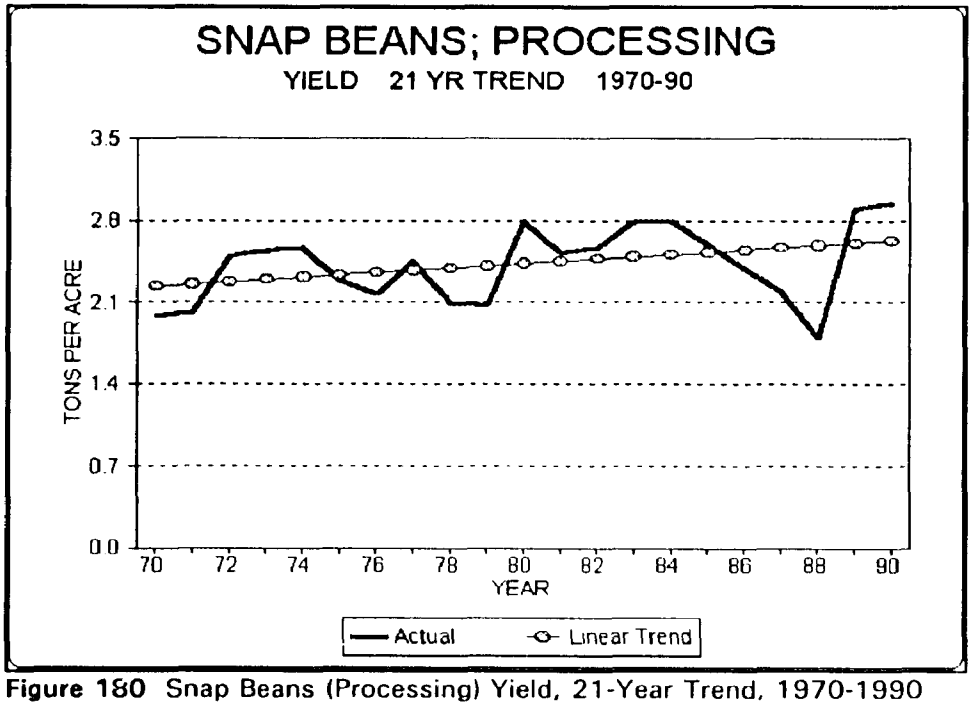
Average:
40.5

High:
79.7

Low:
20.0

Avg. Anl. Chg:
3.61%

Figure 179 Snap Beans (Processing) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
2.43

High:
2.95

Low:
1.80

Avg. Anl. Chg:
0.80%

Figure 180 Snap Beans (Processing) Yield, 21-Year Trend, 1970-1990

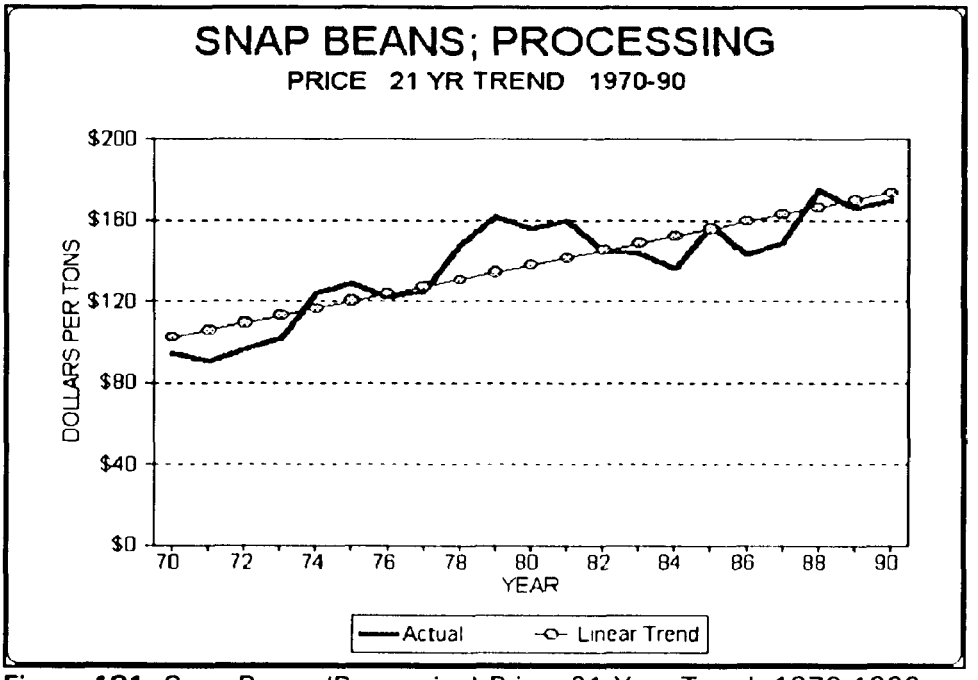


Figure 181 Snap Beans (Processing) Price, 21-Year Trend, 1970-1990

Strawberries (Dual Purpose): Acres harvested of dual purpose strawberries showed significant declines in decades of the 70' and 80's, see Figure 183. Strawberry acreage trended lower, falling an average annual rate of 3.48%, placing it 12th for all vegetable crops. In 1970 the state harvested 5,800 acres, by 1990, acreage had dropped to an all time record low of 2,200, down 62%. Strawberry yields showed a slight improvement, tending upward at an average annual rate of 0.71%. For two years, 1976 and 1982, all time record high yields were set of 80 Cwt. per acre. The modest improvement in yields was not enough to offset the large declines in acre harvested. Strawberry production fell more precipitously than any other vegetable crop. The trend for production was an average annual decline of 2.62%, see Figure

184. By 1990 the state produced almost half the production level of 1970. The trend for price was an average annual increase of 3.51%, slightly below the vegetable crop group average, see Table V. The value of production showed the smallest of gains. The trend was an average annual increase of only 1.15%, last for all vegetable crops, see Table V. In 1990 Michigan's strawberry crop was valued at $7.2 million. Michigan ranked 5th in the country in strawberry production in 1990, producing 1.1% of the share, California was number one.

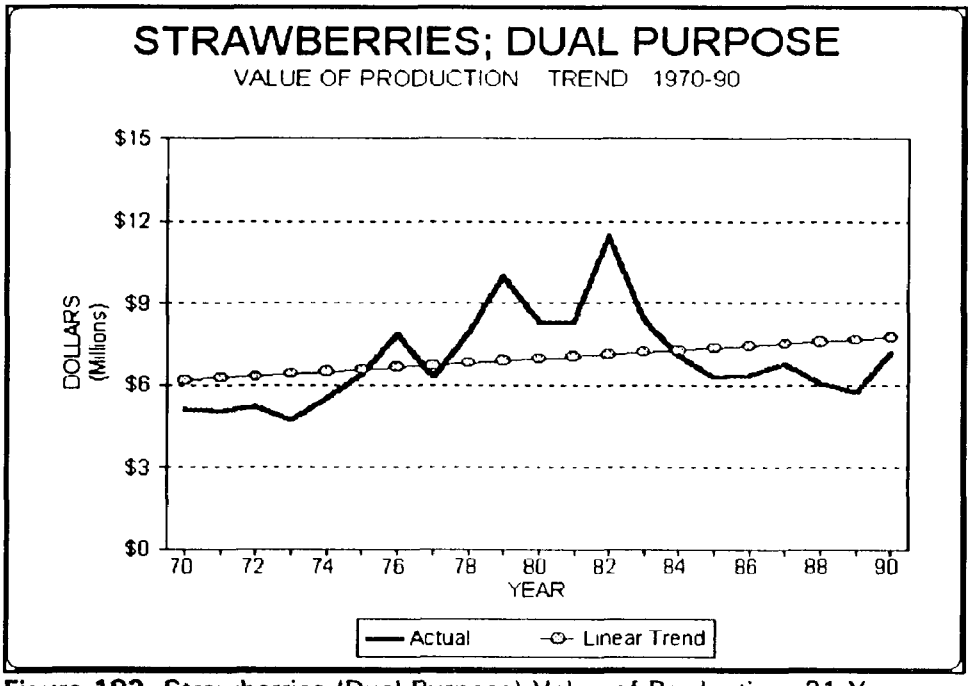
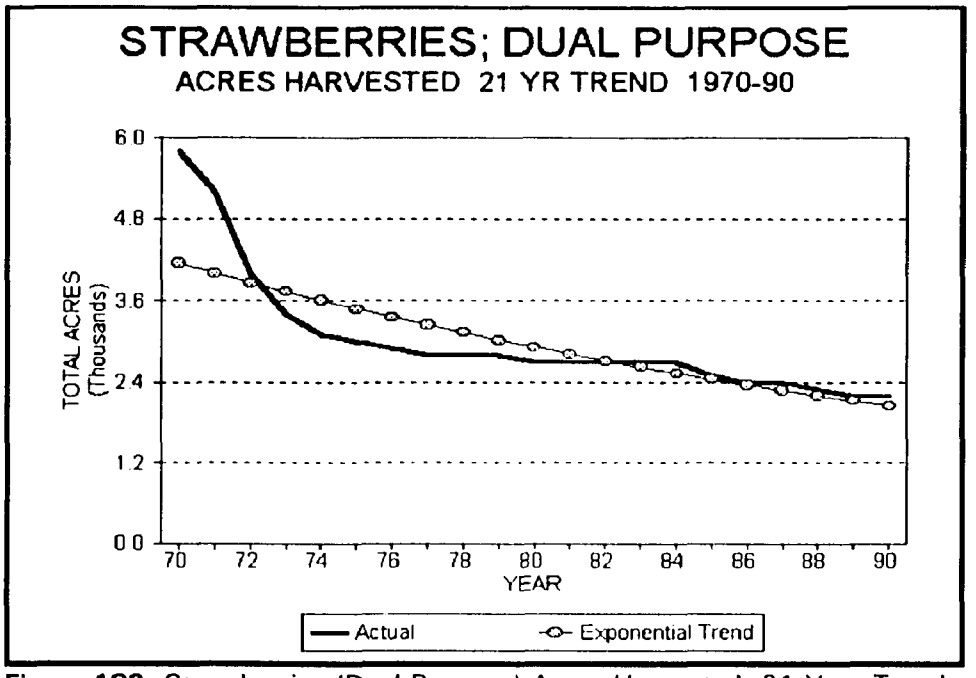


Figure 182 Strawberries (Dual Purpose) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

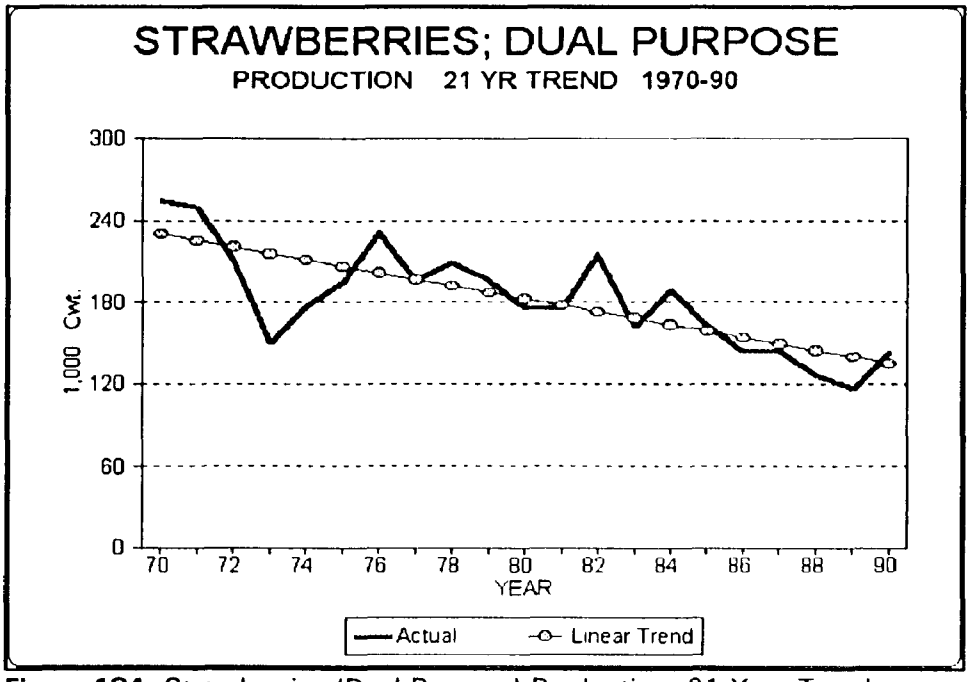
Average: 3,014

High: 5,800

Low: 2,200

Avg. Anl. Chg: -3.48%

Figure 183 Strawberries (Dual Purpose) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

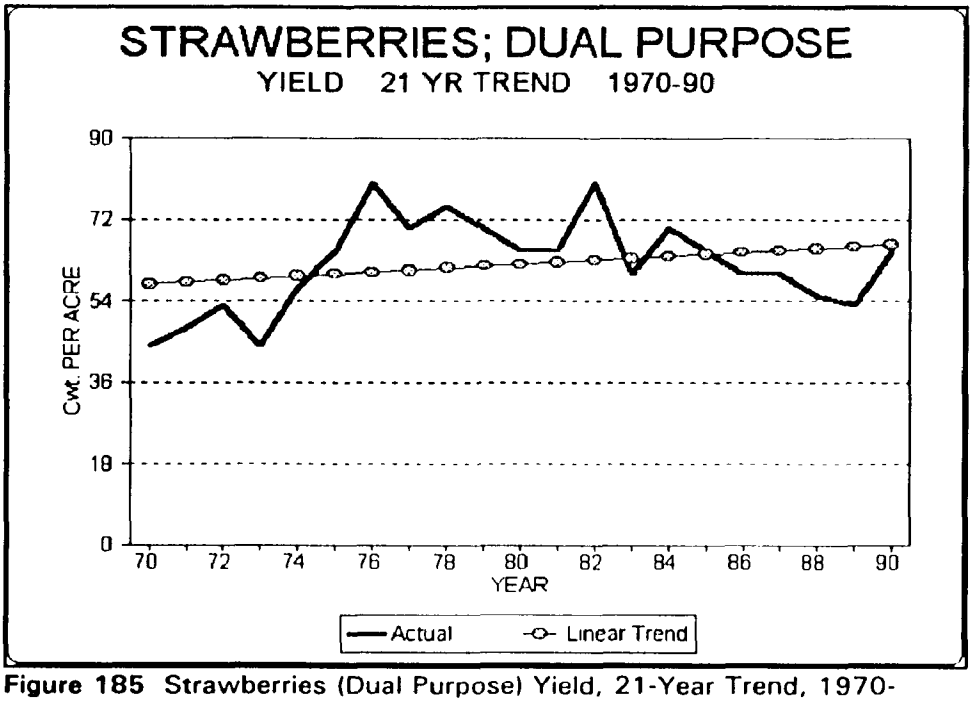
Average: 182

High: 255

Low: 117

Avg. Anl. Chg: -2.62%

Figure 184 Strawberries (Dual Purpose) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

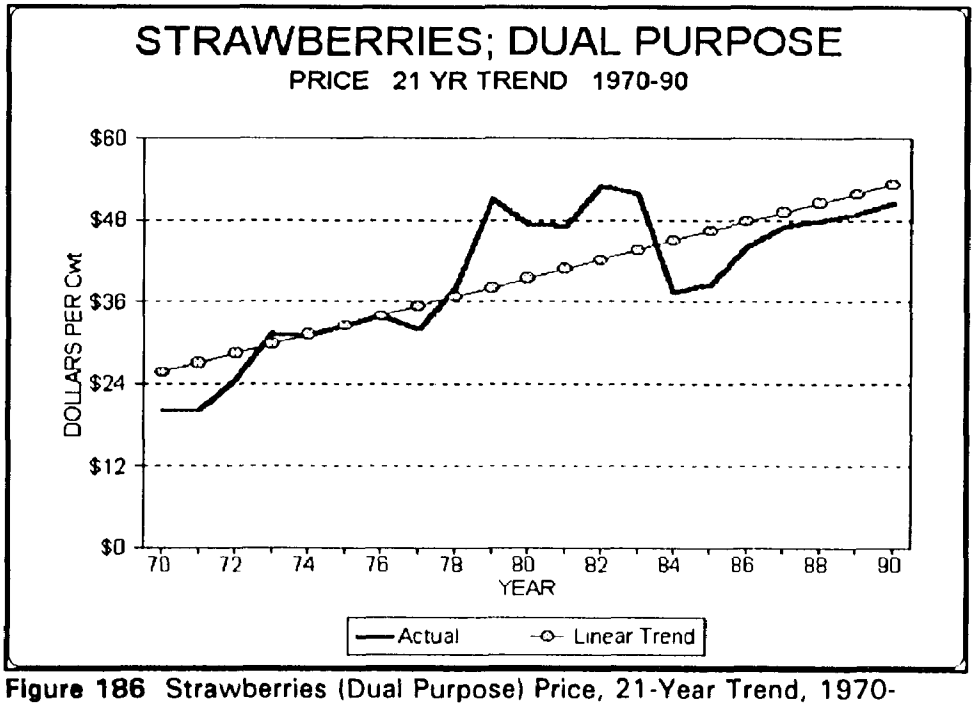
Average:
62.2

High:
80.0

Low:
44.0

Avg. Anl. Chg:
0.71%

Figure 185 Strawberries (Dual Purpose) Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$39.5

High:
$53.1

Low:
$20.1

Avg. Anl. Chg:
3.51%

Figure 186 Strawberries (Dual Purpose) Price, 21-Year Trend, 1970-1990

Sweet Corn (Fresh Market): The number of acres harvested trended downward during the decades of the 70's and 80's, falling an average annual rate of 0.33%. The 21 year annual average of sweet corn acres harvested was 11,948. Production followed a similar trend pattern as acres harvested, declining modestly at an average annual rate of 0.68%, see Figure 189.[103] Yield per acre trended nominally downward, falling at an average annual rate of 0.35%. Sweet corn was one of three vegetable crops to have a negative yield trend,[104] see Table V. Prices increased throughout most of the 70's and 80's, expanding at an average annual rate of 6.18%, highest for all vegetables, see Figure 191. The price of sweet corn has risen from $3.13 per Cwt. in 1970 to above $16.00 per Cwt. in the late 80's. Value of production broke the $10 million barrier for the first time in 1989, with a level of $14 million. For the 21 year period, value of production trended higher at an average annual rate of 6.22%, 4th for all vegetable crops, see Figure 187. In 1990 Michigan ranked 6th in the country in production, producing 4.9% of the total, Florida was the nation's leader.

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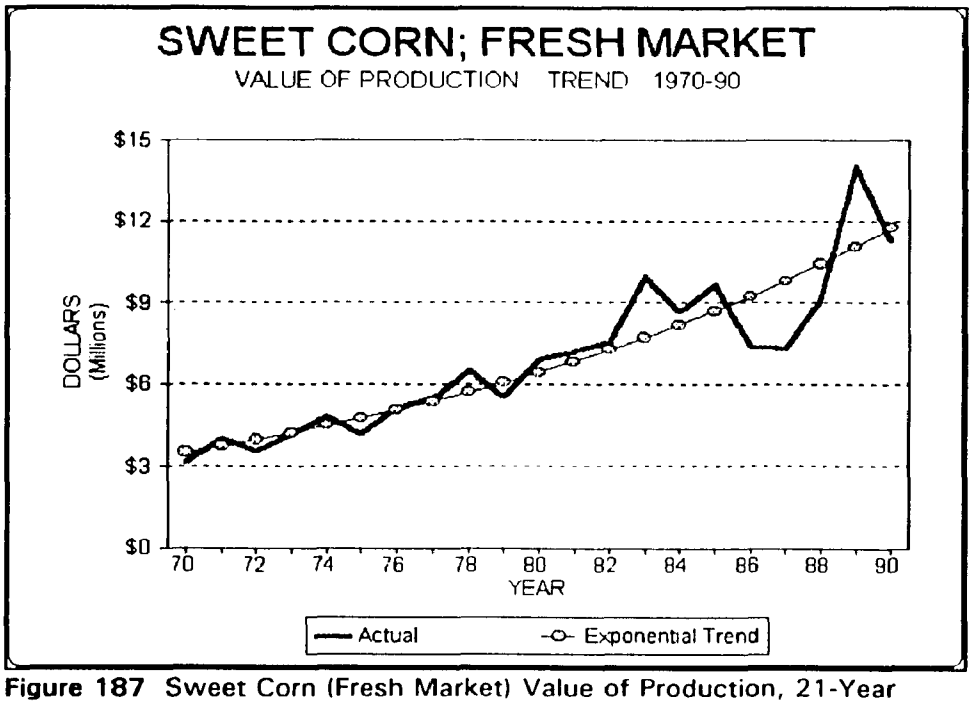
[103] Note: 1970 was the all time record high for sweet corn production, of 1.01 million Cwt.

[104] Note: a record high yield for sweet corn was established in 1970 of 80 Cwt. per acre.



VALUE OF PRODUCTION

21 - YEAR

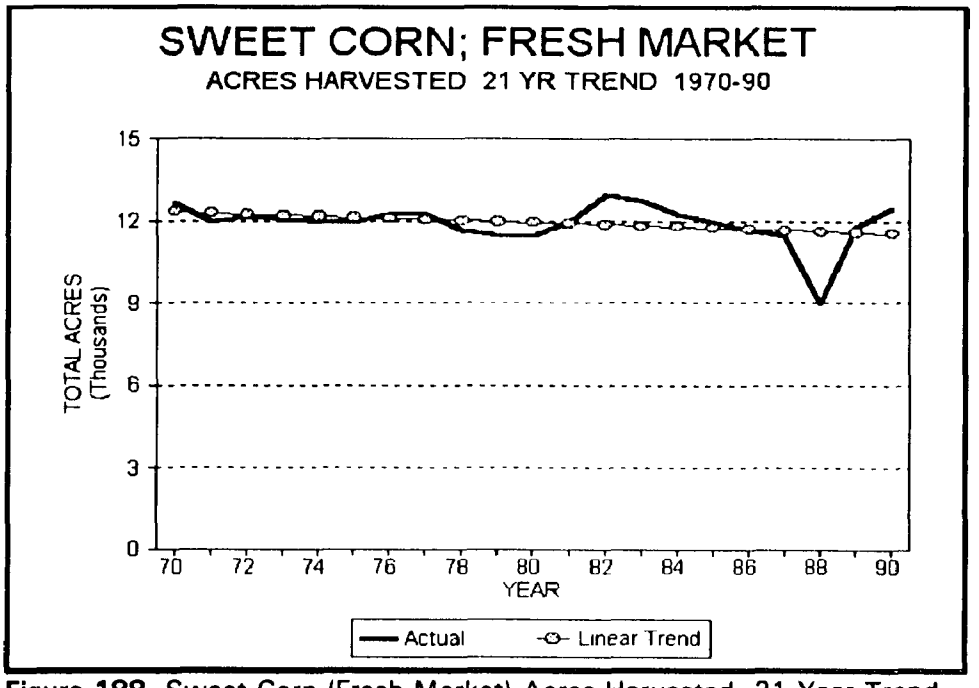
Average: $6,931,699

High: $14,035,000

Low: $3,180,080

Avg. Anl. Chg: 6.22%

Figure 187 Sweet Corn (Fresh Market) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

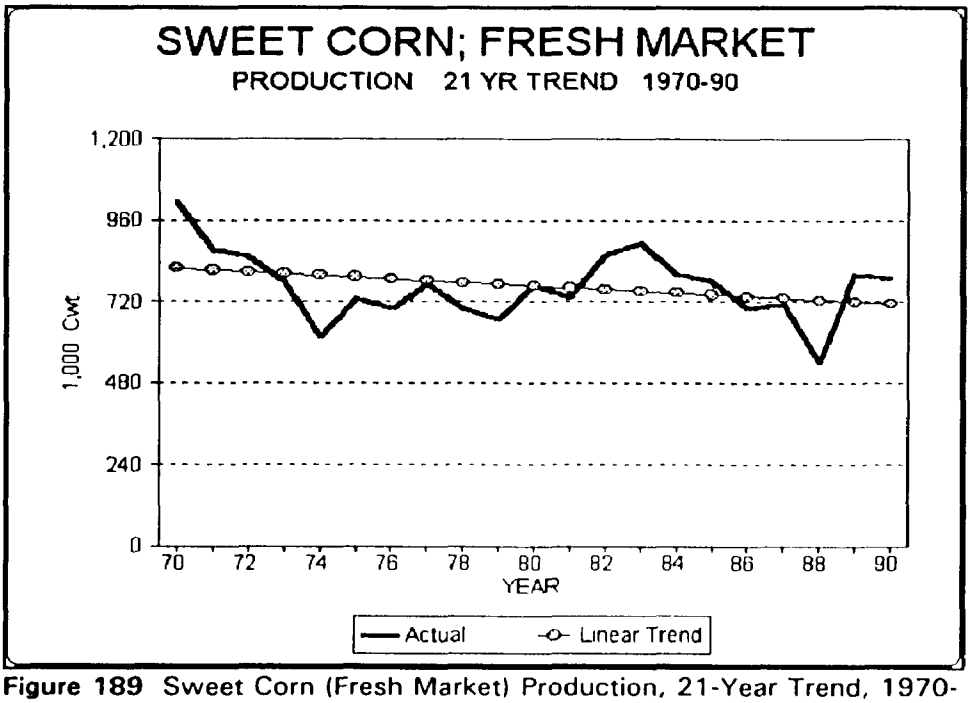
Average: 11,948

High: 13,000

Low: 9,000

Avg. Anl. Chg: -0.33%

Figure 188 Sweet Corn (Fresh Market) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

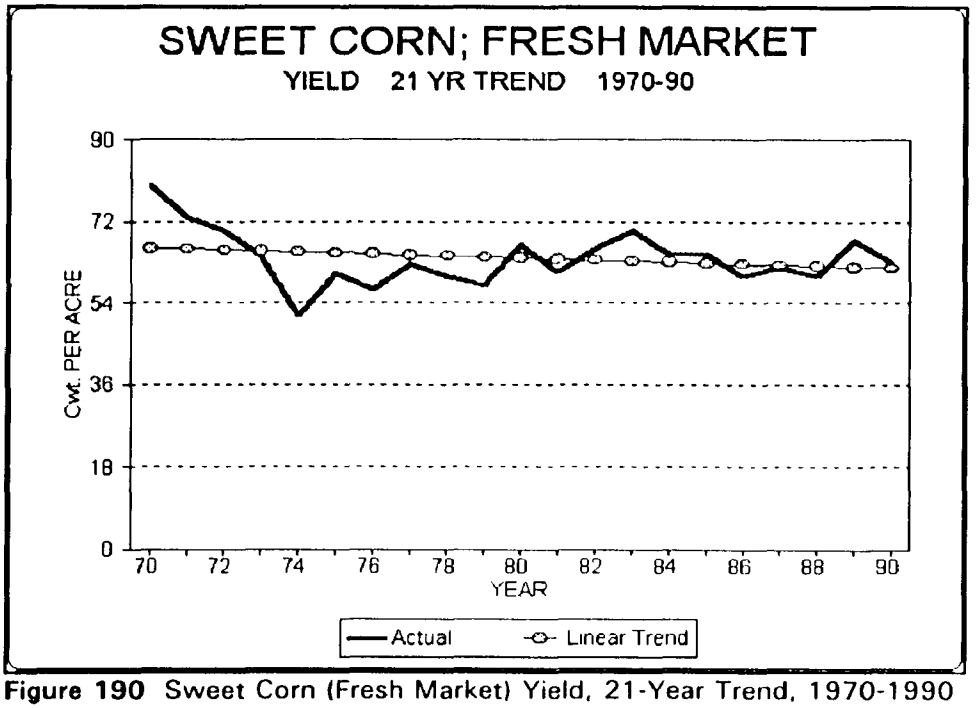
Average:
767

High:
1,016

Low:
540

Avg. Anl. Chg:
-0.68%

Figure 189 Sweet Corn (Fresh Market) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

Average:
64.0

High:
80.0

Low:
51.4

Avg. Anl. Chg:
-0.35%

Figure 190 Sweet Corn (Fresh Market) Yield, 21-Year Trend, 1970-1990

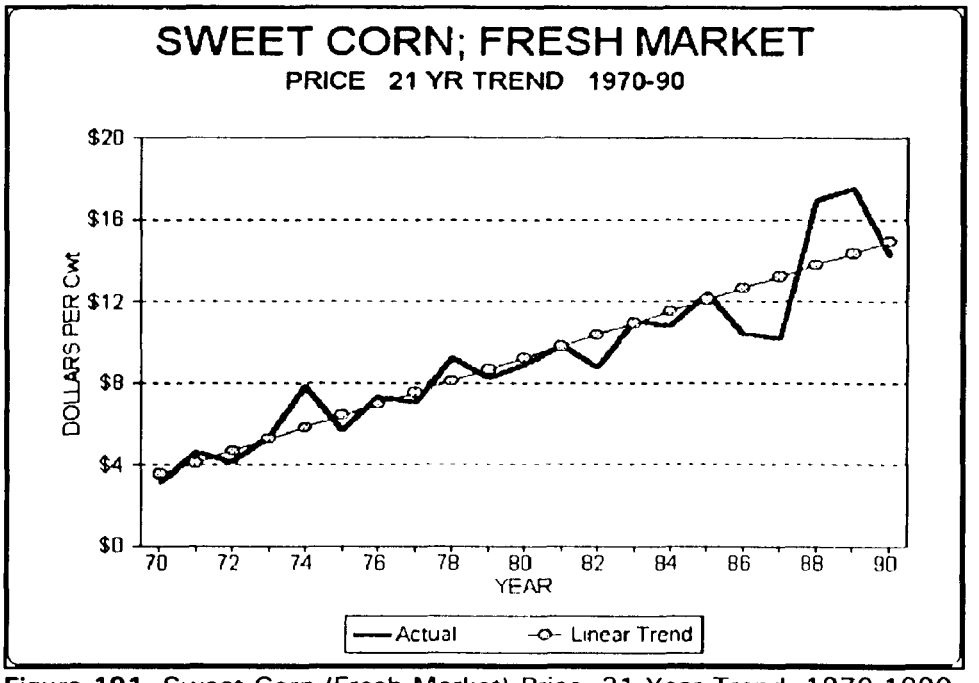


Figure 191 Sweet Corn (Fresh Market) Price, 21-Year Trend, 1970-1990

Tomatoes (Fresh Market): Fresh tomato production declined throughout the decades of the 70's and 80's. Acres harvested declined at an average annual rate of 2.53,[105] see Figure 193. In 1988 acreage dropped to an all time record low of 2,400 acres, from a 21 year high of 4,400 acres in 1974. Production also trended downward, falling an average annual rate of 2.35%, and ranked 12th out of the 13 vegetable crops. Yields remained flat for the two decades, increasing at an average annual rate of only 0.04%, see Figure 195. However, all time record yields of 120 Cwt. per acre were recorded four times in 1979, 1983, 1984, and 1990. Price per hundredweight fluctuated between a high of $34 in 1988 to a low of $9.30 in 1970 and trended higher.

[105] The trend for fresh tomatoes was the 11th largest annual decline for all vegetable crops, see Table V.

The trend was an average annual increase of 3.65%, 5th highest for all vegetable crops. Crop value of production trended higher at an average annual rate of 1.29%, this second to last for vegetable crops, see Table V. For the 21 year time period, fresh market tomatoes averaged a value of production of $7.2 million a year. Michigan ranked 15th in the country in production, accounting for 0.9% of the total U.S. production in 1990, Florida lead all states.

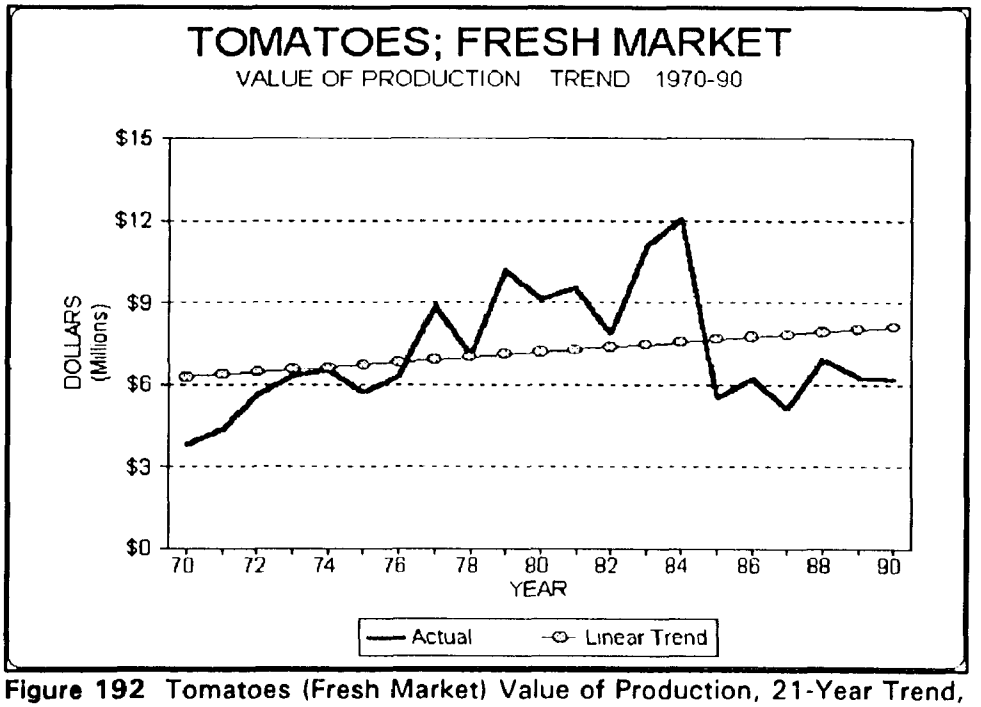
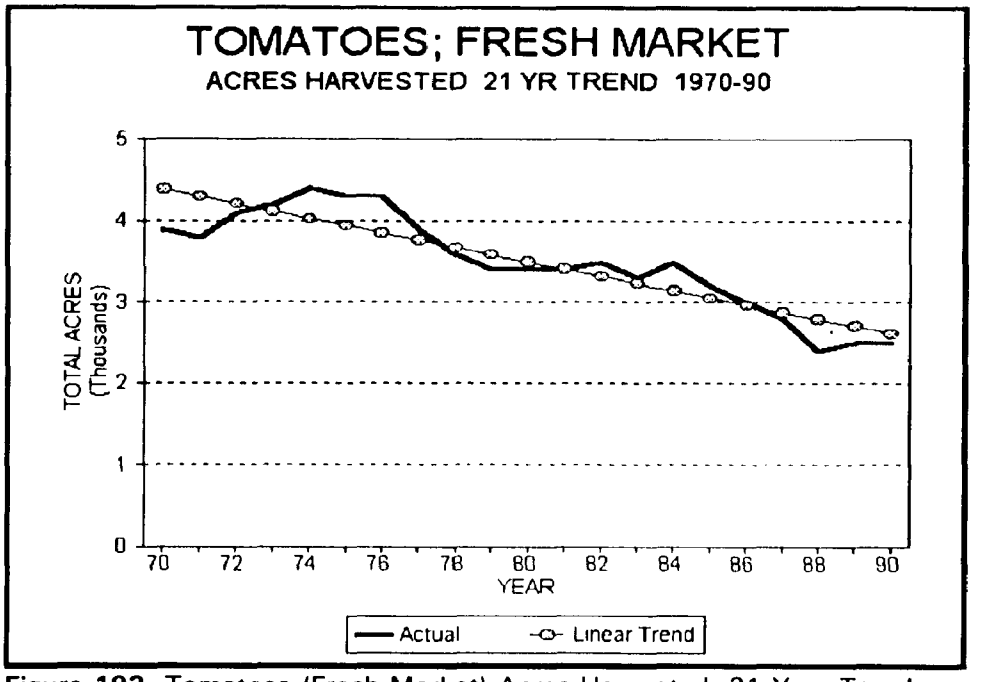


Figure 192 Tomatoes (Fresh Market) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

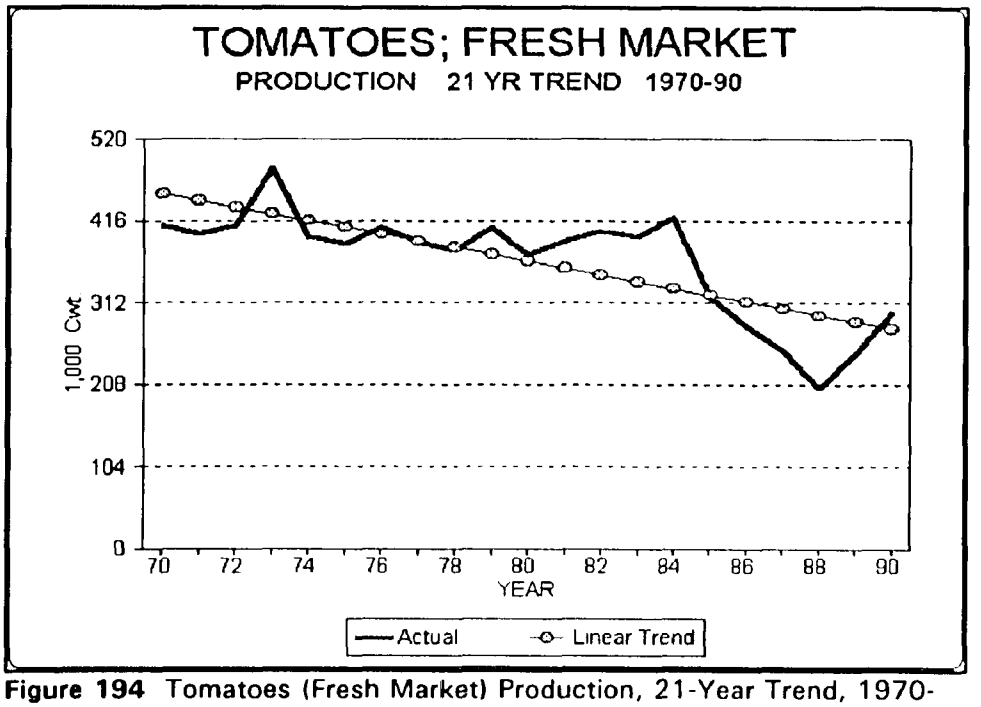
Average: 3,495

High: 4,400

Low: 2,400

Avg. Anl. Chg: -2.53%

Figure 193 Tomatoes (Fresh Market) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

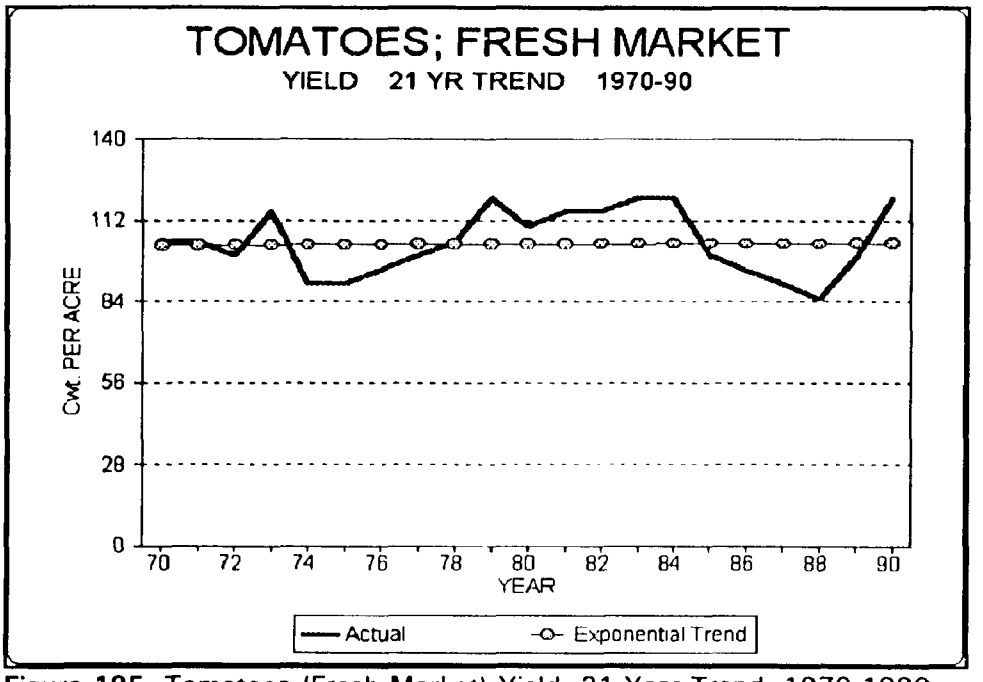
Average: 365

High: 483

Low: 204

Avg. Anl. Chg: -2.35%

Figure 194 Tomatoes (Fresh Market) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

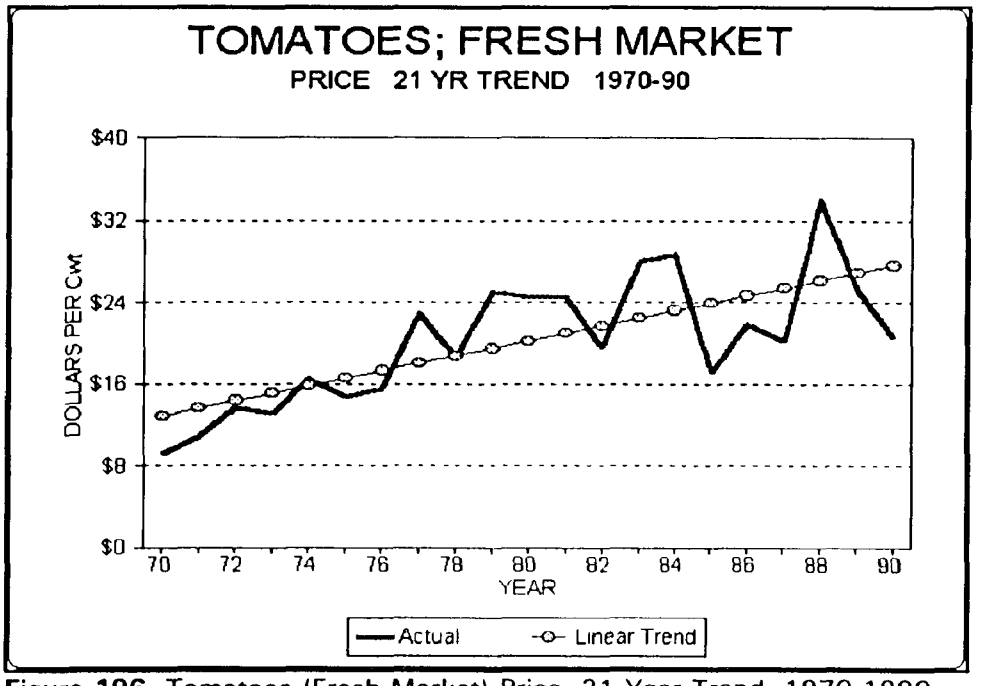
Average:
105

High:
120

Low:
85

Avg. Anl. Chg:
0.04%

Figure 195 Tomatoes (Fresh Market) Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$20.3

High:
$34.0

Low:
$9.3

Avg. Anl. Chg:
3.65%

Figure 196 Tomatoes (Fresh Market) Price, 21-Year Trend, 1970-1990

Tomatoes (Processing): Processing tomatoes showed some of the most significant gains for each of the categories analyzed. Acres harvested trended higher at an average annual rate of 2.49%, the second fastest for all vegetables. The state averaged an annual tomato harvest of 5,471 acres for the 21 year period. In 1982 an all time state record of 9,700 acres harvested was established, see Figure 198. Production increased substantially, tending upward at an average annual rate of 5.62%,[106] this translates into an average yearly increase of 6,040 tons. Yields also rose at consistently higher rate. The calculated yield trend was an average annual rate of 3.53%,[107] see Figure 200. A record yield was set in 1990 of 29.8 tons per acre. Prices ranged from a 21 year high of $92.60 per ton in 1982 to a low of $36.90 per ton in 1970. The trend for prices was an average annual increase of 2.79%, 5th in rank, see Table V. The combination of higher prices and production led to an increase in the value of crops. Value of production expanded at an average annual rate of 7.35%, tied for first for vegetable crops. In the 70's value of production expanded from the $2 million level to above the $10 million mark and higher for most of the 80's. Michigan ranked 4th in the country in tomatoes for processing, producing 1.6% of U.S. total production in 1990, the number one state was California.

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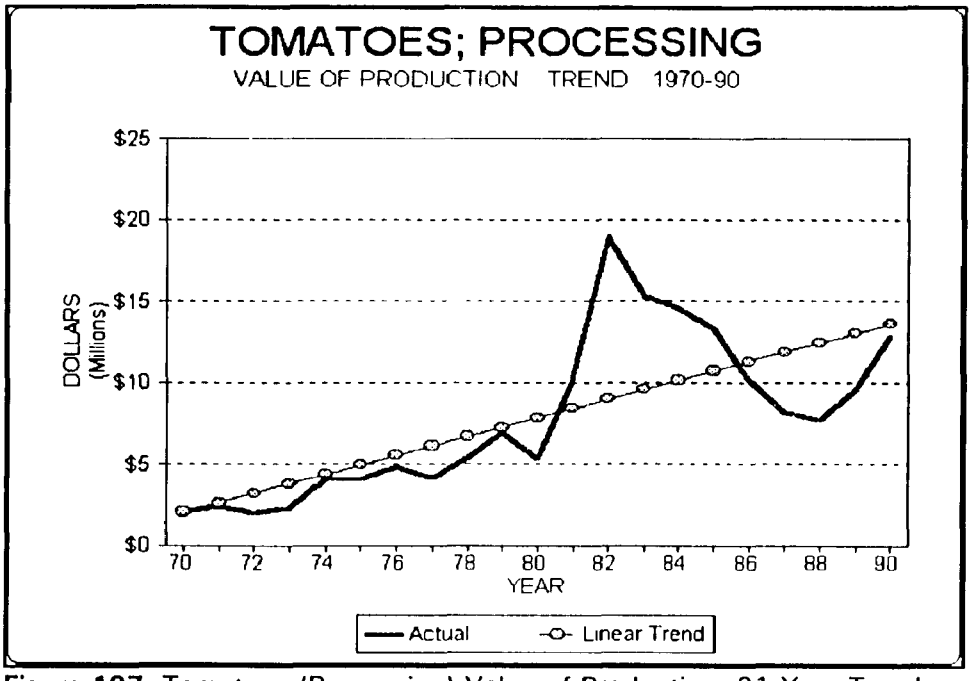
[106] Note: the production trend rate was the swiftest for all crops, see Table V.

[107] Note: the yield trend rate was the second highest for all vegetable crops.



VALUE OF PRODUCTION

21 - YEAR

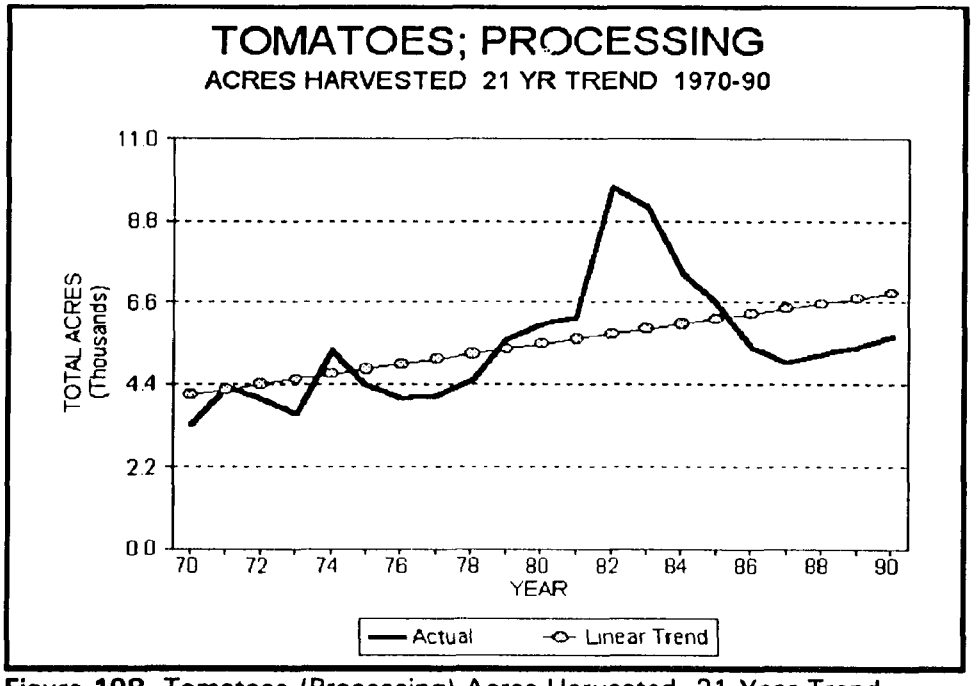
Average: $7,843,060

High: $18,945,960

Low: $2,010,000

Avg. Anl. Chg: 7.35%

Figure 197 Tomatoes (Processing) Value of Production, 21-Year Trend, 1970-1990



ACRES HARVESTED

21 - YEAR

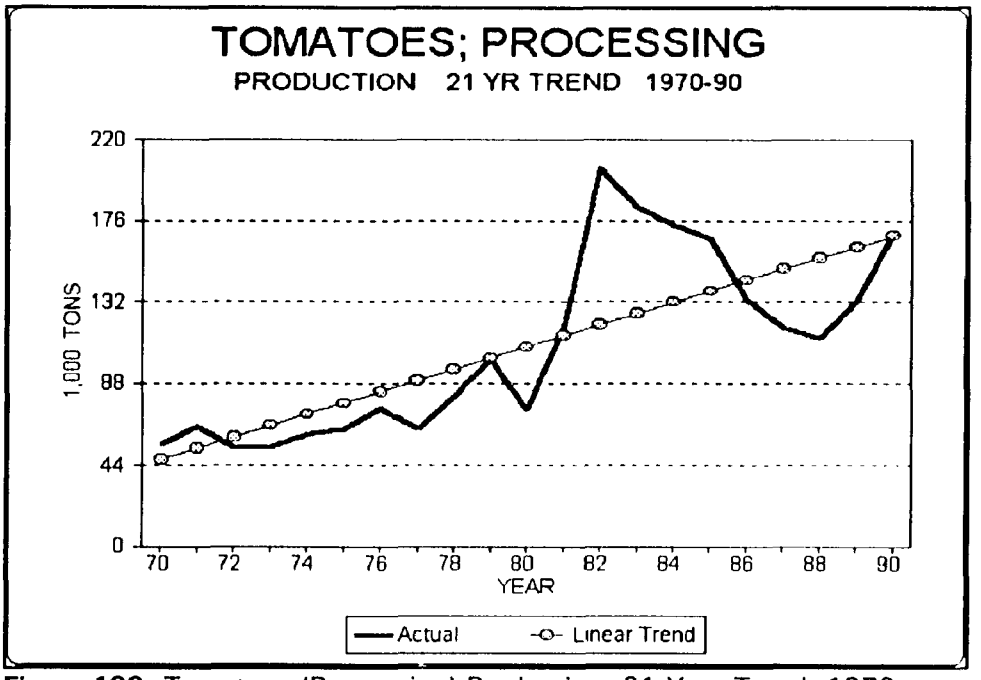
Average: 5,471

High: 9,700

Low: 3,300

Avg. Anl. Chg: 2.49%

Figure 198 Tomatoes (Processing) Acres Harvested, 21-Year Trend, 1970-1990



PRODUCTION

21 - YEAR

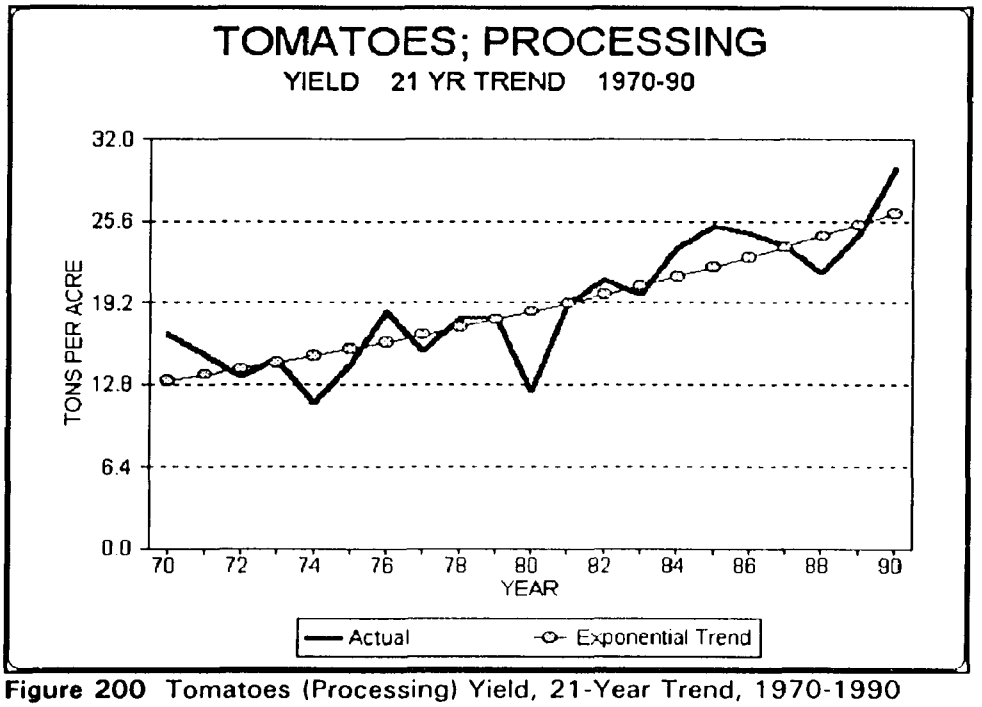
Average:
107.5

High:
204.5

Low:
53.4

Avg. Anl. Chg:
5.62%

Figure 199 Tomatoes (Processing) Production, 21-Year Trend, 1970-1990



YIELD

21 - YEAR

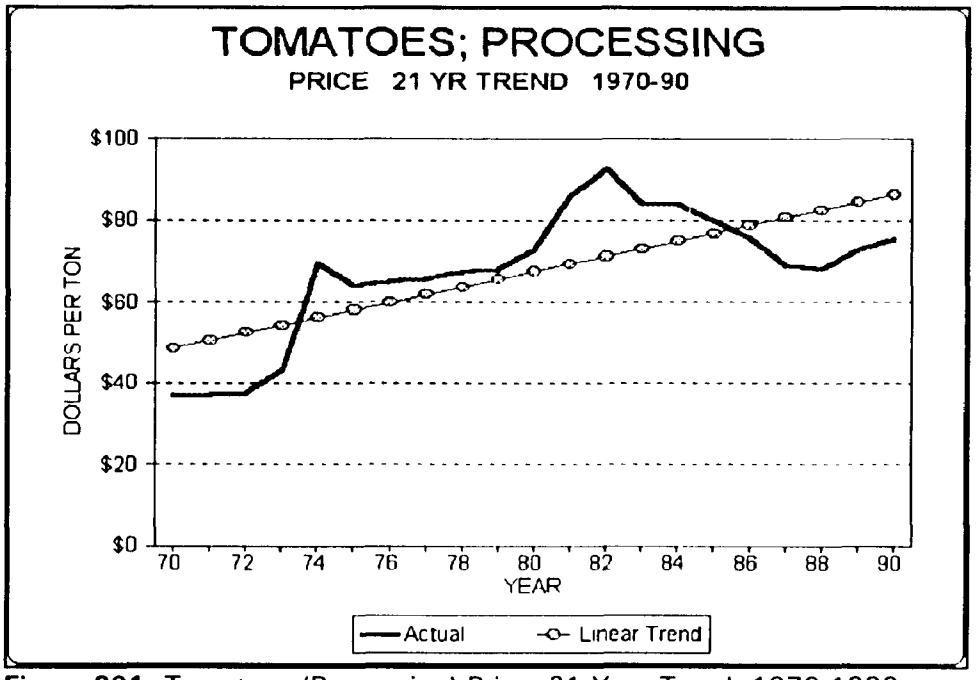
Average:
19.1

High:
29.8

Low:
11.4

Avg. Anl. Chg:
3.53%

Figure 200 Tomatoes (Processing) Yield, 21-Year Trend, 1970-1990



PRICE

21 - YEAR

Average:
$67.4

High:
$92.6

Low:
$36.9

Avg. Anl. Chg:
2.79%

Figure 201 Tomatoes (Processing) Price, 21-Year Trend, 1970-1990

AN ANALYSIS OF BASELINE DATA TO ASSESS STRUCTURAL SHIFTS, TRENDS AND LINKAGES OF MICHIGAN'S PRODUCTION AGRICULTURE ECONOMY DURING THE 1970's AND 1980's

VOLUME II

By

John Frederick Whims

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics

1995

V. THE APPLICATION OF SHIFT-SHARE ANALYSIS TO FARM CASH RECEIPTS, TO ASSESS THE SHIFTS IN MICHIGAN'S COMPETITIVE POSITION IN PRODUCTION AGRICULTURE RELATIVE TO THE UNITED STATES

Introduction

The following discussion is an interpretation of the results of the shift-share method of analysis as applied to Michigan's production agricultural industry. The purpose for using the shift-share technique in the thesis is to investigate the position of Michigan's production agriculture versus the general (United States) production agricultural economy during the decades of the 70's and 80's. The United States is called the base region and Michigan is called the local region of analysis. Three time periods are analyzed to capture the shifts in Michigan production agriculture. The first segment analyzed is the decade of the 70's, the second time period is the decade of the 80's and the third segment is the 70's and 80's combined to yield a longer-run (twenty-one year) focus. Farm cash receipts[108] are used as the basis of comparison between the United States and Michigan. The study is confined to only those agricultural commodities that are produced in the state of Michigan. Regional commodities such as tobacco, citrus fruits, cotton, and tree nuts are excluded from the analysis. The cash receipts data[109] used in the analysis is from various United States Department of Agriculture, Economic Research Service, publications called the "Economic Indicators of the Farm Sector." A potential

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[108] Note: for purposes of this study cash receipts are in nominal terms.

[109] Note: the data used in the analysis is found in the data appendix for chapter V.

problem arises when using cash receipts as a basis for analytical comparison. Farm commodity cash receipts can be highly variable from year to year and differ greatly between regions. The variance can usually be attributable to the differential effects of weather, especially for field crops, vegetables, and fruits. To address the issue of variance of farm commodity cash receipts ***(C)***, weighted averages have been calculated for each of the U.S. and Michigan commodities. The following is a description of the weighting procedure:

$$\left[\frac{(C_{1969} + C_{1970} + C_{1971})}{3}\right] = 1970 \textit{ Weighted Average for each US-Mich Commodity}$$

$$\left[\frac{(C_{1979} + C_{1980} + C_{1981})}{3}\right] = 1980 \textit{ Weighted Average for each US-Mich Commodity}$$

$$\left[\frac{(C_{1989} + C_{1990} + C_{1991})}{3}\right] = 1990 \textit{ Weighted Average for each US-Mich Commodity}$$

When the cash receipts are weighted, they are then applied to the shift-share method of analysis, which is described in detail below.

In chapter V the shift-share results are displayed in a tabular format. The tables are separated by agricultural production sectors and by time divisions. The agricultural sectors are (1) livestock and products, (2) field crops, (3) fruit and other, and (4) vegetables and melons. The time divisions are from 1970 to 1980, 1980 to 1990, and 1970 to 1990. In order to assist the reader with the interpretation of the results, the shift-share model is developed in detail below. It is suggested that the reader review the shift-

share definitions and terms before proceeding to the tables. The first section reviews the basic[110] shift-share method of analysis. The basic model is then extended to a more robust derivation called the Arcelus (I)[111] shift-share model. After describing in detail the Arcelus model, the Arcelus model is applied to a commodity (Michigan dry beans cash receipts) to illustrate the mechanics of the method. The step-by-step analysis of dry beans should facilitate the interpretive process of the shift-share tables. The tables at the end of the chapter highlight the Arcelus (I) shift-share results for most major Michigan commodities.

The Structure of the Basic Shift-Share model

The goal of the shift-share method of analysis is to statistically separate (decompose) the main national and regional forces affecting the incremental change in cash receipts for the various agricultural commodities in Michigan. In its simplest form, shift-share analysis is described by the following equation:

$$\blacktriangle C_{ij} = N_{ij} + NI_{ij} + CE_{ij}$$

---

[110] Note: the literature calls it the "classic" shift-share model.

[111] The technique is named after the researcher Francisco J. Arcelus.

where:

i = The number of sectors or industries in a region or nation ($i = 1, 2, \ldots s$). In this analysis the "i's" represent an agricultural sub-sector such as dairy, hogs, and oats.

j = The number of regions in a geographical area ($j = 1, 2, \ldots r$). In this analysis we are only concerned with the United States as the base region and Michigan as the local region.[112]

$\blacktriangle C_{ij}$ = The change in cash receipts from a base year to a terminal year. For example, when analyzing the 70's, the base year is 1970 and the terminal year is 1980. If a Michigan commodity has $1 million in cash receipts in the base year and $3 million in cash receipts in the terminal year, then the $\blacktriangle C$ is $2 million.

N_{ij} = The *national growth effect*, that part of the $\blacktriangle C_{ij}$ attributable to the growth rate of the nation.

NS_{ij} = The *sectoral*[113] *mix effect*, that part of $\blacktriangle C_{ij}$ attributable to differences between the sectoral composition of region j and that of the nation.

CE_{ij} = The *competitive effect*, that part of $\blacktriangle C_{ij}$ attributable to differences in the growth rate of sector i at regional and national levels.

The three shift-share effects; N_{ij}, NS_{ij}, and CE_{ij} are determined by calculating percent changes (growth rates) of the different levels of national and state commodity cash receipts over specified time periods. The following list of key definitions are part of the basic shift-share model and also the extended shift-share model Arcelus (I) which will be described after the basic model.

---

[112] Note: under typical circumstances shift-share analysis is used to analyze employment data that considers regional differences, e.g., a metropolitan area versus a rural area.

[113] Note: the literature refers to this as the industrial component. For this study the term has been changed to sectoral for consistency in terminology reflected in other chapters.

c_{ij} = The percent change (%▲) in cash receipts in agricultural sub-sector i (commodity), region j (Michigan), relative to a base year and a terminal year, e.g., 1970 to 1990.

c_{io} = The %▲ in national cash receipts for agricultural sub-sector i (commodity).

c_{oj} = The %▲ in total commodity cash receipts for Michigan.

c_{oo} = The %▲ in total national commodity cash receipts, the national growth effect.

C = Capital "C" is the actual level of cash receipts in a base year.

C_{ij} = Cash receipts for the ith commodity in the jth region (Michigan).

C_{oj} = Total Michigan commodity cash receipts, $\Sigma_i E_{ij}$.

C_{io} = Total national commodity cash receipts for the ith commodity, $\Sigma_j E_{ij}$.

C_{oo} = Total national agricultural cash receipts, $\Sigma_i \Sigma_j E_{ij}$.

The three effects of the basic shift-share model are calculated as follows:

$N_{ij} = C_{ij} (c_{oo})$

$NS_{ij} = C_{ij} (c_{io} - c_{oo})$

$CE_{ij} = C_{ij} (c_{ij} - c_{io})$

These three components form the foundation for the expanded Arcelus (I) model which is used in the analysis of Michigan's commodity cash receipts.

The Structure of the Arcelus (I), Shift-Share Model

The Arcelus (I)[114] shift-share model takes the *basic shift-share* model and decomposes the three (national, sectoral, and competitive effects) components into further detail. Each of the components is broken down into two new terms; an "expected" growth effect, and a "differential" effect. The Arcelus[115] shift-share technique also utilizes what is called a homothetic component to separate the *basic shift-share* components into a proportional perspective of the level of economic activity in the local region for each sub-sector "i." The homothetic component is defined as follows:

C^{*}_{ij} = The homothetic component is the level of economic activity (agricultural cash receipts) that a sub-sector "i" (commodity) in Michigan would have if it were identical to the national sub-sector "i's" (commodity) level of economic activity and structure. The following is the formulation of the homothetic component:

$$C^{*}_{ij} = \left[\frac{(C_{oj})\ (C_{io})}{(C_{oo})} \right]$$

For example, if national cash receipts for the dairy sector is $16 billion, the total national agricultural cash receipts are $118 billion and total Michigan cash receipts is $2.5 billion, then the homothetic cash receipts C^{*}_{ij} would be:

---

[114] Note: the Arcelus (I) model is distinguished from another shift-share model he developed called Arcelus (II).

[115] Note: Esteban-Marquillas first applied the homothetic component concept to the *competitive effect*, C_{ij}, variable to lessen the problem of data interdependence. Arcelus was the first researcher to extend the homothetic component to all parts of the shift-share model.

$$C_{ij}^{\bullet} = \left[\frac{(\$2.5 \textit{ billion})\ (\$16 \textit{ billion})}{(\$118 \textit{ billion})} \right] = \$339 \textit{ million}$$

The homothetic component means that if Michigan were to mirror the nation in terms of the proportion of dairy cash receipts, then the state would generate $339 million. The homothetic component forms a basis to measure the degree of specialization and level of comparative advantage for each commodity in Michigan.

The *basic shift-share* effects (variables) are modified in the Arcelus (I) model by introducing the homothetic component and the expected and differential effects. The *basic shift-share* effects (identified in bold and italic) are now decomposed into the following variables where:

$\boldsymbol{N_{ij}} = EN_{ij} + DN_{ij}$ = Both variables combined is called the net national growth effect.

$\boldsymbol{NS_{ij}} = EM_{ij} + D_{ij}$ = Both variables combined is called the net sectoral mix effect.

$\boldsymbol{CE_{ij}} = E_{ij} + A_{ij}$ = Both variables combined is called the net competitive effect.

The complete Arcelus (I) model is described as follows:

$$\blacktriangle C_{ij} = EN_{ij} + DN_{ij} + EM_{ij} + D_{IJ} + E_{ij} + A_{ij}$$

The six variables of the Arcelus (I) model above are defined mathematically as follows:

EN_{ij} = The ***"expected national growth effect"*** is the influence of the change in total national in cash receipts (c_{oo}) on the change in region j cash receipts for commodity i, had C_{ij}^{*} (the homothetic component) been equal to C_{ij}.

$$EN_{ij} = C_{ij}^{*} (c_{oo}) = \left[\frac{(C_{oj})(C_{io})}{(C_{oo})} \right] x (c_{oo})$$

DN_{ij} = The ***"differential national growth effect."*** The influence of the national growth effect (c_{oo}) on cash receipts for commodity i based on the degree of specialization[116] of commodity i in region j.

$$DN_{ij} = (C_{ij} - C_{ij}^{*}) x (c_{oo}) = \left[C_{ij} - \frac{(C_{oj})(C_{io})}{(C_{oo})} \right] x (c_{oo})$$

EM_{ij} = The ***"expected sectoral growth effect."*** Is the expected change in local cash receipts based on the difference between the national growth rate of commodity "i" (c_{io}) versus the growth rate for all national commodities (c_{oo}) applied to the homothetic component. This shows expected effect of the national sub-sectors' "i" pattern of change on the local sub-sector "i."

$$EM_{ij} = C_{ij}^{*} (c_{io} - c_{oo}) = \left[\frac{(C_{oj})(C_{io})}{(C_{oo})} \right] x (c_{io} - c_{oo})$$

---

[116] Specialization is the degree of importance for a commodity i (based on cash receipts) in the state relative to it's share of the national total for commodity i.

D_{ij} = The ***"differential sectoral mix effect."*** The national growth rate differentials applied to the difference between the local level of cash receipts for commodity "i" minus the homothetic component.

$$DM_{ij} = \left(C_{ij} - C_{ij}^{*}\right)\left(c_{io} - c_{oo}\right) = \left[\, C_{ij} - \frac{(C_{oj})\,(C_{io})}{(C_{oo})} \,\right] x \left(c_{io} - c_{oo}\right)$$

E_{ij} = The ***"expected competitive effect"*** measures the competitive advantage or disadvantage of the local region and commodity "i" with respect to the nation and commodity "i."

$$EC_{ij} = C_{ij}^{*}\left(c_{ij} - c_{io}\right) = \left[\, \frac{(C_{oj})\,(C_{io})}{(C_{oo})} \,\right] x \left(c_{ij} - c_{io}\right)$$

A_{ij} = The ***"allocation effect"*** takes into account region j's degree of specialization in the various commodities i that it produces.

$$AE_{ij} = \left(C_{ij} - C_{ij}^{*}\right)\left(c_{ij} - c_{io}\right) = \left[\, C_{ij} - \frac{(C_{oj})\,(C_{io})}{(C_{oo})} \,\right] x \left(c_{ij} - c_{io}\right)$$

To better understand the decompositional process of the Arcelus shift-share technique, a step-by-step example has been included of Michigan dry beans cash receipts from 1970 to 1980. Also included in the example is a section that interprets the results of the model. The interpretive process of the dry beans should aid the reader when reviewing the tables and table summary sections.

An Example of Shift-Share Analysis Applied to Michigan Dry Beans

Dry Beans Cash Receipts from Marketings ($ 000's)[117]

United States:	1970	1980	%▲
Dry Beans	$155,056	$587,662	279.0
Total Receipts	$43,670,616	$118,374,039	171.1
Michigan:			
Dry Beans	$56,233	$153,908	173.7
Total Receipts	$881,295	$2,613,373	187.2

Identification of Variables for Shift-Share Analysis

Calculated Growth Rates, 1970 base year and 1980 terminal year:

c_{io} = 279.0% (%▲ in national dry beans cash receipts)
c_{oo} = 171.1% (%▲ in total national commodity cash receipts)
c_{ij} = 173.7% (%▲ in Michigan dry beans cash receipts)
c_{oj} = 187.2% (%▲ in total Michigan commodity cash receipts)

Cash Receipts ($ 000's):

C_{io} = $155,056	(national cash receipts for dry beans in the base year 1970)
C_{oo} = $43,670,616	(national cash receipts for all commodities in base year 1970)
C_{ij} = $56,233	(national cash receipts for dry beans in the base year 1970)
C_{oj} = $881,295	(national cash receipts for all commodities in base year 1970)

---

[117] Note: the cash receipts are a weighted average of three years centered around 1970 and 1980. This is to reduce the variance of the value of production, which is often associated with agricultural commodities. This technique is applied to all commodities and all base and terminal years in the analysis.

Homothetic Component ($ 000's):

$$C_{ij}^{*} = \left[\frac{(\$881,295)\ (\$155,056)}{(\$43,670,616)} \right] = \$3,129$$

Remembering the shift-share components for the Arcelus model are:

$$\blacktriangle C_{ij} = EN_{ij} + DN_{ij} + EM_{ij} + D_{IJ} + E_{ij} + A_{ij}$$

Calculation of the Arcelus Model Components for Dry Beans ($ 000's)[118]

EN_{ij} =	(3,129) x (1.711) = 5,353	> =	96,193
DN_{ij} =	[(56,233) - (3,129)] x (1.711) = 90,839		
EM_{ij} =	(3,129) x (2.790 - 1.711) = 3,378	> =	60,698
D_{ij} =	[(56,233) - (3,129)] x (2.790 - 1.711) = 57,320		
E_{ij} =	(3,129) x (1.737 - 2.790) = -3,295	> =	-59,214
A_{ij} =	[(56,233) - (3,129)] x (1.737 - 2.790) = -55,919		
$\blacktriangle C_{ij}$ =	153,908 - 56,233 = **$97,675**	=	**$97,675**

Where:

$EN_{ij} + DN_{ij} = N_{ij}$ = 96,193 the net growth effect.

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[118] Note: many of the numbers (esp. the growth rates) have been rounded for simplicity of display and the results may differ slightly.

$EM_{ij} + D_{ij} = NS_{ij} =$ 60,698 the net sectoral mix effect.

$E_{ij} + A_{ij} = CE_{ij} =$ -59,214 the net competitive effect.

Interpretation of the Shift-Share Results for Dry Beans

The first variable of note is the homothetic component[119] for dry beans of $3,129,000. This stipulates that if Michigan were to have the same proportion as the nation in terms of dry beans cash receipts to total cash receipts, Michigan's receipts would have been $3.1 million in 1970. The actual level of Michigan dry bean receipts in 1970 were $56.2 million. Such a large total of dry bean cash receipts (18 times greater than the national proportion) highlights the significance[120] of dry beans to Michigan's agricultural economy. The absolute change in cash receipts for dry beans from 1970 to 1980 were $97.7 million, expanding from $56.2 million to $153.9 million. This change in dry beans cash receipts was then decomposed into the different growth effects. An explanation of calculated growth effects is segmented into the three net growth effect components: the national, sectoral, and competitive. The net effects are as follows:

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[119] Remember the homothetic component is the integral variable which helps to separate the expected effects from the differential effects in the model.

[120] Significance is meant in terms of relative size of total Michigan and national cash receipts.

The Net Growth Effect:

The calculated net national growth effect[121] is $96.2 million. The expected national growth effect is $5.4 million and the differential national growth effect is $90.8 million, these two components combine to yield the net effect. The expected national effect shows the influence of the growth in total national cash receipts multiplied by the homothetic component. This produces the expected national contribution to the absolute change in Michigan dry bean receipts. The differential national growth effect[122] is the difference between the homothetic component and the actual level of Michigan cash receipts. In this example, the differential growth effect is so much larger than the expected growth effect because of the homothetic component is significantly smaller than actual dry bean cash receipts.

The Net Sectorial Growth Effect:

The net sectoral growth effect looks at the difference between the national growth rate for dry beans c_{io} (279.0%) versus the growth rate for all national commodities c_{oo} (171.1%). In this example $c_{io} > c_{oo}$, where bean cash receipts are growing faster than overall cash receipts. This indicates that

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[121] Note: the net growth effect (in this case positive) in total national cash receipts is analogous to the rising tide concept. If total national cash receipts are growing then there is an assumed increased in the change of each commodity's cash receipts because of the influence of the national agricultural economy.

[122] Note: the term $(C_{ij} - C^*_{ij}) \times c_{oo}$ the provides a rough measure of the effect of national market conditions on $\blacktriangle C_{ij}$.

dry beans are in a fast growth sector of production agriculture. Therefore, the net expected sectoral effect on Michigan dry beans cash receipts is an increase of $60.7 million. The expected sectoral growth effect is $3.4 million and the differential sectoral mix effect is $57.3 million.

The Net Competitive Growth Effect:

For purposes of this study the net competitive effect is probably the most important shift-share component calculated. This shows the relative growth in receipts between the local commodity and the national commodity. In this example, the growth in national cash receipts is greater than the growth in Michigan receipts, c_{io} (279.0%) > c_{ij} (173.3%). During the 70's Michigan enjoyed national prominence for dry beans produced in the country, but in 80's the change in cash receipts compared the U.S. shows an erosion in its competitive position. The calculated net competitive effect is a loss of $59.2 million. This means that if the state had kept pace with the national growth in dry beans cash receipts the actual level of Michigan receipts in 1980 should have been $213.1 million instead of $156.9 million. The expected competitive effect is decline of $3.3 million and the allocation effect is a decline of $55.9 million.

Further Considerations for Interpreting the Shift-Share Results

The Net Growth Effect (N_{ij}):

- In periods of national expansion[123] (or contraction) when $c_{oo} > 0$ ($c_{oo} < 0$), there will tend to be a positive (negative) effect on $\blacktriangle C_{ij}$. The size of the national (positive, negative, or no change) effect will be determined by the degree of specialization of region j in industry i, the greater the value of $(C_{ij} - C^*_{ij})$, the greater the effect on the region.

The Net Sectoral Mix Growth Effect (NS_{ij}):

- If $(c_{io} - c_{oo}) > 0$, then the national commodity "i's" cash receipts are growing faster than total national cash receipts. The local commodity i is therefore, in a positively growing sector and has a *sectoral advantage* over other local commodities.

- If $(c_{io} - c_{oo}) > 0$, has been positive for long periods of time for national commodity i and $(C_{ij} - C^*_{ij}) > 0$, then a positive influence is produced on $\blacktriangle C_{ij}$. This means that local region j is *specializing* in a nationally growing commodity i.

- If there are negative signs for both terms of the net sectoral growth effect, then both terms have a positive effect on $\blacktriangle C_{ij}$. The two negative signs

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[123] Note: in the time periods analyzed, every calculated commodity c_{oo} was positive indicating the expansion of cash receipts (cash receipts are in nominal terms). It is possible however, that if all cash receipts were analyzed in real terms (deflated) certain commodity c_{oo} would indicate contractionary economic activity.

show that local region j is not specializing in a lagging commodity i, which is beneficial to the local region.

- If there are opposite signs for the terms, then a negative value is calculated for NS_{ij} and has a negative effect on $\blacktriangle C_{ij}$. The negative effect is because region j is either specializing, $(C_{ij} - C^*_{ij}) > 0$, in a lagging commodity, $(c_{io} - c_{oo}) < 0$,or not specializing, $(C_{ij} - C^*_{ij}) < 0$, in a fast growth commodity, $(c_{io} - c_{oo}) > 0$.

- By summing NS_{ij} for all commodities i (sectors), $NI_{oj} = \Sigma^{s}_{i=1} NI_{ij}$, for each of the four major commodity groups (livestock and products, field crops, fruit & other, and vegetables), produces an indicator of whether region j is specializing (or not specializing) in commodities in which they have a competitive position.

<u>The Net Competitive Growth Effect (CE_{ij}):</u>

- If $(c_{ij} - c_{io}) > 0$, then the local commodity "i's" cash receipts are growing faster than the national commodity "i's" cash receipts, and the local commodity have a *competitive advantage* over the national commodity.

- If $(c_{ij} - c_{io}) > 0$, has been positive for long periods of time for local commodity i and $(C_{ij} - C^*_{ij}) > 0$, then a positive allocation effect is

produced on $\blacktriangle C_{ij}$. This means that region j is specializing in a local commodity i that is fast growing.

- A positive allocation effect can also result if the expected cash receipts and the differential cash receipts are both negative. This means that the region j is not specializing in a commodity i that is growing slower at the regional level than at the national level. The two negative signs create a positive effect on $\blacktriangle C_{ij}$.

- If there are opposite signs for the terms, then a negative value is calculated for CE_{ij} and has a negative effect on $\blacktriangle C_{ij}$. The negative effect is because region j is either specializing, $(C_{ij} - C^*_{ij}) > 0$, in a lagging commodity, $(c_{ij} - c_{io}) < 0$,or not specializing, $(C_{ij} - C^*_{ij}) < 0$, in a fast growth commodity, $(c_{ij} - c_{io}) > 0$.

- By summing CE_{ij} for all commodities, $CE_{oj} = \Sigma^{s}_{i=1} CE_{ij}$, for each of the four major commodity groups (livestock and products, field crops, fruit & other, and vegetables), produces an indicator of whether region j is specializing (or not specializing) in commodities that they have a competitive position in.

Highlights of the Arcelus Shift-Share Model Results[124]

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[124] Note: all dollars are in nominal terms.

Livestock and Products 1970-1980:

- Dairy Products: Dairy cash receipts expanded from $262.3 millon in 1970 to $637.8 million in 1980. At the national level dairy cash receipts lagged the growth rate of total national cash receipts. This is identified by the negative expected sectoral growth effect of $24.5 million on Michigan dairy receipts. The negative $24.3 million differential sectoral mix effect shows that the state was specializing in a lagging sector in terms of cash receipt growth. From a competitive position nationally Michigan fell slightly behind as the expected competitive effect was a negative $12.2 millon, meaning that national dairy receipts grew at a faster rate than Michigan receipts.

- Hogs: In 1970, Michigan hog receipts of $53.0 millon were substantially below the calculated homothetic component of $89.6 million. Receipts expanded from the $53 in 1970 to $129.7 million in 1980. Nationally the hog sector was slow growing in the 70's. This means that at the national level the growth rate of hog cash receipts was less than total national cash receipts. The lagging national hog receipts are indicated by the negative calculated expected sectoral effect of $56.3 million. Michigan gained ground in its share of national hog receipts. The expected competitive effect was a positive effect of $36.8 million, showing that the state's competitive advantage. From an allocation effect

perspective however, the state did not specialize enough, given the calculated allocation negative effect of $15.4 million. The net competitive effect was a positive $21.4 million. Since the state was not specializing in hogs, the differential sectoral mix effect was a positive $23.6 million.

- Total Livestock & Products: From 1970 to 1980 total livestock & products cash receipts grew from $484.9 million to $1.1 billion. The homothetic component of $590.0 million in 1970 shows that Michigan should have approximately 22% more cash receipts coming from the livestock sector in order to match the national structure. Livestock had negative numbers for both the net competitive ($61.0 million) and net sectoral mix effects ($179.6 million). This indicates that the Michigan livestock sector under performed the nation with regards to specialization in fast growth national commodities and also did not keep pace with the national growth rate for all livestock commodity cash receipts.

Livestock and Products 1980-1990:

- Turkeys: Turkeys showed some of the most positive gains in the livestock group. From 1980 to 1990 turkey cash receipts increased from $15.7 million to $47.7 million. The calculated negative differential effects (national, sectoral, and competitive) resulted because the state was under specialized in a fast growth industry. The homothetic component showed

that the state should have had at least $27.1 million in cash receipts in 1980 to mirror the national proportion. All of the expected effects (national, sectoral, and competitive) are prominently positive. Of particular note is the fact that Michigan turkey receipts out performed the growth rate of national turkey cash receipts.

- Both cattle and calves and broilers showed quite large disparities between their actual level of 1980 cash receipts and their respective homothetic components. Cattle and calves actual cash receipts in 1980 were $216.1 millon and the homothetic component was $687.5 million. Broilers actual cash receipts in 1980 were $2.1 million and the homothetic component was $94.0 million.

- The dairy product sector continued to show negative results in the net competitive effect. The expected competitive effect was a negative $31.9 million and the allocation effect was a negative $24.9 million.

- From 1980 to 1990 total livestock & products cash receipts grew from $1.1 billion to $1.3 billion. The homothetic component of $1.5 billion in 1980 shows that Michigan should have approximately 36% more cash receipts coming from the livestock sector in order to match the national structure. During the decade of the 70's livestock posted negative results

for the net competitive component. In the 80's however, the negative effects were reversed, largely in part to the gains made in hog receipts. Actual hog receipts expanded from $129.7 million in 1980 to $221.3 million in 1990.

Livestock and Products 1970-1990:

- Total Michigan livestock cash receipts grew from $484.9 million in 1970 to $1.3 billion in 1990. Both the net sectoral mix effect ($224.9 million) and the net competitive effect ($35.7 million) are negative.

- Hogs posted the largest net competitive effect gain of $96.0 million.

- The largest negative net competitive effect was for dairy at $85.3 million.

- Broilers and Turkeys are the only two commodities positioned in fast growth sectors. This is evidenced by the calculated positive expected sectoral growth effects. However, the specialization in both commodities was below the homothetic component and they registered negative differential sectoral mix effects.

Field Crops 1970-1980:[125]

- During the 70's field crops posted more favorable gains in cash receipts compared to the livestock sector. Total cash receipts expanded from $241.0 millon in 1970 to $1.08 billion in 1980, up approximately 348%. All net effect components are positive: the net competitive effect was $211.2 million, the net sectoral mix effect was $214.6 million, and the net growth effect was $240.5 million.

- Four crops showed large variations from their 1970 levels of cash receipts and their respective homothetic components. Potatoes, sugar beets, and dry beans all had cash receipts levels in 1970 that were substantially higher than their homothetic components. Barley was the one field crop that was substantially lower than it's homothetic component. Actual barley cash receipts were $390 thousand in 1970 compared to a homothetic component of $6.1 million.

- The largest net competitive effect was corn at $198.1 million. Most of the positive net effect was because of the extremely large expected competitive effect of $210.9 million.

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[125] Note: dry beans from 1970 to 1980 have been covered quite extensively in an example above.

- Soybeans also showed a large positive net competitive effect, $54.1 million. The expected competitive effect of $101.7 million was the second largest for field crops. The negative allocation effect of $47.7 million indicates that the state was under specialized in the commodity.

Field Crops 1980-1990:

- Total Michigan field crop cash receipts declined slightly from $1.09 billion in 1980 to $1.07 billion in 1990. Only six crops (soybeans, hay, potatoes, sugar beets, barley, and mushrooms) showed positive growth in actual cash receipts.

- From a net competitive effect perspective the big gainers were soybeans, hay, and sugar beets. For both soybeans and hay the expected competitive effect was highly positive, meaning the growth rate of the local commodities out paced the national commodities growth rate. Their allocation effect however, was negative implying that Michigan was under specialized in soybeans and hay. Sugar beets on the other hand had both a positive expected effect and allocation effect.

- Michigan dry beans continued to show a steady erosion in its competitive position. The net competitive effect was a negative $70.8 million.

- At the national level potatoes, hay, mint, and mushrooms were fast growth sectors for the field crops, (notice the positive expected sectoral growth effects).

- Field crop totals for both the net sectoral mix effect and the net competitive effect are negative. The total negative expected sectoral effect of $220.4 million shows that at the national level many field crop sectors lagged total national cash receipt growth in the 80's. The positive differential sectoral mix effect of $22.5 million means that the state was not over specializing in lagging national sectors. The net competitive effect was a negative $44.1 million. The state out performed many of the national commodities given the positive expected competitive effect of $131.4 million. However, the allocation effect was a negative $175.5 million, showing the over specialization of some the commodities in lagging sectors.

Field Crops 1970-1990:

- Over the two decades, total cash receipts increased from $241.0 million in 1970 to $1.05 billion in 1990. All three shift-share total net effect components are positive, and all total expected and differential effects are positive except for the allocation effect. The total allocation effect is a negative $242.9 million.

- The negative total allocation effect is primarily a result of two crops, soybeans and dry beans. The negative soybean allocation effect of $106,948 million means that the state under specialized in a fast growth commodity (sector). The expected competitive effect for Michigan soybean cash receipts however, grew faster than national soybean cash receipts and the net competitive effect was $121.3 million. Michigan dry beans on the other hand recorded a negative allocation effect because growth in cash receipts is well below the national growth rate. Dry beans like soybeans were considered a fast growth commodity[126] during the 70's and 80's.

- Michigan corn cash receipts improved in the 70's and 80's with most of the growth occurring in the 70's. Actual cash receipts expanded from $61.0 million in 1970 to $338.7 million in 1990. Nationally corn cash receipts grew faster than total cash receipts and are considered a growth commodity. Michigan's corn receipts actually grew at a faster rate than the national corn receipt rate. This resulted in a highly positive expected competitive effect of $94.7 million.

- From a percentage growth perspective hay was one of the largest field

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[126] Note: the fast growth commodity is identified by the positive expected sectoral growth effect, in this case $2,565 million.

crop gainers. Actual cash receipts increased from $10.7 million in 1970 to $86.8 million in 1990, up 711%. The growth in cash receipts of $76.0 million is decomposed into the positive net effects of $24.2 million from the national growth effect, $19.7 million from the net sectoral mix effect, and $32.1 million from the net competitive effect. Each of the modest negative differential and allocation effects show that the state was slightly under specialized in hay.

Fruit and Other 1970-1980:

- Based on the calculated homothetic component of $22.4 million compared to the total actual 1970 cash receipts of $68.4, Michigan is considered a fruit oriented state. Of the seven fruit crops analyzed, five of the crops had 1970 cash receipts that are above their respective homothetic components.

- During the 70's Michigan's competitive position in the fruit sector eroded. Every commodity except cherries, had negative results for their expected competitive effect. The total expected competitive effect was a negative $20.8 million. This means that Michigan fruit cash receipts grew at a much slower rate than the national fruit cash receipts.

- Cherries showed the most significant gains from a competitive position

(growing faster than the national cherry receipts). The net competitive effect was $4.1 million, with the expected competitive effect $282 thousand and the allocation effect $3.8 million. The numbers are not as favorable however, for the net sectoral mix effect, with a negative $5.7 million, showing that cherries were in a slow growth sector in agriculture.

- Apples, an important fruit crop in the state, did not perform well competitively. The net competitive effect was a negative $9.7 million. This happened despite apples being a fast growth sector[127] at the national level.

- Michigan grape cash receipts fell considerably behind the growth in national grape receipts. Grapes posted a negative net competitive effect of $14.8 million.

- Greenhouse & nursery products cash receipts increased from $30.5 million in 1970 to $108.4 million in 1990, up 256%. All net effect components are positive. Of particular note is the fact that greenhouse and nursery products is considered a fast growth sector, (the positive expected sectoral growth effect of $15.4 million). The state also specialized in the commodity, which yielded a positive differential sectoral mix effect of $9.8

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[127] Note: the net sectoral mix effect was $8.2 million.

million.

Fruit and Other 1980-1990:

- During the decade of the 80's total Michigan fruit cash receipts increased only a slight amount, from $180.6 million in 1980 to $193.5 million in 1990. Nationally the total fruit sector was considered a fast growth industry, (the total expected sectoral growth effect was $17.0 million). Despite the national growth for fruit cash receipts, Michigan continued to lose competitive ground. The expected competitive effect for Michigan was a negative $31.2 million and the allocation effect was a negative $19.8 million, for a combined negative net effect of $51.0 million.

- In absolute terms apples had the largest negative net competitive effect of $23.0 million.[128] At the national level apples are a fast growth commodity. The expected sectoral growth effect was a positive $5.1 million.

- Actual strawberry cash receipts fell from $8.5 million in 1980 to $6.5 million in 1990, down 23.5%. This occurred while national strawberry cash receipts were actually growing faster than total commodity cash receipts. In percentage terms strawberries showed the largest negative

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[128] Note: this was 45% of the negative net competitive effect for all fruit.

competitive effects. The expected competitive effect was a negative $8.3 million and the allocation effect was a negative $3.7 million.

- Blueberries[129] were one of Michigan's fruits that remained competitive in the 80's. Actual cash receipts increased from $19.7 million in 1980 to $27.0 million in 1990. The expected competitive effect was $223 thousand and the allocation effect was $3.6 million.

Fruit and Other 1970-1990:

- The decades of the 70's and 80's were periods of slow growth for Michigan fruit cash receipts compared with national fruit receipts. Every Michigan fruit produced a negative net competitive effect. The total net competitive effect was a negative $101.5 million, while the net sectoral mix effect was $46.0 million.

- From a national perspective grapes were one of the fast growth commodities. The expected sectoral growth effect for Michigan was a highly positive $14.0 million. However, Michigan grape receipts did not keep pace with national grape receipts. This is reflected by the negative expected competitive effect of $23.5 million.

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[129] Note: blueberries were not analyzed in the 70's because the Michigan Agricultural Statistical Service did not then collect data on blueberries.

- Michigan has been a national pacesetter in the production of cherries for years. This leadership is reflected by the large difference between the homothetic component of $1.3 million and the actual cash receipts of $19.4 million in 1970. For the 70's and 80's Michigan cherries experienced slight erosion in the sector. Negative effects were calculated for both the net sectoral mix effect and the net competitive effect. Most of the negative effects are a result of national cherry receipts lagging total commodity receipts.[130]

- Michigan's greenhouse and nursery receipts grew substantially during the 70's and 80's but so did national receipts. Michigan cash receipts increased from $30.5 million in 1970 to $259.7 million in 1990, up 751.5%. The extent of the fast growth in national receipts is highlighted by the expected sectoral growth effect of $102.8 million. From a competitive perspective the growth of Michigan receipts was slightly behind the U.S., this is emphasized by the negative expected competitive effect of $4.6 million.

Vegetables and Melons 1970-1980:

- In 1970 the state had total vegetables and melons cash receipts of $56.5

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[130] In other words Michigan was specializing in a lagging sector.

million compared to a homothetic component of $32.5 million.[131] This stresses the relative importance of this sector to Michigan's agricultural economy.

- From 1970 to 1980 total Michigan vegetable and melon cash receipts increased from $56.5 million to $119.1 million. This sector however, was considered a slow growth sector nationally. The expected sectoral growth effect was a negative $16.0 million and the differential sectoral mix effect was a negative $11.7 million. The negative differential effect shows that the state was specializing in a slow growth group (vegetables and melons).

- Three vegetables (snap beans, celery, and asparagus) displayed the greatest competitive effects. The largest net competitive effect belonged to asparagus of $6.3 million, second celery with $3.0 million and third snap beans with $2.5 million.

- Onions and carrots showed the largest negative net competitive effects. The negative effect for onions was $9.9 million and the negative effect for carrots was $5.7 million. Michigan onions had the negative competitive effect despite being in a fast growth national sector and positive sectoral

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[131] Note: of the 13 commodities analyzed in this sector, 10 had actual 1970 cash receipts that are greater than their respective homothetic components.

mix effects.

Vegetables and Melons 1980-1990:

- In the 80's Michigan vegetable and melon receipts increased from $119.1 million in 1980 to $151.1 million in 1990, up $32.0 million. Michigan continued the same pattern as in the 70's with an even larger negative net competitive effect of $24.5 million. As a group at the national level vegetables and melons moved into a growth sector in the 80's.[132]

- The positive competitive effect trend of asparagus in the 70's shifted during the 80's. In the 80's Michigan asparagus had a negative net competitive effect of $6.3 million, despite a positive expected sectoral growth effect.

- Tomatoes are one of the vegetables to show the smallest growth in receipts. In 1980 Michigan tomato receipts were $17.2 million and in 1990 they had only increased to $18.4 million, up approximately 7.0%. The flat Michigan receipts occurred while national cash receipts for tomatoes had expanded almost 83%. The large divergence in receipt growth rates produced a negative expected competitive effect of $15.8

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[132] Note: the total expected sectoral growth effect was $25.5 million, highlighting vegetables and melons as a fast growth group.

million for Michigan tomatoes.

- Sweet corn, cucumbers and snap beans all yielded positive competitive effects. Snap beans had the largest net competitive effect of $3.4 million, followed by cucumbers with a competitive effect of $3.0 million, and sweet corn had a competitive effect of $2.4 million.

Vegetables and Melons 1970-1990:

- During the decades of the 70's and 80's total Michigan vegetables and melons cash receipts increased $94.6 million. Nationally the group's cash receipts grew at a slightly faster pace than total commodity cash receipts.

- Michigan's competitive position for vegetables and melons eroded in during the 70's and 80's. The expected competitive effect was a negative $22.3 million and the allocation effect was a negative $11.0 million.[133]

- Four vegetable crops with large positive expected competitive effects were: sweet corn, snap beans, asparagus, and peppers. Most of the gains for these commodities happened in the 80's. Sweet corn and peppers

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[133] The negative allocation effect shows that the state was over specialized in vegetables and melons that grew at a slower rate than national vegetables and melons cash receipts.

improved their competitive positions in fast growth sectors.[134] Snap beans and asparagus however, improved their competitive positions despite being in slow growth sectors.[135]

- Three commodities with the largest negative expected competitive effects were: tomatoes, lettuce, and onions. Tomatoes and lettuce had negative expected competitive effects of $14.3 million and $7.4 million. Each of these commodities however had positive allocation effects[136] that offset the adverse expected competitive effects. Onions had the largest negative net competitive effect for all vegetables of $14.7 million.

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[134] Note: the positive expected sectoral growth effects for each commodity.

[135] Note: the negative expected sectoral growth effects for each commodity.

[136] The positive allocation effects for tomatoes and lettuce show that the state was not specialized in these commodities.

Chapter V
Shift-Share
Tables

Table VI Shift-Share Analysis of Livestock & Products Cash Receipts, 1970-1980

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: LIVESTOCK & PRODUCTS, PERIOD OF EVALUATION 1970 & 1980, ($ 000's)

Commodities:	Cattle & Calves	Dairy Products	Hogs	Eggs	Broilers	Turkeys	Sheep & Lambs	Farm Chickens	Honey	Total Livestock
1970 Cash Receipts	119,231	262,277	52,038	38,975	922	4,796	3,643	1,547	1,437	484,866
Homothetic Component	277,366	131,540	89,631	42,108	30,243	9,755	6,552	1,982	899	590,076
Expected National Growth Effect	474,466	225,013	153,323	72,031	51,733	16,688	11,208	3,390	1,537	1,009,390
Differential National Growth Effect	(270,508)	223,641	(64,306)	(5,359)	(50,157)	(8,484)	(4,977)	(744)	921	(179,972)
Net Growth Effect:	203,958	448,654	89,017	66,672	1,577	8,204	6,231	2,646	2,458	829,418
Expected Sectoral Growth Effect	(114,127)	(24,457)	(56,304)	(45,430)	5,184	(1,335)	(8,647)	(2,523)	142	(247,498)
Differential Sectoral Mix Effect	65,067	(24,308)	23,615	3,380	(5,026)	679	3,839	554	85	67,885
Net Sectoral Mix Effect:	(49,060)	(48,766)	(32,689)	(42,050)	158	(656)	(4,807)	(1,970)	227	(179,613)
Expected Competitive Effect	(134,941)	(12,220)	36,795	(1,090)	(17,782)	6,861	(1,387)	(244)	(521)	(124,527)
Allocation Effect	76,934	(12,146)	(15,433)	81	17,240	(3,488)	616	53	(312)	63,546
Net Competitive Effect:	(58,007)	(24,366)	21,363	(1,009)	(542)	3,373	(771)	(190)	(833)	(60,981)
1980 Cash Receipts	216,123	637,800	129,729	62,589	2,114	15,717	4,296	2,034	3,289	1,073,690
Change in Cash Receipts	96,892	375,523	77,691	23,613	1,193	10,921	653	487	1,852	588,824

Table VII Shift-Share Analysis of Livestock & Products Cash Receipts, 1980-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: LIVESTOCK & PRODUCTS, PERIOD OF EVALUATION 1980 & 1990, ($ 000's)

Commodities:	Cattle & Calves	Dairy Products	Hogs	Eggs	Broilers	Turkeys	Sheep & Lambs	Farm Chickens	Honey	Total Livestock
1980 Cash Receipts	216,123	637,800	129,729	62,589	2,114	15,717	4,296	2,034	3,289	1,073,690
Homothetic Component	687,540	358,047	201,236	74,079	93,971	27,071	9,825	3,072	2,779	1,457,620
Expected National Growth Effect	134,998	70,302	39,513	14,545	18,451	5,315	1,929	603	546	286,202
Differential National Growth Effect	(92,562)	54,929	(14,040)	(2,256)	(18,036)	(2,229)	(1,086)	(204)	100	(75,384)
Net Growth Effect:	42,436	125,231	25,472	12,289	415	3,086	843	399	646	210,818
Expected Sectoral Growth Effect	22,171	(9,736)	(8,027)	(3,528)	72,724	18,070	(2,320)	(1,527)	(993)	86,833
Differential Sectoral Mix Effect	(15,202)	(7,607)	2,852	547	(71,087)	(7,579)	1,306	516	(182)	(96,436)
Net Sectoral Mix Effect:	6,969	(17,344)	(5,175)	(2,981)	1,636	10,491	(1,014)	(1,011)	(1,176)	(9,603)
Expected Competitive Effect	34,599	(31,904)	110,593	(6,586)	(139,293)	31,706	376	133	1,287	910
Allocation Effect	(23,723)	(24,928)	(39,298)	1,021	136,159	(13,298)	(211)	(45)	236	35,915
Net Competitive Effect:	10,876	(56,832)	71,295	(5,564)	(3,134)	18,408	164	88	1,524	36,825
1990 Cash Receipts	276,404	688,855	221,322	66,333	1,032	47,702	4,289	1,510	4,282	1,311,730
Change in Cash Receipts	60,281	51,056	91,593	3,744	(1,083)	31,985	(7)	(523)	994	238,040

Table VIII Shift-Share Analysis of Livestock & Products Cash Receipts, 1970-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: LIVESTOCK & PRODUCTS, PERIOD OF EVALUATION 1970 & 1990, ($ 000's)

Commodities:	Cattle & Calves	Dairy Products	Hogs	Eggs	Broilers	Turkeys	Sheep & Lambs	Farm Chickens	Honey	Total Livestock
1970 Cash Receipts	119,231	262,277	52,038	38,975	922	4,796	3,643	1,547	1,437	484,866
Homothetic Component	277,366	131,540	89,631	42,108	30,243	9,755	6,552	1,982	899	590,076
Expected National Growth Effect	622,088	295,022	201,027	94,442	67,829	21,880	14,695	4,445	2,015	1,323,443
Differential National Growth Effect	(354,671)	293,223	(84,313)	(7,027)	(65,762)	(11,123)	(6,525)	(976)	1,207	(235,967)
Net Growth Effect:	267,416	588,245	116,713	87,415	2,067	10,757	8,170	3,470	3,223	1,087,476
Expected Sectoral Growth Effect	(115,972)	(38,290)	(74,804)	(57,622)	73,654	15,163	(12,496)	(4,435)	(752)	(215,555)
Differential Sectoral Mix Effect	66,119	(38,057)	31,374	4,287	(71,409)	(7,709)	5,549	973	(450)	(9,322)
Net Sectoral Mix Effect:	(49,853)	(76,347)	(43,430)	(53,335)	2,245	7,455	(6,948)	(3,461)	(1,202)	(224,877)
Expected Competitive Effect	(140,488)	(42,790)	165,351	(7,263)	(137,874)	50,232	(1,036)	(57)	516	(113,410)
Allocation Effect	80,096	(42,529)	(69,350)	540	133,672	(25,537)	460	13	309	77,674
Net Competitive Effect:	(60,391)	(85,319)	96,000	(6,723)	(4,202)	24,695	(576)	(45)	825	(35,736)
1990 Cash Receipts	276,404	688,855	221,322	66,333	1,032	47,702	4,289	1,510	4,282	1,311,730
Change in Cash Receipts	157,172	426,578	169,284	27,358	110	42,906	646	(37)	2,845	826,863

Table IX Shift-Share Analysis of Field Crops Cash Receipts, 1970-1980

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: FIELD CROPS, PERIOD OF EVALUATION 1970 & 1980, ($ 000's)

Commodities:	Corn	Soybeans	Wheat	Hay	Potatoes	Sugar Beets	Barley
1970 Cash Receipts	61,012	33,389	26,575	10,770	21,060	22,587	390
Homothetic Component	64,946	62,829	39,728	12,887	12,553	7,804	6,091
Expected National Growth Effect	111,097	107,476	67,959	22,045	21,474	13,350	10,420
Differential National Growth Effect	(6,729)	(50,361)	(22,500)	(3,622)	14,552	25,288	(9,753)
Net Growth Effect:	104,368	57,116	45,459	18,423	36,026	38,638	667
Expected Sectoral Growth Effect	78,573	96,352	74,866	2,099	(6,137)	(777)	(1,256)
Differential Sectoral Mix Effect	(4,759)	(45,148)	(24,786)	(345)	(4,159)	(1,472)	1,176
Net Sectoral Mix Effect:	73,814	51,204	50,080	1,754	(10,296)	(2,249)	(80)
Expected Competitive Effect	210,870	101,712	(1,901)	(8,890)	1,938	4,623	8,001
Allocation Effect	(12,772)	(47,660)	629	1,461	1,313	8,757	(7,489)
Net Competitive Effect:	198,098	54,052	(1,271)	(7,430)	3,252	13,381	512
1980 Cash Receipts	437,293	195,761	120,843	23,518	50,042	72,357	1,489
Change in Cash Receipts	376,281	162,372	94,268	12,748	28,982	49,770	1,099

Table IX (Continued), Shift-Share Analysis of Field Crops Cash Receipts, 1970-1980

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: FIELD CROPS, PERIOD OF EVALUATION 1970 & 1980, ($ 000's)

Commodities:	Oats	Dry Beans	Mushrooms	Rye	Mint	Total Field Crops
1970 Cash Receipts	7,066	56,233	n.a.	648	1,283	241,014
Homothetic Component	4,366	3,129	n.a.	610	545	215,490
Expected National Growth Effect	7,469	5,353	n.a.	1,043	933	368,620
Differential National Growth Effect	4,618	90,841	n.a.	66	1,261	43,662
Net Growth Effect:	12,087	96,193	n.a.	1,109	2,194	412,281
Expected Sectoral Growth Effect	(5,462)	3,378	n.a.	(952)	(196)	240,488
Differential Sectoral Mix Effect	(3,377)	57,320	n.a.	(60)	(265)	(25,876)
Net Sectoral Mix Effect:	(8,839)	60,698	n.a.	(1,012)	(462)	214,612
Expected Competitive Effect	6,842	(3,295)	n.a.	151	(601)	319,451
Allocation Effect	4,230	(55,922)	n.a.	10	(813)	(108,255)
Net Competitive Effect:	11,072	(59,217)	n.a.	161	(1,414)	211,196
1980 Cash Receipts	21,386	153,908	n.a.	906	1,501	1,079,104
Change in Cash Receipts	14,320	97,675	n.a.	258	318	838,090

Table X Shift-Share Analysis of Field Crops Cash Receipts, 1980-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: FIELD CROPS, PERIOD OF EVALUATION 1980 & 1990, ($ 000's)

Commodities:	Corn	Soybeans	Wheat	Hay	Potatoes	Sugar Beets	Barley
1980 Cash Receipts	437,293	195,761	120,843	23,518	50,042	72,357	1,489
Homothetic Component	274,514	287,496	196,820	39,926	30,070	21,970	16,447
Expected National Growth Effect	53,901	56,450	38,645	7,839	5,904	4,314	3,229
Differential National Growth Effect	31,962	(18,012)	(14,918)	(3,222)	3,922	9,894	(2,937)
Net Growth Effect:	85,862	38,438	23,727	4,618	9,826	14,207	292
Expected Sectoral Growth Effect	(48,466)	(111,198)	(94,604)	22,711	14,191	(1,251)	(2,355)
Differential Sectoral Mix Effect	(28,739)	35,481	36,519	(9,333)	9,426	(2,870)	2,141
Net Sectoral Mix Effect:	(77,205)	(75,717)	(58,085)	13,378	23,617	(4,121)	(213)
Expected Competitive Effect	(67,349)	113,868	10,884	76,825	(7,036)	8,479	7,888
Allocation Effect	(39,936)	(36,333)	(4,201)	(31,572)	(4,673)	19,447	(7,174)
Net Competitive Effect:	(107,285)	77,535	6,682	45,253	(11,709)	27,926	714
1990 Cash Receipts	338,665	236,017	93,168	86,767	71,777	110,369	2,282
Change in Cash Receipts	(98,628)	40,256	(27,675)	63,249	21,734	38,012	793

Table X (Continued) Shift-Share Analysis of Field Crops Cash Receipts, 1980-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: FIELD CROPS, PERIOD OF EVALUATION 1980 & 1990, ($ 000's)

Commodities:	Oats	Dry Beans	Mushrooms	Rye	Mint	Total Field Crops
1980 Cash Receipts	21,386	153,908	14,684	906	1,601	1,093,788
Homothetic Component	6,871	12,786	7,574	756	1,382	896,612
Expected National Growth Effect	1,349	2,511	1,487	148	271	176,049
Differential National Growth Effect	2,850	27,709	1,396	29	43	38,715
Net Growth Effect:	4,199	30,220	2,883	178	314	214,764
Expected Sectoral Growth Effect	(3,546)	(1,591)	5,191	(541)	1,079	(220,378)
Differential Sectoral Mix Effect	(7,490)	(17,555)	4,873	(107)	170	22,516
Net Sectoral Mix Effect:	(11,036)	(19,146)	10,065	(648)	1,249	(197,861)
Expected Competitive Effect	(1,172)	(5,884)	(3,624)	129	(1,613)	131,396
Allocation Effect	(2,475)	(64,943)	(3,402)	26	(255)	(175,492)
Net Competitive Effect:	(3,647)	(70,827)	(7,026)	155	(1,868)	(44,096)
1990 Cash Receipts	10,902	94,155	20,606	591	1,296	1,066,595
Change in Cash Receipts	(10,484)	(59,753)	5,922	(315)	(305)	(27,193)

Table XI Shift-Share Analysis of Field Crops Cash Receipts, 1970-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: FIELD CROPS, PERIOD OF EVALUATION 1970 & 1990, ($ 000's)

Commodities:	Corn	Soybeans	Wheat	Hay	Potatoes	Sugar Beets	Barley
1970 Cash Receipts	61,012	33,389	26,575	10,770	21,060	22,587	390
Homothetic Component	64,946	62,829	39,728	12,887	12,553	7,804	6,091
Expected National Growth Effect	145,663	140,915	89,103	28,904	28,155	17,504	13,662
Differential National Growth Effect	(8,823)	(66,029)	(29,500)	(4,749)	19,080	33,156	(12,787)
Net Growth Effect:	136,841	74,886	59,603	24,155	47,235	50,660	875
Expected Sectoral Growth Effect	49,048	12,133	1,820	23,577	5,821	(2,090)	(3,687)
Differential Sectoral Mix Effect	(2,971)	(5,685)	(603)	(3,874)	3,944	(3,959)	3,451
Net Sectoral Mix Effect:	46,077	6,448	1,217	19,703	9,765	(6,050)	(236)
Expected Competitive Effect	100,843	228,242	8,630	38,457	(3,746)	14,917	19,581
Allocation Effect	(6,108)	(106,948)	(2,857)	(6,318)	(2,538)	28,255	(18,327)
Net Competitive Effect:	94,735	121,294	5,773	32,138	(6,284)	43,172	1,254
1990 Cash Receipts	338,665	236,017	93,168	86,767	71,777	110,369	2,282
Change in Cash Receipts	277,653	202,628	66,593	75,997	50,716	87,782	1,892

Table XI (Continued) Shift-Share Analysis of Field Crops Cash Receipts, 1970-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: FIELD CROPS, PERIOD OF EVALUATION 1970 & 1990, ($ 000's)

Commodities:	Oats	Dry Beans	Mushrooms	Rye	Mint	Total Field Crops
1970 Cash Receipts	7,066	56,233	n.a.	648	1,283	241,014
Homothetic Component	4,366	3,129	n.a.	610	545	215,490
Expected National Growth Effect	9,793	7,018	n.a.	1,368	1,223	483,309
Differential National Growth Effect	6,055	119,104	n.a.	86	1,654	57,246
Net Growth Effect:	15,847	126,122	n.a.	1,454	2,877	540,555
Expected Sectoral Growth Effect	(9,823)	2,565	n.a.	(1,641)	766	78,488
Differential Sectoral Mix Effect	(6,073)	43,539	n.a.	(103)	1,035	28,700
Net Sectoral Mix Effect:	(15,897)	46,104	n.a.	(1,744)	1,800	107,188
Expected Competitive Effect	2,401	(7,473)	n.a.	218	(1,983)	400,086
Allocation Effect	1,484	(126,831)	n.a.	14	(2,681)	(242,855)
Net Competitive Effect:	3,885	(134,305)	n.a.	232	(4,664)	157,231
1990 Cash Receipts	10,902	94,155	n.a.	591	1,296	1,045,989
Change in Cash Receipts	3,836	37,922	n.a.	(58)	13	804,975

Table XII Shift-Share Analysis of Fruit & Other Cash Receipts, 1970-1980

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: FRUIT & OTHER, PERIOD OF EVALUATION 1970 & 1980, ($ 000's)

Commodities:	Grapes	Apples	Peaches	Straw-berries	Cherries	Plums & Prunes	Pears	Blueberries	Total Fruit	Greenhouse & Nursery
1970 Cash Receipts	7,159	28,571	4,943	5,722	19,392	1,233	1,400	n.a.	68,421	30,479
Homothetic Component	6,395	6,058	3,571	2,283	1,343	1,369	1,402	n.a.	22,421	18,604
Expected National Growth Effect	10,940	10,363	6,108	3,905	2,298	2,342	2,398	n.a.	38,354	31,823
Differential National Growth Effect	1,307	38,511	2,348	5,884	30,875	(233)	(3)	n.a.	78,688	20,314
Net Growth Effect:	12,247	48,874	8,456	9,788	33,172	2,109	2,395	n.a.	117,042	52,138
Expected Sectoral Growth Effect	7,788	1,743	(2,545)	(766)	(395)	21	(350)	n.a.	5,495	15,354
Differential Sectoral Mix Effect	930	6,476	(978)	(1,154)	(5,313)	(2)	0	n.a.	(40)	9,801
Net Sectoral Mix Effect:	8,718	8,218	(3,524)	(1,919)	(5,708)	19	(350)	n.a.	5,455	25,155
Expected Competitive Effect	(13,232)	(2,062)	(1,894)	(2,032)	282	(354)	(1,525)	n.a.	(20,817)	350
Allocation Effect	(1,581)	(7,663)	(728)	(3,062)	3,784	35	2	n.a.	(9,213)	223
Net Competitive Effect:	(14,813)	(9,725)	(2,622)	(5,094)	4,066	(318)	(1,523)	n.a.	(30,029)	573
1980 Cash Receipts	13,311	75,939	7,254	8,497	50,922	3,043	1,922	n.a.	160,888	108,345
Change in Cash Receipts	6,152	47,367	2,311	2,775	31,530	1,810	522	n.a.	92,467	77,866

Table XIII Shift-Share Analysis of Fruit & Other Cash Receipts, 1980-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: FRUIT & OTHER, PERIOD OF EVALUATION 1980 & 1990, ($ 000's)

Commodities:	Grapes	Apples	Peaches	Straw-berries	Cherries	Plums & Prunes	Pears	Blueberries	Total Fruit	Greenhouse & Nursery
1980 Cash Receipts	13,311	75,939	7,254	8,497	50,922	3,043	1,922	19,712	180,600	108,345
Homothetic Component	27,086	19,584	7,691	5,845	3,499	4,024	3,719	1,149	72,598	70,921
Expected National Growth Effect	5,318	3,845	1,510	1,148	687	790	730	226	14,255	13,925
Differential National Growth Effect	(2,705)	11,065	(86)	521	9,311	(193)	(353)	3,645	21,206	7,348
Net Growth Effect:	2,614	14,910	1,424	1,668	9,998	597	377	3,870	35,461	21,273
Expected Sectoral Growth Effect	5,032	5,117	(1,018)	5,713	(159)	1,026	1,296	(23)	16,983	91,015
Differential Sectoral Mix Effect	(2,559)	14,725	58	2,591	(2,158)	(250)	(626)	(378)	11,404	48,027
Net Sectoral Mix Effect:	2,473	19,842	(960)	8,304	(2,317)	776	670	(401)	28,387	139,042
Expected Competitive Effect	(11,856)	(5,941)	1,329	(8,261)	(786)	(2,823)	(3,115)	223	(31,232)	(5,858)
Allocation Effect	6,030	(17,097)	(76)	(3,748)	(10,656)	688	1,505	3,596	(19,757)	(3,091)
Net Competitive Effect:	(5,827)	(23,038)	1,253	(12,009)	(11,442)	(2,135)	(1,610)	3,819	(50,989)	(8,949)
1990 Cash Receipts	12,571	87,653	8,972	6,460	47,161	2,282	1,359	27,000	193,459	259,711
Change in Cash Receipts	(740)	11,715	1,717	(2,036)	(3,761)	(761)	(563)	7,288	12,859	151,366

Table XIV Shift-Share Analysis of Fruit & Other Cash Receipts, 1970-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: FRUIT & OTHER, PERIOD OF EVALUATION 1970 & 1990, ($ 000's)

Commodities:	Grapes	Apples	Peaches	Straw-berries	Cherries	Plums & Prunes	Pears	Blueberries	Total Fruit	Greenhouse & Nursery
1970 Cash Receipts	7,159	28,571	4,943	5,722	19,392	1,233	1,400	n.a.	68,421	30,479
Homothetic Component	6,395	6,058	3,571	2,283	1,343	1,369	1,402	n.a.	22,421	18,604
Expected National Growth Effect	14,344	13,588	8,009	5,119	3,013	3,071	3,144	n.a.	50,287	41,725
Differential National Growth Effect	1,713	50,493	3,078	7,714	40,481	(306)	(4)	n.a.	103,170	26,635
Net Growth Effect:	16,057	64,081	11,087	12,834	43,493	2,765	3,140	n.a.	153,457	68,359
Expected Sectoral Growth Effect	13,984	6,831	(3,989)	4,383	(621)	977	783	n.a.	22,348	102,787
Differential Sectoral Mix Effect	1,670	25,385	(1,533)	6,604	(8,340)	(97)	(1)	n.a.	23,688	65,613
Net Sectoral Mix Effect:	15,655	32,215	(5,523)	10,987	(8,961)	880	782	n.a.	46,036	168,400
Expected Competitive Effect	(23,494)	(7,891)	(1,110)	(9,208)	(468)	(2,884)	(3,967)	n.a.	(49,021)	(4,595)
Allocation Effect	(2,806)	(29,323)	(426)	(13,875)	(6,295)	287	5	n.a.	(52,434)	(2,933)
Net Competitive Effect:	(26,300)	(37,214)	(1,536)	(23,082)	(6,763)	(2,597)	(3,963)	n.a.	(101,455)	(7,528)
1990 Cash Receipts	12,571	87,653	8,972	6,460	47,161	2,282	1,359	n.a.	166,459	259,711
Change in Cash Receipts	5,412	59,082	4,028	738	27,769	1,049	(41)	n.a.	98,038	229,232

Table XV Shift-Share Analysis of Vegetables & Melons Cash Receipts, 1970-1980

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: VEGETABLES AND MELONS, PERIOD OF EVALUATION 1970 & 1980, ($ 000's)

Commodities:	Tomatoes	Lettuce	Sweet Corn	Snap Beans	Onions	Carrots	Cantaloupes
1970 Cash Receipts	7,561	2,259	2,924	3,040	6,691	9,012	1,241
Homothetic Component	8,705	5,314	2,614	2,109	2,083	1,778	1,849
Expected National Growth Effect	14,890	9,090	4,471	3,608	3,563	3,041	3,162
Differential National Growth Effect	(1,956)	(5,225)	531	1,592	7,883	12,375	(1,039)
Net Growth Effect:	12,934	3,865	5,002	5,200	11,446	15,416	2,123
Expected Sectoral Growth Effect	(4,221)	(2,626)	(1,452)	(1,759)	2,260	(1,615)	(1,683)
Differential Sectoral Mix Effect	555	1,510	(172)	(777)	5,000	(6,574)	553
Net Sectoral Mix Effect:	(3,666)	(1,117)	(1,624)	(2,536)	7,260	(8,190)	(1,130)
Expected Competitive Effect	372	2,529	120	1,721	(3,085)	(1,123)	1,429
Allocation Effect	(49)	(1,453)	14	759	(6,825)	(4,570)	(470)
Net Competitive Effect:	323	1,075	134	2,480	(9,911)	(5,693)	960
1980 Cash Receipts	17,152	6,083	6,436	8,184	15,487	10,546	3,194
Change in Cash Receipts	9,591	3,823	3,512	5,144	8,796	1,534	1,953

Table XV (Continued) Shift-Share Analysis of Vegetables & Melons Cash Receipts, 1970-1980

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: VEGETABLES AND MELONS, FERIOD OF EVALUATION 1970 & 1980, ($ 000's)

Commodities:	Cucumbers	Celery	Cabbage	Asparagus	Peppers	Cauliflower	Total Vegetables
1970 Cash Receipts	9,733	5,080	2,843	4,312	1,220	597	56,515
Homothetic Component	1,781	1,790	1,562	1,229	1,185	537	32,534
Expected National Growth Effect	3,046	3,061	2,672	2,102	2,026	919	55,652
Differential National Growth Effect	13,604	5,629	2,191	5,275	61	102	41,022
Net Growth Effect:	16,650	8,690	4,863	7,377	2,087	1,021	96,675
Expected Sectoral Growth Effect	(1,098)	(1,270)	(1,009)	(1,481)	(623)	532	(16,045)
Differential Sectoral Mix Effect	(4,902)	(2,335)	(827)	(3,715)	(19)	59	(11,645)
Net Sectoral Mix Effect:	(6,000)	(3,604)	(1,837)	(5,196)	(641)	592	(27,690)
Expected Competitive Effect	(608)	1,062	(1,259)	1,782	671	(96)	3,515
Allocation Effect	(2,717)	1,954	(1,032)	4,472	20	(11)	(9,908)
Net Competitive Effect:	(3,325)	3,016	(2,291)	6,254	691	(107)	(6,393)
1980 Cash Receipts	17,058	13,182	3,579	12,747	3,357	2,102	119,107
Change in Cash Receipts	7,325	8,102	736	8,435	2,137	1,505	62,592

Table XVI Shift-Share Analysis of Vegetables & Melons Cash Receipts, 1980-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: VEGETABLES AND MELONS, PERIOD OF EVALUATION 1980 & 1990, ($ 000's)

Commodities:	Tomatoes	Lettuce	Sweet Corn	Snap Beans	Onions	Carrots	Cantaloupes
1980 Cash Receipts	17,152	6,083	6,436	8,184	15,487	10,546	3,194
Homothetic Component	20,888	12,698	6,073	4,267	8,524	3,453	3,588
Expected National Growth Effect	4,101	2,493	1,192	838	1,674	678	704
Differential National Growth Effect	(734)	(1,299)	71	769	1,367	1,393	(77)
Net Growth Effect:	3,368	1,194	1,264	1,607	3,041	2,071	627
Expected Sectoral Growth Effect	13,200	3,753	3,107	(461)	2,013	2,240	(641)
Differential Sectoral Mix Effect	(2,361)	(1,955)	186	(423)	1,645	4,601	70
Net Sectoral Mix Effect:	10,839	1,798	3,293	(884)	3,658	6,841	(571)
Expected Competitive Effect	(15,839)	(9,940)	2,238	1,749	(278)	(1,051)	(1,575)
Allocation Effect	2,833	5,178	134	1,606	(228)	(2,159)	173
Net Competitive Effect:	(13,006)	(4,762)	2,371	3,355	(506)	(3,210)	(1,402)
1990 Cash Receipts	18,353	4,313	13,364	12,263	21,680	16,247	1,848
Change in Cash Receipts	1,201	(1,769)	6,928	4,079	6,193	5,701	(1,346)

Table XVI (Continued) Shift-Share Analysis of Vegetables & Melons Cash Receipts, 1980-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: VEGETABLES AND MELONS, PERIOD OF EVALUATION 1980 & 1990, ($ 000's)

Commodities:	Cucumbers	Celery	Cabbage	Asparagus	Peppers	Cauliflower	Total Vegetables
1980 Cash Receipts	17,058	13,182	3,579	12,747	3,357	2,102	119,107
Homothetic Component	4,021	3,861	3,477	1,995	2,790	2,143	77,779
Expected National Growth Effect	790	758	683	392	548	421	15,272
Differential National Growth Effect	2,560	1,830	20	2,111	111	(8)	8,115
Net Growth Effect:	3,349	2,588	703	2,503	659	413	23,387
Expected Sectoral Growth Effect	(0)	376	(2,014)	868	1,436	1,668	25,546
Differential Sectoral Mix Effect	(1)	907	(59)	4,681	292	(32)	7,549
Net Sectoral Mix Effect:	(1)	1,282	(2,073)	5,549	1,728	1,636	33,096
Expected Competitive Effect	708	(1,137)	761	(981)	628	(1,735)	(26,453)
Allocation Effect	2,296	(2,746)	22	(5,287)	128	34	1,984
Net Competitive Effect:	3,004	(3,883)	784	(6,268)	756	(1,701)	(24,469)
1990 Cash Receipts	23,410	13,170	2,992	14,532	6,500	2,449	151,120
Change in Cash Receipts	6,352	(13)	(587)	1,784	3,143	347	32,013

Table XVII Shift-Share Analysis of Vegetables & Melons Cash Receipts, 1970-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: VEGETABLES AND MELONS, PERIOD OF EVALUATION 1970 & 1990, ($ 000's)

Commodities:	Tomatoes	Lettuce	Sweet Corn	Snap Beans	Onions	Carrots	Cantaloupes
1970 Cash Receipts	7,561	2,259	2,924	3,040	6,691	9,012	1,241
Homothetic Component	8,705	5,314	2,614	2,109	2,083	1,778	1,849
Expected National Growth Effect	19,523	11,918	5,862	4,730	4,672	3,987	4,146
Differential National Growth Effect	(2,565)	(6,851)	696	2,088	10,336	16,225	(1,362)
Net Growth Effect:	16,958	5,067	6,558	6,818	15,008	20,212	2,784
Expected Sectoral Growth Effect	7,194	339	1,145	(2,532)	4,571	145	(2,608)
Differential Sectoral Mix Effect	(945)	(195)	136	(1,118)	10,113	591	857
Net Sectoral Mix Effect:	6,249	144	1,281	(3,650)	14,684	736	(1,751)
Expected Competitive Effect	(14,293)	(7,427)	2,325	4,201	(4,577)	(2,705)	(634)
Allocation Effect	1,878	4,269	276	1,854	(10,126)	(11,009)	208
Net Competitive Effect:	(12,415)	(3,158)	2,601	6,055	(14,703)	(13,714)	(426)
1990 Cash Receipts	18,353	4,313	13,364	12,263	21,680	16,247	1,848
Change in Cash Receipts	10,792	2,054	10,440	9,223	14,989	7,235	607

Table XVII (Continued) Shift-Share Analysis of Vegetables & Melons Cash Receipts, 1970-1990

SHIFT-SHARE ANALYSIS OF AGRICULTURAL CASH RECEIPTS, MICHIGAN VERSUS THE UNITED STATES
SECTOR: VEGETABLES AND MELONS, PERIOD OF EVALUATION 1970 & 1990, ($ 000's)

Commodities:	Cucumbers	Celery	Cabbage	Asparagus	Peppers	Cauliflower	Total Vegetables
1970 Cash Receipts	9,733	5,080	2,843	4,312	1,220	597	56,515
Homothetic Component	1,781	1,790	1,562	1,229	1,185	537	32,534
Expected National Growth Effect	3,994	4,014	3,504	2,756	2,657	1,204	72,968
Differential National Growth Effect	17,836	7,381	2,873	6,916	79	134	53,786
Net Growth Effect:	21,830	11,394	6,376	9,672	2,736	1,338	126,753
Expected Sectoral Growth Effect	(1,314)	(1,171)	(3,076)	(966)	587	2,184	4,500
Differential Sectoral Mix Effect	(5,866)	(2,153)	(2,522)	(2,423)	18	243	(3,264)
Net Sectoral Mix Effect:	(7,179)	(3,323)	(5,597)	(3,389)	605	2,427	1,235
Expected Competitive Effect	(178)	6	(346)	1,122	1,883	(1,721)	(22,346)
Allocation Effect	(796)	12	(284)	2,815	56	(191)	(11,037)
Net Competitive Effect:	(974)	18	(630)	3,937	1,939	(1,912)	(33,383)
1990 Cash Receipts	23,410	13,170	2,992	14,532	6,500	2,449	151,120
Change in Cash Receipts	13,677	8,089	149	10,219	5,280	1,853	94,606

VI. THE APPLICATION OF INPUT-OUTPUT MODELING TO ASSESS THE LINKAGES AND IMPACT OF PRODUCTION AGRICULTURE ON THE STATE OF MICHIGAN'S ECONOMY

Introduction

The following chapter interprets the research findings[137] of the I-O (I-input, O-output) model, micro IMPLAN,[138] pertaining to Michigan production agriculture. The IMPLAN model provides an understanding of the linkages and impacts of Michigan's production agriculture on the state's economy. The I-O model also provides information regarding the state's supply and demand relationships for goods and services, trade flow accounts, and economic multipliers. Economic multipliers are useful measurements in the estimation of economic impacts in the state's economy resulting from a change in the final demand of goods or services from a particular sector[139] (this will be described below in greater detail). The trade flow accounts produced show the supply, demand, export and import levels (in dollars) for each of IMPLAN's 528 sectors of Michigan's economy.

In this chapter the estimated multipliers and trade accounts are displayed

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[137] Note: each micro IMPLAN model utilizes large quantities of Michigan specific data and generates numerous econometric results. Of particular importance to the quality of the analysis is the use of production agriculture data that is based on the 1992 United States Census of Agriculture for Michigan.

[138] See the "Methods" chapter III for a more comprehensive discussion of the method of I-O analysis and an overview of micro IMPLAN.

[139] IMPLAN's data base consists of 528 different industrial sectors.

in a tabular format. Each table is arranged by the major Michigan production agriculture sub-sectors: crop, livestock, and miscellaneous, (e.g., dairy farm products, fruits, and feed grains) plus aggregated nonagricultural sectors such as manufacturing, trade, and services. The inclusion of the nonagricultural subsectors in the I-O analysis provides a benchmark to compare Michigan production agriculture against the other sectors of the economy.

In order to assist the reader with the interpretation of the multiplier and trade account results, key terms and definitions are presented. It is suggested that the reader review the definitions for the different I-O variables before proceeding.[140]

For purposes of this study three different multiplier classifications were calculated, they are as follows: (1) employment, (2) output, and (3) total income. Each multiplier classification is further separated into two different "Types," of impacts. The different multiplier impacts are designated as a "Type I" or a "Type III" coefficient. The foundations of the multipliers are the economic impacts known as the direct effect, indirect effect and induced effect. The "Type I" multiplier is a composition of the direct, and indirect effects and the "Type III" multiplier is described in terms of the direct, indirect, and induced effects. The following is a list of the definitions of the

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[140] Note: IMPLAN calculates a Type III multiplier instead of the typical Type II found in most other I-O models, this is discussed in the methods Chapter III.

three different effects:

Direct Effect: Is a change in production associated with the immediate effect of a change in final demand for a good or service.

Indirect Effect: Is the change in production in backward-linked industries (sectors) caused by a change in input needs of the directly effected industry.

Induced Effect: Is the change in regional household spending patterns caused by changes in household income, generated from the direct and indirect effects.

Total Effect: The total effect is the combination of both the indirect and induced effects.

An example will help clarify the process of how a change in the final demand for a good or service in a specific sector, influences the rest of the economy. For example, assume that there is a significant increase[141] in the demand (consumption) for low fat fluid milk in Michigan, and focus on the dairy producer as the pivotal link in the economy. The initial response in the economy would be a ***direct effect*** by the producer (farmer) to increase output (more fluid milk) to meet the rise in demand. In the long-run the producer will demand more production inputs (livestock, labor, feed, capital, etc.), causing an increase in output from all the backward-linked industries that supply the farmer their inputs, this is called the ***indirect effect***. The last stage of the response to an increase in final demand is called the ***induced***

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[141] Note: a reduction (instead of an increase) in final demand can also be used to model negative economic impacts, for example, a manufacturing plant closing and the repercussions (loss of jobs, income, etc.).

effect. The induced effect captures the changes in income and employment patterns beyond the farm level as transactions and spending spread throughout the economy at large.

Employment, Output, and Personal Income Multipliers Explained

Employment Multipliers

The Type I and Type III employment multipliers[142] are estimates of the direct, indirect, and induced effects on a region's employment given an increase or decrease in demand for a good or service in the local economy. I-O employment multiplier calculations are a valuable statistical results that show the forward and backward impact of the number of jobs created (or reduced) beyond a core employment change in the region's economy. The employment multiplier is often the most discussed multiplier in the input-output literature, policy debates, and strategic planning analyses because of the critical topic of "jobs." Many analysts and politicians seek answers to such questions as, "how many jobs will be created in a local economy if a new processing plant (e.g., a soybean milling facility) is attracted to the area?" The success or failure of attracting the plant to the region will often hinge on the "bottom line" estimation of the number of new jobs that might be generated. Positive employment estimations can also lead to tax

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[142] Note: Micro IMPLAN uses the measure of full time equivalent units or what's known as FTE's for all employment calculations.

abatements for corporations, reelection for politicians, and an increase in consumer confidence in the local economy.

Example: The Type I employment multiplier for Michigan's dairy farm sector is 1.34, meaning that for each job created directly by the sector, 0.34 jobs are created[143] indirectly, in the backward linked sectors, see Table XVII. The Type III employment multiplier of 2.25 for the dairy industry is larger than the Type I multiplier. The Type III multiplier is larger because it captures both the indirect and induced effects, or what is called the total effect. The total effect for dairy is the combination of the indirect effect coefficient 0.34 plus the induced effect coefficient of 0.90, or 1.25, see Table XVIII. The Type III multiplier shows that for each new job created in the dairy sector, there will be 1.25 new jobs generated in the economy at large.

Output Multipliers

The Type I output multiplier represents the value of production (from the indirect and direct effects) required from all sectors in the economy by a particular sector to deliver one dollar's worth of output. The Type III output multiplier adds the induced effect. It is important to know that the relative size of the output multiplier is not a measure of the importance of a given

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[143] Note: the multiplier can be used to address either the creation of jobs or the negative impacts of a decline in final demand and the reduction of jobs.

industry in the economy. The output multiplier is an estimation of what happens if a specific industry's sales to final demand is increased or decreased. One of the useful properties of an output multiplier is the identification of a sector's ***interdependence*** with the rest of the economy. The larger (smaller) the calculated multiplier for a sector, the greater (lesser) is the interdependency or linkage a sector.

Example: The calculated Type I output multiplier for Michigan's dairy farm products sector is 1.29, see Table XIX. This means that for each dollar of increased output produced by the sector (to meet an increase in final demand), 0.29 dollars worth of indirect output (backward-linked sectors) is generated in other Michigan industries, see Table XX.[144] The multiplier can also be used to answer the question, "what if final demand drops by one dollar in the dairy sector, what is the indirect effect?" The answer is an economic impact with an indirect effect that causes a decline of output of 0.29 dollars in the backward-linked sectors.

The calculated Type III dairy multiplier is 1.84, see Table XIX. From the definition above remember that the Type III multiplier builds on the Type I multiplier. The Type III captures both the direct and indirect effects the same as the Type I multiplier, but it also includes the induced effect. To capture the induced effect, the Type III multiplier of 1.84 is subtracted by

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[144] Note: All of the indirect effects are easily determined by subtracting 1.00 from the Type I multiplier, in this example, 1.29- 1.00 yields the indirect effect of 0.29.

the Type I multiplier of 1.29, and equals the induced effect of 0.54, see Table XX. The induced output effect of 0.54 dollars occurs for every dollar of output produced by the dairy farm sector. To calculate the total output effect of the increase in final demand, the Type I multiplier of 1.00 is subtracted from the Type III multiplier of 1.84, yielding 0.84 dollars, see Table XX. The total effect of 0.84 is the combination of the indirect effect 0.29 plus the induced effect of 0.54.[145]

Total Income Multipliers

The Type I total income multiplier is the direct and indirect employee compensation, proprietary income and other income divided by the direct employee compensation, proprietary income and other income that is generated by the change in one dollar of final output for a specific sector. "Employee compensation" is defined as the wages and salaries paid to employees by industries plus the value of benefits, and the contributions to social security and pension funds by the employee and employer. "Proprietary income" is the income from self employment, which is the major source of farm enterprise income in Michigan. "Other income" includes corporate income, rental income, interest, and corporate transfer payments. The Type III multiplier adds to the Type I multiplier the induced effect. The

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[145] Note: the indirect and induced effects do not equal the total effect. This is because of rounding the calculated multipliers from the four digit level to the two digit level.

advantage of the total income multiplier (versus a personal income multiplier) is the inclusion of those individuals that are self employed. The self employed component in this multiplier is especially important to the farming sector because of the high number of enterprises having a self employed tax structure.

Example: Continuing with Michigan's dairy farm sector, the calculated Type I total income multiplier is 1.63, and the Type III multiplier is 2.93, see Table XXI. For each dollar of direct employee compensation generated by one dollar of final output in the dairy sector, 0.63 dollars of indirect employment compensation, and 1.00 dollar of induced employee compensation is generated.

Review of I-O Model Results: the Multipliers

Employment Multiplier Review[146]

The average Type I multiplier for the agricultural production sector[147] is 1.38, see Table XVII. The agricultural livestock sector has a lower Type I multiplier of 1.26 than the Type I multiplier of 1.49 for the crop sector. The higher crop multiplier compared to the lower livestock multiplier is consistent with other studies. Typically, crop enterprises are more labor

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[146] For an explanation of the employment multiplier definitions see the definition section above.

[147] The agricultural production sector includes the livestock and crop sectors.

intensive,[148] and livestock enterprises are more capital intensive.[149] A number of crop multipliers exhibited the labor intensive properties. The Type I multiplier for fruit crops was 2.04 and vegetables posted a 2.26, the highest for all production agriculture. The other Type I multipliers for the production crops ranged from 1.04 to 1.59. The largest Type I multipliers in the livestock sector were for the hog and swine subsector at 1.38, and the dairy subsector at 1.34. Compared to the nonagricultural sector,[150] the agricultural production sector Type I multiplier average is marginally higher 1.38 versus 1.35. The largest Type I nonagricultural multiplier calculated was 1.86 in the manufacturing sector. The Type III agricultural multipliers are all commensurately higher than the Type I multipliers by approximately 66%. The larger Type III multiplier reflects the addition of the induced effect in the economy. It is estimated that for each job that is created in the production agriculture sector that another 1.31 jobs would be created in other sectors of the economy, given the Type III multiplier of 2.31. The estimated Type III multiplier average for the non-agricultural economy is slightly lower at 2.21, see Table XVII.

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[148] Requiring more labor in production processes and therefore a higher employment multipliers is expected. For example, cash crops such as vegetables have heavy labor needs especially during harvests.

[149] Note: the livestock sector usually requires more capital investments such as shelter for layers, milking parlors for dairy, and hog confinement structures.

[150] Note: the nonagricultural sector is the rest of the state's economy aggregated into eight major categories, see Table XVII.

Output Multiplier Review[151]

The Type I output multiplier for Michigan production agriculture was 1.24, consistent with the non-agricultural average of 1.24, see Table XIX. A Type I multiplier of 1.24 for production agriculture means that a $1 million increase in final demand for the average agricultural production subsector would increase total state output of goods and services an additional $0.24 million. Within production agriculture, the livestock sector had a Type I multiplier average of 1.26, slightly higher than the crop sector Type I multiplier average of 1.22. The Type I livestock production subsector multipliers ranged from a low of 1.09 to a high of 1.39. The subsectors of hogs, pigs and swine and "other meat animals products" had the largest Type I multipliers with a coefficient of 1.39. Sheep, lambs, and goats had the lowest livestock coefficient of 1.09. The crop sector Type I multiplier also ranged quite widely. Crop multipliers varied from a low of 1.07 for greenhouse and nursery products to a high of 1.34 for fruits.[152] The greater than average fruit sector multiplier of 1.34 highlights the importance of the industry in the state from the backward-linked (integrated) perspective. The fruit subsector Type III multiplier of 1.82 also highlights the significant degree of interdependence from the induced effect, or

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[151] For an explanation of the output multiplier definitions see the definition section above.

[152] Note: the fruit subsector had the second highest Type I employment multiplier of 2.04.

forward-linked perspective. The calculated Type III multipliers reveal that many production agriculture subsectors in Michigan's economy are very important because of their forward-linkages. Of special note is the greenhouse and nursery products subsector. Greenhouse and nursery products had the largest Type III output multiplier of 4.57 for all agricultural production subsectors, see Table XIX. Michigan is a national leader in the production of many of the commodities produced in this subsector. The sheep, lambs and goats subsector also registered a larger than average Type III multiplier of 3.72. Production agriculture in general yielded higher Type III multipliers than the rest of the economy. The average Type III output multiplier for the crop and livestock sectors of 2.06, is 11% higher than the non-agricultural average of 1.85, see Table XIX. The large production agriculture output multipliers signifies the importance of the industry's contribution to total economic activity in the state.

Total Income Multiplier Review[153]

Michigan production agriculture total income multipliers on average are higher than the non-agriculture sectors. The average Type I total income multiplier for Michigan production agriculture is 1.29 and the Type III is 2.22, compared to the non-agricultural sectoral Type I average of 1.25 and a Type

[153] For an explanation of the personal income multiplier definitions see the definition section above.

III average of 1.84. The livestock sector in general has larger total income multipliers than the crop sector. The average livestock Type I multiplier is 1.34 and the Type III is 2.46 compared to the average crop Type I multiplier of 1.25 and a Type III of 1.99. Several of the agricultural subsectors are characterized as having sizable total income multipliers, such as fruits and greenhouse and nursery products. The Type I and Type III total income multipliers for these two subsectors are quite large because of the significant number of indirect jobs and the level of value added activity linked to the state's economy. The Type I total income multiplier for fruits is 1.70 and the Type III multiplier is 3.19. The fruits Type I multiplier is 36% greater than the non-agricultural average and the Type III is 73% higher than the non-agricultural average. The greenhouse and nursery subsector Type I multiplier is 1.07 and the Type III increases notably to 3.21. Two other subsectors with large induced effects are sheep, lambs and goats with an induced effect of 2.01 and dairy farm products at 1.30.

Table XVII 1992 Michigan Type I and Type III Employment Multipliers for Production Agriculture and Rest of the Economy

TYPE I and TYPE III EMPLOYMENT MULTIPLIERS
for PRODUCTION AGRICULTURE and DIFFERENT SECTORS
ESTIMATED for MICHIGAN, 1992

Sector	Type I	Type III
Livestock		
Dairy Farm Products	1.34	2.25
Poultry And Eggs	1.24	2.08
Ranch Fed Cattle	1.23	2.07
Range Fed Cattle	1.24	2.07
Cattle Feedlots	1.24	2.08
Sheep, Lambs And Goats	1.03	1.73
Hogs, Pigs And Swine	1.38	2.30
Other Meat Animal Products	1.29	2.18
Miscellaneous Livestock	1.31	2.20
Average	1.26	2.11
Crops		
Food Grains	1.50	2.50
Feed Grains	1.31	2.18
Hay And Pasture	1.45	2.42
Grass Seeds	1.09	1.82
Fruits	2.04	3.42
Vegetables	2.26	3.79
Sugar Crops	1.34	2.25
Miscellaneous Crops	1.25	2.10
Oil Bearing Crops	1.59	2.65
Greenhouse And Nursery Products	1.04	1.76
Average	1.49	2.49
Misc. Agricultural Related		
Agricultural, Forestry, Fishery Services	1.27	2.14
Landscape and Horticultural Services	1.48	2.50
Forest Products	2.74	4.58
Commercial Fishing	1.02	1.72
Average	1.63	2.74
Non-Agricultural		
Mining (14)	1.59	2.59
Construction (9)	1.36	2.23
Manufacturing (349)	1.86	3.04
Transportation, Comm., Utilities (14)	1.47	2.40
Trade (9)	1.14	1.86
Finance, Insurance, Real Estate (7)	1.53	2.50
Services (47)	1.17	1.93
Government (9)	1.02	1.68
Average	1.35	2.21

Note: the ( ) that follow the nonagricultural industry headings in the table above identify the number of sectors in each aggregated industry.

Table XVIII Analysis of Michigan Employment Multiplier Effects for Production Agriculture and Rest of the Economy

ANALYSIS of EMPLOYMENT MULTIPLIER EFFECTS for PRODUCTION AGRICULTURE and DIFFERENT SECTORS ESTIMATED for MICHIGAN, 1992

Sector	Indirect Effect	Induced Effect	Total Effect
Livestock			
Dairy Farm Products	0.34	0.90	1.25
Poultry And Eggs	0.24	0.84	1.08
Ranch Fed Cattle	0.23	0.84	1.07
Range Fed Cattle	0.24	0.83	1.07
Cattle Feedlots	0.24	0.84	1.08
Sheep, Lambs And Goats	0.03	0.71	0.73
Hogs, Pigs And Swine	0.38	0.93	1.30
Other Meat Animal Products	0.29	0.89	1.18
Miscellaneous Livestock	0.31	0.88	1.20
Average	0.26	0.85	1.11
Crops			
Food Grains	0.50	1.01	1.50
Feed Grains	0.31	0.88	1.18
Hay And Pasture	0.45	0.98	1.42
Grass Seeds	0.09	0.73	0.82
Fruits	1.04	1.37	2.42
Vegetables	1.26	1.52	2.79
Sugar Crops	0.34	0.90	1.25
Miscellaneous Crops	0.25	0.84	1.10
Oil Bearing Crops	0.59	1.07	1.65
Greenhouse And Nursery Products	0.04	0.72	0.76
Average	0.49	1.00	1.49
Misc. Agricultural Related			
Agricultural, Forestry, Fishery Services	0.27	0.87	1.14
Landscape and Horticultural Services	0.48	1.02	1.50
Forest Products	1.74	1.84	3.58
Commercial Fishing	0.02	0.77	0.72
Average	0.63	1.11	1.74
Non-Agricultural			
Mining (14)	0.59	1.00	1.59
Construction (9)	0.36	0.86	1.23
Manufacturing (349)	0.86	1.18	2.04
Transportation, Comm., Utilities (14)	0.47	0.93	1.40
Trade (9)	0.14	0.73	0.86
Finance, Insurance, Real Estate (7)	0.53	0.97	1.50
Services (47)	0.17	0.75	0.93
Government (9)	0.02	0.65	0.68
Average	0.35	0.86	1.21

Note: (1) The ( ) that follow the nonagricultural industry headings in the table above identify the number of sectors in each aggregated industry. (2) Numbers may not add correctly because of rounding.

Table XIX 1992 Michigan Type I and Type III Output Multipliers for Production Agriculture and Rest of the Economy

TYPE I and TYPE III OUTPUT MULTIPLIERS
for PRODUCTION AGRICULTURE and DIFFERENT SECTORS
ESTIMATED for MICHIGAN, 1992

Sector	Type I	Type III
Livestock		
Dairy Farm Products	1.29	1.84
Poultry And Eggs	1.18	1.75
Ranch Fed Cattle	1.30	2.10
Range Fed Cattle	1.23	1.77
Cattle Feedlots	1.29	2.00
Sheep, Lambs And Goats	1.09	3.72
Hogs, Pigs And Swine	1.39	2.03
Other Meat Animal Products	1.39	2.38
Miscellaneous Livestock	1.20	1.52
Average	1.26	2.12
Crops		
Food Grains	1.29	1.69
Feed Grains	1.18	1.54
Hay And Pasture	1.23	1.59
Grass Seeds	1.08	1.52
Fruits	1.34	2.00
Vegetables	1.25	1.64
Sugar Crops	1.29	1.87
Miscellaneous Crops	1.21	1.87
Oil Bearing Crops	1.29	1.67
Greenhouse And Nursery Products	1.07	4.57
Average	1.22	2.00
Misc. Agricultural Related		
Agricultural, Forestry, Fishery Services	1.30	3.00
Landscape and Horticultural Services	1.30	3.46
Forest Products	1.28	1.73
Commercial Fishing	1.04	2.13
Average	1.23	2.58
Non-Agricultural		
Mining (14)	1.34	1.72
Construction (9)	1.27	1.88
Manufacturing (349)	1.40	1.74
Transportation, Comm., Utilities (14)	1.28	1.69
Trade (9)	1.25	2.41
Finance, Insurance, Real Estate (7)	1.28	1.67
Services (47)	1.27	2.28
Government (9)	1.05	2.23
Average	1.24	1.85

Note: the ( ) that follow the nonagricultural industry headings in the table above identify the number of sectors in each aggregated industry.

Table XX Analysis of Michigan Output Multiplier Effects for Production Agriculture and Rest of the Economy

ANALYSIS of OUTPUT MULTIPLIER EFFECTS
for PRODUCTION AGRICULTURE and DIFFERENT SECTORS
ESTIMATED for MICHIGAN, 1992

Sector	Indirect Effect	Induced Effect	Total Effect
Livestock			
Dairy Farm Products	0.29	0.54	0.84
Poultry And Eggs	0.18	0.57	0.75
Ranch Fed Cattle	0.30	0.80	1.10
Range Fed Cattle	0.23	0.54	0.77
Cattle Feedlots	0.29	0.71	1.00
Sheep, Lambs And Goats	0.09	2.63	2.72
Hogs, Pigs And Swine	0.39	0.65	1.03
Other Meat Animal Products	0.39	0.98	1.38
Miscellaneous Livestock	0.20	0.32	0.52
Average	0.26	0.86	1.12
Crops			
Food Grains	0.29	0.40	0.69
Feed Grains	0.18	0.36	0.54
Hay And Pasture	0.23	0.36	0.59
Grass Seeds	0.08	0.44	0.52
Fruits	0.34	0.66	1.00
Vegetables	0.25	0.40	0.64
Sugar Crops	0.29	0.58	0.87
Miscellaneous Crops	0.21	0.67	0.87
Oil Bearing Crops	0.29	0.37	0.67
Greenhouse And Nursery Products	0.07	3.50	3.57
Average	0.22	0.77	1.00
Misc. Agricultural Related			
Agricultural, Forestry, Fishery Services	0.30	1.70	2.00
Landscape and Horticultural Services	0.30	2.16	2.46
Forest Products	0.28	0.44	0.73
Commercial Fishing	0.04	1.09	1.13
Average	0.23	1.35	1.58
Non-Agricultural			
Mining (14)	0.34	0.38	0.72
Construction (9)	0.27	0.61	0.88
Manufacturing (349)	0.40	0.34	0.74
Transportation, Comm., Utilities (14)	0.28	0.40	0.69
Trade (9)	0.25	1.16	1.41
Finance, Insurance, Real Estate (7)	0.28	0.39	0.67
Services (47)	0.27	1.01	1.28
Government (9)	0.05	1.18	1.23
Average	0.24	0.61	0.85

Note: (1) The ( ) that follow the nonagricultural industry headings in the table above identify the number of sectors in each aggregated industry. (2) Numbers may not add correctly because of rounding.

Table XXI 1992 Michigan Type I and Type III Total Income Multipliers for Production Agriculture and Rest of the Economy

TYPE I and TYPE III TOTAL INCOME MULTIPLIERS
for PRODUCTION AGRICULTURE and DIFFERENT SECTORS
ESTIMATED for MICHIGAN, 1992

Sector	Type I	Type III
Livestock		
Dairy Farm Products	1.63	2.93
Poultry And Eggs	1.15	1.90
Ranch Fed Cattle	1.40	2.67
Range Fed Cattle	1.26	1.98
Cattle Feedlots	1.38	2.51
Sheep, Lambs And Goats	1.07	3.07
Hogs, Pigs And Swine	1.49	2.52
Other Meat Animal Products	1.49	3.04
Miscellaneous Livestock	1.19	1.55
Average	1.34	2.46
Crops		
Food Grains	1.30	1.80
Feed Grains	1.14	1.48
Hay And Pasture	1.23	1.64
Grass Seeds	1.07	1.48
Fruits	1.70	3.19
Vegetables	1.26	1.71
Sugar Crops	1.29	1.98
Miscellaneous Crops	1.17	1.77
Oil Bearing Crops	1.27	1.69
Greenhouse And Nursery Products	1.06	3.21
Average	1.25	1.99
Misc. Agricultural Related		
Agricultural, Forestry, Fishery Services	1.43	3.68
Landscape and Horticultural Services	1.36	3.26
Forest Products	1.31	1.80
Commercial Fishing	1.02	1.70
Average	1.28	2.61
Non-Agricultural		
Mining (14)	1.38	1.84
Construction (9)	1.29	1.98
Manufacturing (349)	1.53	2.11
Transportation, Comm., Utilities (14)	1.28	1.71
Trade (9)	1.23	2.34
Finance, Insurance, Real Estate (7)	1.31	1.75
Services (47)	1.22	2.08
Government (9)	1.03	1.71
Average	1.25	1.84

Note: the ( ) that follow the nonagricultural industry headings in the table above identify the number of sectors in each aggregated industry.

Table XXII Analysis of Michigan Total Income Multiplier Effects for Production Agriculture and Rest of the Economy

ANALYSIS of TOTAL INCOME MULTIPLIER EFFECTS for PRODUCTION AGRICULTURE and DIFFERENT SECTORS ESTIMATED for MICHIGAN, 1992

Sector	Indirect Effect	Induced Effect	Total Effect
Livestock			
Dairy Farm Products	0.63	1.30	1.93
Poultry And Eggs	0.15	0.72	0.90
Ranch Fed Cattle	0.40	1.28	1.67
Range Fed Cattle	0.26	0.72	0.98
Cattle Feedlots	0.38	1.13	1.51
Sheep, Lambs And Goats	0.07	2.01	2.07
Hogs, Pigs And Swine	0.49	1.03	1.52
Other Meat Animal Products	0.49	1.55	2.04
Miscellaneous Livestock	0.19	0.37	0.55
Average	0.34	1.12	1.46
Crops			
Food Grains	0.30	0.50	0.80
Feed Grains	0.14	0.34	0.48
Hay And Pasture	0.23	0.41	0.64
Grass Seeds	0.07	0.42	0.48
Fruits	0.70	1.49	2.19
Vegetables	0.26	0.46	0.71
Sugar Crops	0.29	0.68	0.98
Miscellaneous Crops	0.17	0.60	0.77
Oil Bearing Crops	0.27	0.42	0.69
Greenhouse And Nursery Products	0.06	2.15	2.21
Average	0.25	0.75	0.99
Misc. Agricultural Related			
Agricultural, Forestry, Fishery Services	0.43	2.25	2.68
Landscape and Horticultural Services	0.36	1.90	2.26
Forest Products	0.31	0.49	0.80
Commercial Fishing	0.02	0.68	0.70
Average	0.28	1.33	1.61
Non-Agricultural			
Mining (14)	0.38	0.46	0.84
Construction (9)	0.29	0.69	0.98
Manufacturing (349)	0.53	0.58	1.11
Transportation, Comm., Utilities (14)	0.28	0.43	0.71
Trade (9)	0.23	1.10	1.34
Finance, Insurance, Real Estate (7)	0.31	0.44	0.75
Services (47)	0.22	0.86	1.08
Government (9)	0.03	0.69	0.71
Average	0.25	0.58	0.84

Note: (1) The ( ) that follow the nonagricultural industry headings in the table above identify the number of sectors in each aggregated industry. (2) Numbers may not add correctly because of rounding.

Supply, Demand, and Trade Accounts Explained

Three statistical tables are included in this chapter because of their potential importance in assisting policy and strategic planning processes. IMPLAN terms these descriptive tables as the "social accounts." The social accounts are the result of the transformation of regional (in this case Michigan) and national data sets into the social accounts. The IMPLAN social accounts feature the following four categories : (1) the values of the commodities supplied (produced) regionally, (2) the values of regional commodities demanded, (3) regional (Michigan) trade flow coefficients, and (4) trade flow coefficients applied to gross regional commodities (Michigan) demanded.[154] For purposes of this research report, the social accounting information has been restructured to appropriately capture and emphasize the economic activities of Michigan production agriculture. The three restructured statistical tables are the demand-side, supply-side, and trade balance accounts for the state.[155] These tables render a solid foundation (baseline) for further research and discussion concerning the flow of goods and services of state's production agriculture sector.

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[154] Note: this is a highly simplified explanation of the calculation of the social accounts.

[155] Note: even though the statistics are discrete (1992), one year is still useful because little information is available concerning trade patterns for Michigan production agriculture.

Preceding all of the tables are definitions that explain each tables variables. The definitions also describe the composition of the demand, supply and balance of trade equations.

Supply-Side Account Definitions: Table VII

The supply-side account is the calculation of the net commodity supplied by an industry sector. The net supply is calculated by adding the value of production for each commodity and the nonindustrial (e.g., inventory sales) supplies of each commodity and subtracting the foreign exports of the commodity. The definitions below describe each column 1-6 moving from left to right in the table.

Column 1 Sector: the industry sector name.

Column 2 Gross Commodity Production (GCP): the total value of a commodity produced by an industry sector in Michigan.

Column 3 State, Local, and Federal Sales (SLGS): Sales of goods and services that have been produced or stockpiled by the different government agencies.

Column 4 Inventory Reduction (IR): Michigan goods that were produced in an earlier time period (a year) and were not immediately consumed. Now the stored goods are taken out of inventory for direct consumption or utilized as a productive input. Note: a good that comes out of inventory has nonperishable characteristics (an item that will last longer than a year). For example, a farmer may hold grain in storage for a season hoping to receive higher prices at a latter date instead of selling the grain upon immediate harvesting.

Column 5 Foreign Exports (FE): this is the value of goods and services that are produced or generated in Michigan and are shipped outside of the United States.

Column 6 Net Commodity Supply (NCS): The net commodity supplied for each sector is calculated by the following arithmetic equation:

GCP + SLGS + IR - FE = NCS

Demand-Side Account Definitions: Table VIII

The demand-side account is the calculation of gross regional (Michigan) commodity demand. Gross commodity demand is calculated by adding the local demands for locally produced commodities with the local demands for imported commodities. The definitions below describe each column 1-6 moving from left to right in the table.

Column 1 Sector: the industry sector name.

Column 2 Gross Michigan Commodity[156] Demand (GMCD): represents Michigan's demand for various goods and services. These goods and services are either imported or produced in the state in order to meet demand. The arithmetic calculation of gross commodity demand is:

GMCD = TMFD + CCI

Column 3 Average Regional Purchase Coefficient (RPC): the RPC represents the proportion of locally (in Michigan) produced goods or services (net commodity supply NCS) that are used to meet local demand (total Michigan final demand TMFD). The RPC for each commodity is unique to the study region (in this case Michigan) and is based on prediction equation in IMPLAN.

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[156] Note: the term commodity denotes either a good or a service.

Column 4 Total Michigan Final Demand (TMFD): The value of Michigan produced commodities purchased for local final use is calculated by multiplying the RPC for each commodity by the corresponding level of gross Michigan commodity demand. For example, consider the Dairy farm products sector in 1992:

GMCD x RPC = TMFD

456.7 x 0.65 = 296.7

The equation above shows that 65% of the final demand for dairy products in the state is met by goods that are produced in the state, the rest are imported.

Column 5 Average Import Propensity Coefficient (IPC): the import propensity represents the portion of the gross commodity demanded not purchased locally (Michigan), or one minus the regional propensity to consume (1-RPC).

Column 6 Competitive Commodity Imports (CCI): is the value of commodity imports purchased for local final use. CCI is calculated by multiplying (1- RPC) for each commodity by the corresponding level of gross Michigan commodity demand. For example, consider the Dairy farm products sector in 1990:

GMCD x (1-RPC) = CCI

456.7 x (1 - 0.65) = 160.0

Balance of Trade Account Definitions: Table IX

The trade-flow account focuses on two important trade statistics: (1) the value of domestic commodity exports and (2) the net trade surplus or deficit for each commodity. The definitions below describe each column 1-6 moving from left to right in the Table.

Column 1 Sector: the industry sector name.

Column 2 Foreign Exports (FE): see variable definition above in the supply-side table definitions.

Column 3 Domestic "Michigan" Commodity Exports (DCE): domestic commodity export is the value of those commodities that are produced in Michigan and are exported outside the state to the rest of the U.S. This is differentiated from the "Foreign Exports" category in the supply-side account table that focuses on Michigan produced products that are shipped outside the U.S. Domestic commodity exports are calculated by subtracting the value of net commodity supplied from the total Michigan final demand. The arithmetic calculation of domestic commodity exported is:

NCS - TMFD = DCE

Column 4 Competitive Commodity Imports (CCI): see variable definition above in the demand-side classification.

Column 5 The Net Trade Surplus or Net Trade Deficit (NTS or NTD): is the calculation that addresses the balance of trade for each of the commodities in the state. NTS or NTD is calculated by subtracting the value of "foreign exports" and "domestic commodity exports" for each commodity from the value of it's "competitive commodity imports." A net trade surplus means that more (the $ value) of a good or service is being exported from the state than the value of the good or service that is coming into the state. A net trade deficit is just the opposite as the trade surplus. The trade deficit means that the state is importing more of a good or service than exporting the good or service. The arithmetic calculation of a net commodity trade surplus, net trade commodity surplus or balance is as follows:

if (FE + DCE) > CCI there is a Net Trade Surplus
if (FE + DCE) < CCI there is a Net Trade Deficit
if (FE + DCE) = CCI there is a balance of trade

Review of I-O Model Results: Supply, Demand, and Trade Flow Accounts

Supply-Side Account Review[157]

The IMPLAN model estimates that the total value of Michigan's gross commodity production for production agriculture (livestock and crops) was $3.76 billion in 1992. This was approximately 0.90% of the total gross production for all goods and services in the state.[158] The value of production for all livestock subsectors was $985.7 million. Within the livestock sector, dairy farm products accounted for 47% of the value of production, or $460.6 million, see Table XXIII. Hogs, pigs and swine were next in the value of livestock commodity production, with 15% of the share, of $147.4 million. The value of production for all crops was $2.77 billion. The greenhouse and nursery products subsector in terms of value of production was the largest for all crops at $674.8 million, or 24% of the total. The next largest crop subsectors were the feed grains and fruits. Both of these subsectors combined accounted for $898.6 million in value of production.

The value of exported agricultural goods to foreign markets was calculated to be $492.3 million. The majority of the goods exported were

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[157] Note: the subsectors of cotton, tobacco, and tree nuts are included in the supply-side account, Table XXIII, though the state does not produce the commodities. The three commodities will however, enter the demand-side account, Table XXIV.

[158] Note: total Michigan gross commodity production was $419.1 billion for all goods and services.

from the crop sector, $484.6 million, versus the livestock sector of $7.7 million. Leading all agricultural subsectors was feed grain, which $182.3 million worth of product was exported. The largest proportion of foreign exports as a percent share of gross commodity product was in the subsector of food grains. Over 57% or a total $45.8 million of the food grain value of production was shipped abroad. The miscellaneous livestock subsector was the largest foreign exporter in the livestock industry, exporting $3.1 million of product in 1992. A point of significance in the supply account is the relative importance of foreign exports to production agriculture. As mentioned above production agriculture's share of the state's total value of gross commodity production was 0.90%. On the other hand, production agriculture's share of total Michigan foreign exports is almost double, 1.6%, the proportion of gross commodity production. This highlights the importance of foreign exports to production agriculture.

Demand-Side Account Review[159]

In 1992 Michigan demanded $440.1 billion worth of goods and services, see table XXIV. As a portion of the state total, $3.75 billion[160] in

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[159] Note: there is some redundancy between the demand-side and the trade-flow tables. The demand-side table looks at the regional purchase coefficients (RPC's) and import propensity coefficients (IPC's) as it relates to gross Michigan commodity demand. The trade-flow table also examines the RPC's and IPC's but in the context of the net flow of commodities.

[160] This represents 0.85% of the state total.

livestock and crop products were demanded for final consumption or to be used as an input. Of the $3.75 billion agricultural commodities demanded 61% of the total value is for the crop sector and 39% for the livestock sector. The agriculture production subsector with the largest value of demand was dairy farm products at $500.6 million. The vegetable subsector is the next largest for gross commodity demanded the and largest value for crops, with a total of $394.4 million. The considerable commodity demand for vegetables emphasizes the significance of the state's vegetable industry.[161] As mentioned above the tobacco, cotton, and tree nut subsectors are not produced in the state, however, there is demand for the raw commodities. In 1992 Michigan imported $1.0 million from the cotton subsector and $171.3 from the tree nut subsector. Since Michigan imports everything for both of these commodities, the average import propensity coefficient (IPC) is 1.00 and the regional (Michigan) purchase coefficient (RPC) is 0.00. In some subsectors the coefficients are just the opposite, where the average import propensity is considerably smaller and the regional purchase is considerably larger. These subsectors reflect the fact that most of the local demand (gross Michigan commodity demand) is met by local production (total Michigan final demand). Three subsectors have noticeably large agricultural production RPC's, they are sugar crops, "hogs, pigs and

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[161] Michigan has such firm's as Vlasic and Gerber's that require large quantities of vegetables for their processing activities. Michigan is also a national leader in the production of vegetable crops like: cucumbers, celery, carrots, cauliflower, snap beans and asparagus.

swine," and greenhouse and nursery products. Each of these subsectors have RPC's that are above 92% or higher. The average RPC for all livestock was 58.6% and the IPC was 41.4%, compared to the average RPC for all crops of 46.9% and an IPC of 53.1%.

Balance of Trade Account[162]

The balance of trade account addresses the net flow of the value of goods and services as they cross the state line. In 1992 Michigan production agriculture exported $1.40 billion worth of commodities to the rest of the United States (domestically). The $1.40 billion is approximately 0.80% of the state's total goods and services that were exported domestically that year. The crop sector exported the major share, 90% of the total commodities, valued at $1.38 billion compared to the livestock sector, which exported $133.3 million. Over 57% of the value of domestic commodity exports for production agriculture were attributable to three commodities. The largest exports were greenhouse and nursery products, which constituted 20.6% of the value of total domestic agricultural exports or $287.3 million. The second largest domestic exports were feed grains with 20.2% of the share, at $281.2 million. And the third largest domestic export was hay and pasture with a 16.6% share valued at $231.1 million.

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[162] Note: refer to the definition section above for an explanation of the balance of trade calculation.

The I-O model estimated that in 1992 the state of Michigan had a total trade deficit of $12.3 billion.[163] Production agriculture however, had a moderate trade surplus of $67.5 million. Most of Michigan's production agriculture trade surpluses occurred in the crop subsectors. Crop's trade surplus was $525.1 millon compared a trade deficit for livestock of $457.7 million. The largest trade surpluses in the crop sector belonged to the subsectors of feed grains and greenhouse and nursery products of $329.2 million and $277.8 million. The other meat animal products subsector yielded the largest trade surplus for livestock, at a level of $5.9 million. The hog, pigs and swine subsector also produced a small trade surplus of $3.9. The major crop trade deficits occurred in the food grains and tree nut subsectors. Food grains a $308.5 million trade deficit and tree nuts posted a $171.1 million trade deficit.[164] The largest livestock trade deficits are in the cattle feed lots and ranch fed cattle subsectors at levels of $114.5 million and $111.9 million respectively.

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[163] Note: a deficit occurs when (FE + DCE) < CCI.

[164] Note: the trade deficit for tree nuts is expected since the state does not produce tree nut crops.

Table XXIII 1992 Supply-Side Account for Michigan Production Agriculture and Aggregated Industries

Supply-Side Account for Michigan Production Agriculture and Aggregated Industries, 1992, ($MM)

Sector	Gross Commodity Production	State, Local, and Federal Sales	Inventory Reduction	Foreign Exports	Net Commodity Supply
Livestock					
Dairy Farm Products	460.6	0.0	0.0	1.2	459.4
Poultry And Eggs	95.3	0.0	0.0	1.4	93.8
Ranch Fed Cattle	92.9	0.0	0.7	0.5	93.1
Range Fed Cattle	13.8	0.0	0.1	0.2	13.8
Cattle Feedlots	144.4	0.0	1.4	0.7	145.1
Sheep, Lambs And Goats	2.8	0.0	0.0	0.3	2.6
Hogs, Pigs And Swine	147.4	0.0	1.3	0.3	148.5
Other Meat Animal Products	10.1	0.0	0.1	0.0	10.1
Miscellaneous Livestock	18.4	0.0	0.0	3.1	15.3
Total	$985.7	$0.0	$3.6	$7.7	$981.7
Crops					
Cotton	0.0	0.0	0.0	0.0	0.0
Food Grains	80.3	0.0	4.3	45.8	38.9
Feed Grains	472.7	0.0	27.6	182.3	318.1
Hay And Pasture	256.1	0.0	14.4	9.9	260.6
Grass Seeds	2.7	0.0	0.0	0.8	2.0
Tobacco	0.0	0.0	0.0	0.0	0.0
Fruits	425.9	0.0	0.0	87.2	338.7
Tree Nuts	0.2	0.0	0.0	0.0	0.2
Vegetables	343.8	0.0	0.0	27.9	315.9
Sugar Crops	126.1	0.0	0.0	0.2	125.8
Miscellaneous Crops	68.8	0.3	0.0	0.0	69.1
Oil Bearing Crops	323.2	0.0	4.6	107.9	219.9
Greenhouse And Nursery Products	674.8	0.0	0.0	22.6	652.3
Total	$2,774.6	$0.3	$50.9	$484.6	$2,341.5

Table XXIII (Continued) 1992 Supply-Side Account for Michigan Production Agriculture and Aggregated Industries

Supply-Side Account for Michigan Production Agriculture and Aggregated Industries, 1992, ($MM)

Sector	Gross Commodity Production	State, Local, and Federal Sales	Inventory Reduction	Foreign Exports	Net Commodity Supply
Misc. Agricultural Related					
Agricultural, Forestry, Fishery Services	157.9	20.6	0.0	0.0	178.5
Landscape and Horticultural Services	526.3	12.8	0.0	0.0	539.1
Forest Products	186.0	20.8	0.0	9.7	203.3
Commercial Fishing	10.1	0.0	0.0	8.2	1.9
Total	$880.3	$54.2	$0.0	$17.9	$922.8
Non-Agricultural					
Mining (14)	1,200.4	80.6	7.1	89.2	1,199.0
Construction (9)	21,950.4	0.0	0.0	0.0	21,950.4
Manufacturing (349)	196,492.2	76.8	39.5	24,172.8	172,435.8
Transportation, Comm., Utilities (14)	23,335.3	95.1	0.0	1,052.5	22,377.9
Trade (9)	41,775.9	381.3	0.0	1,413.1	40,744.2
Finance, Insurance, Real Estate (7)	44,170.5	0.6	0.0	1,215.6	42,955.5
Services (47)	63,568.7	4,166.4	0.0	309.9	67,425.2
Government (9)	22,066.1	43.2	0.0	1,854.6	23,671.5
Total	$410,601.9	$4,844.2	$321.1	$30,107.7	$392,956.5
State Total	$419,122.8	$4,904.7	$375.7	$30,617.7	$397,202.3

Note: the ( ) that follow the nonagricultural industry headings in the table above identify the number of sectors in each aggregated industry.

Note: the **"State Total"** summation for each category above reflects a number of special adjustments by the I-O model and does not equal the sum of the individual sectoral totals.

Table XXIV 1992 Demand-Side Account for Michigan Production Agriculture and Aggregated Industries

Demand-Side Account for Michigan Production Agriculture and Aggregated Industries, 1992, ($MM)

Sector	Gross Michigan Commodity Demand	Average Regional Purchase Coefficient	Total Michigan Final Demand	Average Import Propensity Coefficient	Competitive Commodity Imports
Livestock					
Dairy Farm Products	500.6	0.688	344.6	0.312	156.0
Poultry And Eggs	196.8	0.477	93.8	0.523	103.0
Ranch Fed Cattle	205.5	0.453	93.1	0.547	112.3
Range Fed Cattle	58.9	0.233	13.8	0.767	45.2
Cattle Feedlots	260.3	0.557	145.1	0.443	115.3
Sheep, Lambs And Goats	8.2	0.315	2.6	0.685	5.6
Hogs, Pigs And Swine	144.9	0.939	136.0	0.061	8.8
Other Meat Animal Products	4.3	0.953	4.1	0.047	0.2
Miscellaneous Livestock	67.5	0.227	15.3	0.773	52.2
Total	$1,447.0	0.586	$48.4	0.414	$98.6
Crops					
Cotton	1.0	0.000	0.0	1.000	1.0
Food Grains	393.2	0.099	38.9	0.901	354.3
Feed Grains	171.1	0.216	36.9	0.784	134.2
Hay And Pasture	158.2	0.186	29.5	0.814	128.7
Grass Seeds	36.9	0.054	2.0	0.946	34.9
Tobacco	0.0	0.000	0.0	1.000	0.0
Fruits	296.6	0.576	170.9	0.424	125.7
Tree Nuts	171.3	0.000	0.0	1.000	171.3
Vegetables	394.4	0.547	215.6	0.453	178.8
Sugar Crops	100.8	0.983	99.1	0.017	1.8
Miscellaneous Crops	41.1	0.841	34.6	0.159	6.5
Oil Bearing Crops	140.2	0.623	87.3	0.377	52.9
Greenhouse And Nursery Products	397.0	0.919	365.0	0.081	32.1
Total	$2,301.9	0.469	$1,079.7	0.531	$1,222.1

Table XXIV (Continued) 1992 Demand-Side Account for Michigan Production Agriculture and Aggregated Industries

Demand-Side Account for Michigan Production Agriculture and Aggregated Industries, 1992 ($MM)

Sector	Gross Michigan Commodity Demand	Average Commodity Purchase Coefficient	Total Michigan Final Demand	Average Import Propensity Coefficient	Competitive Commodity Imports
Misc. Agricultural Related					
Agricultural, Forestry, Fishery Services	622.1	0.287	178.5	0.713	443.6
Landscape and Horticultural Services	510.2	0.620	316.2	0.380	194.0
Forest Products	222.8	0.019	4.2	0.981	218.6
Commercial Fishing	134.7	0.014	1.9	0.986	132.8
Total	$1,489.8	0.336	$500.8	0.664	$989.0
Non-Agricultural					
Mining (14)	3,201.8	0.038	123.2	0.962	3,078.6
Construction (9)	24,327.7	0.897	21,813.9	0.103	2,513.8
Manufacturing (349)	175,857.4	0.349	61,402.4	0.651	114,455.1
Transportation, Comm., Utilities (14)	31,133.6	0.503	15,673.3	0.497	15,460.4
Trade (9)	47,947.6	0.717	34,379.9	0.283	13,567.7
Finance, Insurance, Real Estate (7)	51,125.6	0.567	29,013.6	0.433	22,112.0
Services (47)	73,757.2	0.474	34,994.0	0.526	38,763.1
Government (9)	27,194.5	0.855	23,243.2	0.145	3,951.2
Total	$434,905.8	0.507	$220,643.5	0.493	$214065.2
State Total	$440,144.5		$223,269.5		$216,875.0

Note: the ( ) that follow the nonagricultural industry headings in the table above identify the number of sectors in each aggregated industry.

Note: the "State Total" summation for each category above reflects a number of special adjustments by the I-O model and does not equal the sum of the individual sectoral totals.

Table XXV 1992 Balance of Trade Account for Michigan Production Agriculture and Aggregated Industries

Balance of Trade Account for Michigan Production Agriculture and Aggregated Industries, 1992, ($MM)

Sector	Foreign Exports	Domestic Commodity Exports	Competitive Commodity Imports	Net Trade Surplus + or Deficit (-)
Livestock				
Dairy Farm Products	1.2	114.8	156.0	(40.0)
Poultry And Eggs	1.4	0.0	103.0	(101.6)
Ranch Fed Cattle	0.5	0.0	112.3	(111.9)
Range Fed Cattle	0.2	0.0	45.2	(45.0)
Cattle Feedlots	0.7	0.0	115.3	(114.5)
Sheep, Lambs And Goats	0.3	0.0	5.6	(5.4)
Hogs, Pigs And Swine	0.3	12.4	8.8	3.9
Other Meat Animal Products	0.0	6.1	0.2	5.9
Miscellaneous Livestock	3.1	0.0	52.2	(49.1)
Total	$7.7	$133.3	$598.6	($457.7)
Crops				
Cotton	0.0	0.0	1.0	(1.0)
Food Grains	45.8	0.0	354.3	(308.5)
Feed Grains	182.3	281.2	134.2	329.2
Hay And Pasture	9.9	231.1	128.7	112.3
Grass Seeds	0.8	0.0	34.9	(34.2)
Tobacco	0.0	0.0	0.0	0.0
Fruits	87.2	167.8	125.7	129.3
Tree Nuts	0.0	0.1	171.3	(171.1)
Vegetables	27.9	100.3	178.8	(50.6)
Sugar Crops	0.2	26.7	1.8	25.2
Miscellaneous Crops	0.0	34.6	6.5	28.0
Oil Bearing Crops	107.9	132.6	52.9	187.6
Greenhouse And Nursery Products	22.6	287.3	32.1	277.8
Total	$484.6	$1,261.7	$1,221.1	$525.2

Table XXV (Cont.) 1992 Balance of Trade Account for Mich. Production Agriculture and Aggregated Industries

Balance of Trade Account for Michigan Production Agriculture and Aggregated Industries, 1992, ($MM)

Sector	Foreign Exports	Domestic Commodity Exports	Competitive Commodity Imports	Net Trade Surplus + or Deficit (-)
Misc. Agricultural Related				
Agricultural, Forestry, Fishery Services	0.0	0.0	443.6	(443.6)
Landscape and Horticultural Services	0.0	222.9	194.0	28.9
Forest Products	9.7	198.9	218.6	(124.5)
Commercial Fishing	8.2	0.0	132.7	(10.0)
Total	$17.9	$421.8	$989.0	(549.3)
Non-Agricultural				
Mining (14)	89.2	1,075.8	3,078.6	(1,913.6)
Construction (9)	0.0	136.5	2,513.8	(2,377.2)
Manufacturing (349)	24,172.8	111,033.5	114,455.1	20,751.3
Transportation, Comm., Utilities (14)	1,052.5	6,704.7	15,460.4	(7,703.3)
Trade (9)	1,413.1	6,364.2	13,567.7	(5,790.4)
Finance, Insurance, Real Estate (7)	1,215.6	13,941.9	22,112.0	(6,954.5)
Services (47)	309.9	32,431.1	38,763.1	(6,022.1)
Government (9)	1,854.6	428.2	3,951.2	(1,668.3)
Total	$30,107.7	$172,115.9	$214,065.2	($11,841.6)
State Total	$30,617.7	$173,932.8	$216,875.0	($12,324.5)

Note: the ( ) that follow the non-agricultural industry headings in the table above identify the number of sectors in each aggregated industry.

Note: the **"State Total"** summation for each category above reflects a number of special adjustments by the I-O model and does not equal the sum of the individual sectoral totals.

VII. MAJOR FINDINGS AND SYNTHESIS

Introduction

The stated intent of this dissertation as defined in chapter I was to accomplish the following purpose:

"assemble a comprehensive collection of Michigan production agriculture baseline data and to apply the statistical methods of ordinary least squares regression, shift-share analysis, and input-output modeling to determine the trends, shifts, and linkages of the sector during the decades of the 70's and 80's. This research effort is one of the most extensive historical reviews of Michigan production agriculture generated to date. The study was designed to assist decision makers in Michigan farm organizations, farm enterprises, agribusinesses, food processing companies, governmental agencies, universities, environmental groups, and input suppliers."

This chapter synthesizes the major research findings resulting from the application of various statistical methods to agricultural baseline data to achieve the stated purpose above. The findings in this chapter are not exhaustive but rather are meant to be illustrative. The chapter is segmented into five primary classifications (1) general farming, (2) field crops, (3) livestock and products, (4) fruit, and (5) vegetables. Selected commodities have been identified within each classification to discuss the statistical results of the trend regressions, shifts-share, and input-output analyses.

A brief overview of a number of the unique characteristics of the

dissertation is provided here for those readers that are not interested in wading through the larger body of text. This study is the first to review in such great detail the decades of the 70's and 80's, for Michigan production agriculture. The comprehensive nature of the dissertation is characterized by the number of commodities reviewed. In the trend chapter IV, 38 commodities are analyzed and in the shift-share chapter V, 43 commodities are analyzed over the two-decade period. Secondly, the dissertation merges numerous powerful personal computer (PC) applications. These PC applications were used to generate all figures, tables, statistical regressions, spreadsheets, input-output analysis and word processing aspects of the dissertation. Thirdly, a number of statistical methods and models have been applied to Michigan production agriculture data for the first time. This is the first known research application of the shift-share method of analysis, used to decompose the competitive shifts and trends in Michigan production agriculture based on commodity cash receipts. The study is also the first to apply the input-output model, Micro-IMPLAN, to examine the economic structure and linkages of production agriculture with Michigan's general economy.

Major Findings

General Farming

Trend Analysis Highlights:

- From 1970 to 1990 the number of Michigan farms declined by 36%, falling from 84.000 to 54,000, an annual decline of 2.07%.
- Land in farms declined from a high of 12.7 million acres in 1970 to a low of 10.8 million acres in 1990, an annual decline of 0.70%.
- The size of Michigan farms expanded from an average of 151 acres in 1970 to 200 acres in 1990, up 32.5%.

Field Crops

Trend Analysis Highlights for Field Crops:[170]

The 21-year field crop trend analysis focused on the categories of acres harvested, value of production, quantity produced, yield, and price for the commodities.

- Every field crop posted positive trends for price, value of production, and yield.
- Total field crops value of production trended higher at an average annual rate of 4.40%. This was the largest computed average annual growth rate for the four major commodity groups analyzed. Field crops value of production expanded from just below $400 million in the early 70's to above $1.50 billion in the late 80's.

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[170] Note: ten field crops were analyzed in the field crop trend section of chapter IV; barley, corn for grain, corn silage, dry beans, hay, oats, potatoes, soybeans, sugarbeets, and wheat.

- Total acres harvested increased gradually for the two decades. Acreage rose more rapidly in the 70's than the 80's. For the 21-year period the state averaged 6.54 million acres of field crops.
- Soybeans showed the most significant trend increases in production. Soybean production quadrupled, expanding from 10 million bushels per year in the early 70's to over 40 million bushels in 1990. The yield (per acre) trend was also the most prominent, increasing at an average annual rate of 2.30%.
- Although the state does not produce large quantities of barley from a national perspective, barley was a fast growth crop, doubling in the amount of acres harvested. Acres harvested expanded from the low 20 thousand acres range in the 70's to above 40 thousand acres in the late 80's.
- The state had a significant decline in the production of dry beans in the 70's and 80's. The number of acres harvested fell from a level of 600,000 acres in the 70's to a level of 300,000 acres in the 80's (an average annual trend decline of 3.38%). The quantity of beans produced declined commensurately, falling an average annual rate of 1.99%, from a range of 7.0 million Cwt. to 4.5 million Cwt.
- Sugarbeets, and hay showed the greatest increase in the value of production. Value of production for these crops grew at an average annual rate above 7.00%.

Shift-Share Analysis Highlights for Field Crops:[171]

Shift-share analysis has specific terminology that is used to describe the statistical results. In chapter V there are two sections entitled "The Structure of the Arcelus (I), Shift-Share Model" and "An Example of Shift-Share Analysis Applied to Michigan Dry Beans" the reader is encouraged to review these sections to facilitate a better understanding of the results discussed below. The highlights are segmented into three time periods 1970-1980, 1980-1990, and 1970-1990.

1970-1980 Highlights:

- Total field crop cash receipts recorded unusual gains in the 70's. Cash receipts expanded from $241 million in 1970 to $1.08 billion in 1980, up 348%. The calculated net "expected competitive effect" of $319.5 million means that Michigan field crop cash receipts grew at a significantly faster rate than national field crop cash receipts.
- Soybeans were one of Michigan's crops that exhibited notable receipt growth, increasing from $33 million in 1970 to $195 million in 1980, up 486%. Nationally, soybeans were considered a "fast growth"

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[171] Note: twelve field crops were analyzed in shift-share chapter V; barley, corn dry beans, hay, mint, mushrooms, oats, potatoes, rye, soybeans, sugarbeets, and wheat. Also note that mushrooms are included in the field crop analysis, this the way that the cash receipt data was divided by the U.S.D.A. Economic Research Service.

commodity[172] in terms of cash receipts. Growth of Michigan soybean cash receipts was even faster than the national soybean rate. The state was actually under allocated in soybeans given the negatively calculated differential growth effect, differential sectoral mix effect, and allocation effect.

- Michigan corn receipts rose significantly in the 70's, increasing by more than seven times, to $437 million. Michigan corn receipts also grew at a faster rate than national corn receipts.

1980-1990 Highlights:

- During the 80's growth in field crop cash receipts slowed significantly. In fact, total field crop receipts declined slightly from $1.09 billion in 1980 to $1.07 billion in 1990.
- Three crops showed strong positive gains in their competitive position nationally. Hay, soybeans, and sugar beets all posted net competitive effects (meaning that the growth rate of the receipts out paced the national commodity growth rate). Hay and soybeans however, had negative allocation effects implying that the state was under specialized in the two commodities. Sugar beets on the other hand had a positive allocation effect highlighting the state's

[172] Fast growth meaning that the cash receipts for the specific commodity increased at a faster rate than total cash receipts for all national commodities.

prominence in their production.

- Dry beans continued to show steady erosion in its competitive position. Actual cash receipts fell from $151 million in 1980 to $94 million in 1990, a decline of approximately 38%.

1970-1990 Highlights:

- Over the long-run, total field crop cash receipts more than quadrupled to a level of $1.05 billion in 1990. During this time period Michigan's share of national field crop receipts increased substantially, this is indicated by the calculated expected competitive effect of $400 million.
- Both corn and soybeans showed positive cash receipt advancements for the two decades. Michigan corn receipts increased by more than five times to $339 million in 1990 and soybeans increased by more than seven times to $236 million in 1990. Cash receipts for each of these crops grew substantially faster than the respective national commodity rate.
- Hay was one of the biggest gainers from a percent growth perspective. Actual cash receipts increased from $10.7 million in 1970 to $86.8 million in 1990, up 711%. Michigan hay receipts expanded at a much faster rate than the national rate, the calculated expected competitive effect was a highly positive $38.5 million.

Input-Output Analysis Highlights for Field Crops:[173]

- Field crop *employment* multipliers (both Type I and Type III) were both comparable to the state non-agricultural averages. The Type I field crop multiplier was 1.32 and the Type III field crop multiplier was 2.21 compared to the state non-agricultural averages of 1.35 and 2.21.
- The Type I *output* multiplier for field crops was slightly lower than the state non-agricultural average and the crop Type III multiplier was slightly larger than the state non-agricultural average.
- In 1992 Michigan's field crop exports (both domestic and foreign) totaled $1.75 billion.

Livestock and Poultry

Trend Analysis Highlights for Livestock and Poultry:[174]

The 21-year livestock and poultry trend analysis focused on the categories of quantity produced, number of head, value of production, yield, and price for the respective commodities.

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[173] Note: seven field crop type categories were analyzed in the input-output chapter VI; food grains, feed grains, grass seed, hay and pasture, sugar crops, oil bearing crops, and miscellaneous crops. The shift-share analysis was conducted for three time periods, 1970 to 1980, 1980 to 1990, and 1970 to 1990.

[174] Note: nine commodities were analyzed in the livestock and poultry trend section of chapter IV; beef, broilers, cattle-calves, chickens, dairy, hogs-pigs, layer hens, sheep-lambs, and turkeys.

- Only three of the nine livestock commodities had positive trends for the number of head (or birds) for the two decades. The three commodities with positive trends were turkeys, hogs-pigs and broilers.
- All livestock commodities had positive trends for their value of production, (except for chickens, which declined at an average annual rate of 1.08%). As commodity group, livestock value of production increased at an average annual rate of 3.72% (3rd among the major commodity groups analyzed). The fastest value of production growth trend was turkeys increasing at an exceptionally fast annual rate of 12.57%.
- Turkeys were the fast growth commodity in the livestock sector. The number of birds expanded by an average annual rate of 9.43%, rising from approximately 1.0 million birds in the early 70's to 4.3 million in 1990. Total production in millions of pounds quintupled from the low 20's (20 million pounds) to above 120 (million pounds).
- Hogs and pigs also showed positive trends for all categories analyzed. For all commodities, hogs and pigs ranked 2nd (behind turkeys) in the average annual increases (see Table II in chapter IV) in the number of head, quantity produced, and value of production. For the two decades, state production has doubled from approximately 240 million pounds per year to 480 million pounds per year.

- The number of dairy cows in the state declined almost every year from 1970 to 1990, falling from 433,000 head to 344,000 head. Despite the decline in the number of cows, production has actually trended higher because of higher yields per cow. Milk per cow yield rose at an average annual rate of 1.97%, increasing from 10,500 pounds to above 15,000 pounds per cow in 1990, up over 42%.
- There were significant declines in sheep and lamb numbers for the two decades. The largest declines occurred in the 1970's and moderated in the 80's. In total, the state has had reduction of 55 to 60% of sheep and lamb numbers over the 21-year period.

Shift-Share Analysis Highlights for Livestock and Poultry:[175]

The highlights are segmented into three time periods 1970-1980, 1980-1990, and 1970-1990.

1970-1980 Highlights:

- At the national level livestock and products, were considered to be a slow growth sector relative to the change in total commodity cash receipts.

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[175] Note: nine livestock and products commodities were analyzed in shift-share chapter V; broilers, cattle-calves, chickens, dairy, eggs, hogs, honey, sheep-lambs, and turkeys.

- From 1970 to 1990 total Michigan livestock and products cash receipts increased from $484.9 million to $1.1 billion, up 127%.
- Of the nine commodities analyzed only two commodities (turkeys and hogs) posted positive net competitive effects (by growing at a faster rate than their national counterpart). Turkeys and hogs however, had negative allocation effects. The negative allocation effects mean that the state was under specialized in both commodities relative to the U.S.
- From a competitive position nationally Michigan dairy fell slightly behind, given the negative net competitive effect of $24.4 million. However, at the national level dairy was a slow growth sector where dairy receipts lagged total commodity receipts.

1980-1990 Highlights:

- From 1980 to 1990 total livestock and livestock products cash receipts increased from $1.1 billion to $1.3 billion. The homothetic component of $1.5 billion in 1980 shows that if the state were to match the national structure Michigan livestock receipts should be 36% higher.
- The dairy product sector continued to lose its competitive share in the 80's. The expected competitive effect was negative $31.9 million and the allocation effect was negative $24.9 million.

- Turkeys and hogs again made significant gains in receipts in the 80's. Turkey receipts increased from $15.7 million in 1980 to $47.7 million in 1990, up 204%. The expected competitive effect for turkeys was $31.7 million. Hog receipts increased from $129.7 million in 1980 to $221.3 million in 1990, up 71%. The expected competitive effect for hogs was $110.6 million.

1970-1990 Highlights:

- From 1970 to 1990 Michigan livestock receipts increased from $484.9 million to $1.3 billion. The receipts lagged slightly behind the nation in the rate of growth. The total net competitive effect was a negative $113.4 million for Michigan. Nationally the livestock sector was a slow growth sector. The state was actually under specialized in this sector that was advantageous.
- Of the nine commodities analyzed only three: honey, turkeys and hogs outperformed their respective national commodity growth rate and had a positive net competitive effect.
- Two commodities posted large negative net competitive effects, dairy products and cattle and calves. Dairy had the largest negative net competitive effect for all livestock commodities, of $85.3 million. Cattle and calves negative net competitive effect was $60.4 million.

Input-Output Analysis Highlights for Livestock and Poultry:[176]

- The average *employment* multiplier (both Type I and Type III) for the livestock sector was slightly lower than for the crop sector.
- The subsectors of hogs, pigs and swine and dairy farm products have the largest Type III *employment* multipliers at 2.30 and 2.25.
- The Type I and III *output* multipliers for the livestock sector were moderately higher than the crop sector output multipliers.
- In 1992 Michigan livestock exports (both domestic and foreign) totaled $141.0 million. Total state livestock imports were valued at $598.6 million.
- The state had a net trade deficit[177] of $457.7 million for livestock and products.

Fruit and Other

Trend Analysis Highlights for Fruit and Other:[178]

The 21-year fruit crop trend analysis focused on the categories of

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[176] Note: nine livestock categories were analyzed in the input-output chapter VI; dairy farm products, poultry and eggs, ranch fed cattle, range fed cattle, cattle feedlots, sheep-lambs-goats, hogs-pigs-swine, other meat animals, miscellaneous livestock.

[177] Note: a net trade surplus/deficit is defined as the difference between Michigan domestic commodity exports and Michigan foreign exports minus Michigan competitive commodity imports.

[178] Note: seven commodities were analyzed in the fruit trend section of chapter IV; apples, grapes, peaches, pears, prunes and plums, sweet cherries, and tart cherries.

acres harvested, value of production, quantity produced, yield, price, and number of fruit bearing trees for each of the commodities.

- All fruit crops had positive trends for yields, prices, and value of production (except pears).
- Total fruit crop value of production increased at an average annual rate of 3.61%, from $58 million in 1970 to consistently above $140 million in the late 80's. Fruit crops' value of production trend of 3.61% placed the group last for the major commodity groups analyzed, (field crops were first with a rate of 4.4%).
- Only apples and sweet cherries posted positive trends for the number of fruit bearing trees.
- Every fruit crop had a negative 21-year trend for acres harvested. The 21-year total state trend for acres harvested was a decline by an average of 1.75% per year. When investigating the historical data further however, (see Figure 92) two distinct trend patterns emerge. The first trend pattern is from 1970 to 1982, where total acres harvested fell every year from 156,300 acres to 100,900 acres. In 1982 the negative trend reverses as acreage increases each year from 100,900 acres to 119,000 in 1990.

- Apples, despite a declining trend in acres harvested, displayed an

average annual increase of 1.99% for the quantity produced. The reason for the upward trend in production was the increasing trend in yields per acre. The rise in apple yields was a function of the significant expansion of trees. The number of fruit bearing trees in the state grew from 2.9 million in 1970 to 5.5 million in 1990, rising at an average annual rate of 3.28% (highest for all fruit crops). The combination of greater production, and higher prices, lead to a value of production that tripled from $25 million to $75 million.

- Pears showed the largest declines and were last in acres harvested, quantity produced, value of production, and number of fruit bearing trees for all fruit crops. For each of the preceding categories, pears posted negative trends. The number of fruit bearing trees in the state fell from a level of 1.0 million trees in 1970 to 140,000 trees in 1990, a decline of 86.0%.

Shift-Share Analysis Highlights for Fruit and Other:[179]

The highlights are segmented into three time periods 1970-1980, 1980-1990, and 1970-1990.

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[179] Note: eight fruit crops were analyzed in shift-share chapter V; apples, blueberries, cherries, peaches, pears, plums and prunes, strawberries. Also note: the commodity of greenhouse and nursery products was analyzed separately but included in the result tables for fruit and other, the "other" being greenhouse and nursery products..

1970-1980 Highlights:

- Total fruit cash receipts increased from $68 million in 1970 to 161 million in 1980, up approximately 137%. The competitive position of Michigan fruit eroded however, despite the increase in cash receipts. If Michigan had kept pace with the national growth rate for fruit crops receipts should have been $30 million higher (this is reflected in the negative expected competitive effect of $20.8 and the negative allocation effect of $9.2 million).
- Every commodity, except for cherries, had negative results for their expected competitive effect. Cherry receipts expanded from $19.4 million in 1970 to $50.9 million in 1990, up 162%. The expected competitive effect for cherries was $282 thousand and the allocation effect was $3.8 million for a net competitive effect of $4.1 million.
- Apples an important fruit crop in the state, posted cash receipts that were slightly behind the national growth rate. The net competitive effect was a negative $9.7 million. Nationally apples were a fast growth commodity.

1980-1990 Highlights:

- Total state fruit crop receipts increased only marginally in the 80's. From 1980 to 1990, receipts rose from $180.6 million to $193.5 million. Despite fruit crops being a fast growth sector nationally,

Michigan continued to lose ground competitively. If Michigan had kept pace with the national growth rate for fruit crops, 1990 receipts would be larger by $51 million.

- Apples were the major contributor to the downward trend in the state's competitive fruit crop position. Apples posted a negative net competitive effect of $23 million.
- Blueberries were one of the important fruit crop gainers in the state in 80's. Receipts expanded from $19.7 million in 1980 to $27.0 million in 1990, up 37%. The relative strength of blueberries nationally is identified by the calculated net competitive effect of $3.8 million.

1970-1990 Highlights:

- Total Michigan fruit crop receipts lagged significantly behind the nation in the rate of growth. A negative net competitive effect was calculated for every Michigan fruit crop.[180] In total, the net competitive effect was a negative $101.5 million for Michigan. This means that if Michigan fruit cash receipts had grown at the national rate, total receipts would be $267 million, instead of $166.5 million in 1990.
- For the two decades strawberries were a fast growth commodity at the national level. In Michigan receipts increased from $5.7 million in

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[180] Note: blueberries were analyzed only for the decade of the 80's.

1970 to $6.5 million in 1990. Michigan however, did not keep pace with the national growth rate, state strawberry receipts should have been $23.1 million[181] higher in 1990, showing how significantly receipts lagged.

- Michigan greenhouse and nursery products receipts expanded from $30.5 million in 1970 to $259.7 in 1990, up approximately 752%. Michigan cash receipts increased substantially during the 70's and 80's, but so did national greenhouse and nursery receipts. From a competitive position, state receipts were actually just behind the U.S. in terms of the rate of growth, this is illustrated by the negative net competitive effect of $7.5 million.

Input-Output Analysis Highlights for Fruit and Other:[182]

- Fruit *employment* multipliers (both Type I and Type III) were both considerably higher than the state non-agricultural averages. The Type I fruit multiplier was 2.04 and the Type III fruit multiplier was 3.42 compared to the state non-agricultural average of 1.35 and 2.21.

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[181] Michigan strawberries had a negative net competitive effect of $23.1 million.

[182] Note: a general fruit category and a greenhouse and nursery products category was analyzed in the input-output chapter VI.

- The Type I *output* multiplier for fruit was slightly higher than the state crop average and the Type III multiplier was approximately the same as the state crop average.
- In 1992 Michigan's fruit exports (both domestic and foreign) totaled $255.0 million. Total state fruit imports were valued at $125.7 million.
- The state had a net fruit trade surplus[183] valued at $129.3 million.

Vegetables

Trend Analysis Highlights for Vegetables:[184]

The 21-year vegetable crop trend analysis focused on the categories of acres harvested, value of production, quantity produced, yield, and price for each of the commodities.

- Total vegetable crops acres harvested expanded gradually throughout the 70's and 80's. Acreage increased from 88,000 thousand in 1970 to 116 thousand in 1990, rising at an average annual rate of

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[183] Note: a net trade surplus/deficit is defined as the difference between Michigan domestic commodity exports and Michigan foreign exports minus Michigan competitive commodity imports.

[184] Note: thirteen commodities were analyzed in the vegetable trend section of chapter IV; asparagus, cauliflower, carrots, celery, cucumbers, lettuce, mushrooms, onions, snap beans, strawberries, sweet corn, fresh tomatoes, and process tomatoes. Also note that strawberries are included with the vegetables, the Michigan Agricultural Statistical Service categorizes the data in this manner.

0.83%.

- Total vegetable crops value of production trended higher at an average annual rate of 4.29% (ranking 2nd of the major commodity groups analyzed, field crops were first with a rate of 4.4%). Value of almost tripled from the $48 million level in the early 70's to above $140 million in the late 80's.
- Every vegetable crop posted positive trends for price and value of production. The commodities with the largest positive price trends were: sweet corn 6.18%, cauliflower 5.77%, and lettuce 5.33%. The commodities with the largest positive value of production trends were cauliflower 7.35%, processing tomatoes 7.35%, and snap beans 6.52%.
- Ten of the thirteen vegetable crops exhibited positive yield trends. The top three commodities were mushrooms[185] 5.99%, processing tomatoes 3.53%, and cucumbers 2.43%.
- Tomatoes for processing showed significant production gains. The positive trend was an average annual increase of 5.62%, the largest for all vegetable crops. Production tripled from 55,000 tons in the early 70's to the 170,000-ton level in the late 80's. Acres harvested also trended higher, rising from the 3,500-acre range to the

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[185] Note: the mushroom yield is calculated on a square foot basis. Also, the data used in the mushroom analysis (from 1981 to 1990) is not as complete as other Michigan Agricultural Statistical Service time series.

5,500-acre level. The value of production also increased considerably rising over six times, from approximately $2 million a year to $12 million annually.

- Snap beans were another crop that expanded significantly in the decades of the 70's and 80's. Acres harvested trended higher doubling from 11,000 to 22,000 acres. Average annual production increased at a rate of 3.61%, from a range of 26,000 tons per year in the 70's to the 54,000 tons per year in the late 80's.
- Fresh market strawberries generated the largest negative trend for the vegetable crop category of production. The state's production of fresh market strawberries fell an average annual rate of 2.62%, from 255,000 Cwt. in 1970 to the 140,000 Cwt. level in the late 80's. Acres harvested dropped nearly 50% in the early 70's and the negative trend began to slow in the 80's ranging from 2,700 acres to 2,200 acres.
- Another crop that displayed negative production trends was fresh market tomatoes. Fresh market tomato production fell an average annual rate of 2.35%. The number of acres harvested fell from the 4,000-acre level in the early 70's to the 2,500-acre level in the late 80's.

Shift-Share Analysis Highlights for Vegetables:[186]

The highlights are segmented into three time periods 1970-1980, 1980-1990, and 1970-1990.

1970-1980 Highlights:

- Total vegetable cash receipts increased from $56.5 million in 1970 to 119.1 million in 1980, up 111%.
- From a competitive standpoint Michigan vegetables outperformed national vegetable receipts, given the positive expected competitive effect of $3.5 million. However, the allocation effect was a negative $9.9 million, meaning that the state over specialized in many slow growth (at the national level) vegetables.
- Three vegetables: snap beans, celery, and asparagus posted positive competitive gains. Each of these commodities had positive expected competitive effects and allocation effects. The large net competitive effect pertain to asparagus of $6.3 million, second was celery with $3.0 million, and third was snap beans with $2.5 million.

1980-1990 Highlights:

- In the 80's cash receipts expanded from $119.1 million in 1980 to

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[186] Note: thirteen vegetable crops were analyzed in shift-share chapter V; asparagus, cabbage, cantaloupes, cauliflower, carrots, celery, cucumbers, lettuce, onions, peppers, snap beans, sweet corn, and tomatoes.

$151.1 million in 1990. Michigan continued a similar pattern as in the 70's with a negative expected competitive effect, one of $24.5 million.

- Nationally the vegetable sector moved into a fast growth mode. This is highlighted by the net sectoral mix effect of $33.1 million that was estimated for all Michigan vegetables.
- Snap beans continued to gain strength competitively as in the 70's. The net competitive effect of $3.4 million was the largest for all vegetables.
- Four commodities actually had declines in their cash receipts from 1980 to 1990: cantaloupes down 42%, lettuce down 29%, cabbage down 16%, and celery down 0.09%. Each of these commodities had estimates of negative net competitive effects except for cabbage. Even though Michigan cabbage receipts declined, they declined even further at the national level.

1970-1990 Highlights:

- Total Michigan vegetable and melons cash receipts increased from $56.5 million in 1970 to $151.1 million, up 167%.
- The net competitive effect for total vegetables was a negative $33.4 million. This means that if Michigan receipts had kept pace with the national growth rate for vegetables, than total Michigan receipts

should have been $184.5 million in 1990.

- The commodities with the largest estimated net competitive effects were: sweet corn, snap beans, asparagus, and peppers.
- The commodities with the largest estimated negative net competitive effects were: onions, carrots, tomatoes, and lettuce.

Input-Output Analysis Highlights for Vegetables:[187]

- Both Type I and III vegetable *employment* multipliers were some of the highest for all sectors analyzed. The Type I multiplier was 2.26 and the Type III was 3.79 compared to the state non-agricultural averages of 1.35 and 2.21. The larger multipliers reflect the labor intensive nature of vegetable crops.
- The Type I and III *output* multipliers for vegetables were slightly higher for the Type I and slightly lower for the Type III than the state non-agricultural averages.
- In 1992 Michigan's vegetable exports (domestic and foreign) totaled $128.2 million. Total state vegetable imports were valued at $178.8 million.
- The state had a vegetable net trade deficit[188] valued at $50.6 million.

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[187] Note: a general vegetable category was analyzed in the input-output chapter VI.

[188] Note: a net trade surplus/deficit is defined as the difference between Michigan domestic commodity exports and Michigan foreign exports minus Michigan competitive commodity imports.

Synthesis

The vast amount of research information presented in this dissertation could be considered overwhelming and invoke a response by the reader(s) that says, "all this is very nice but what difference does it make to me." The purpose of this dissertation was to create an analysis of key baseline data for Michigan production agriculture during the decades of the 70's and 80's. The dissertation is designed to be a foundation that will assist state policy makers affiliated with production agriculture. This applied research endeavor provides a resource that will help to minimize the search and transaction costs that are associated with the generation of production agriculture policies, specifically to the State of Michigan.

During the developmental stages of most policies, it is critical to have a reference point in order to identify realistic goals and objectives. This dissertation is a road map that provides an anchor point and a description of the path that Michigan has taken, regarding the production of many and varied agricultural commodities, over the last 20 years. It should be noted, however, that the analysis does not furnish a prescription for the policy maker of what should or should not be done.

How then might the policy maker best utilize this dissertation? The dissertation has three primary sections. Each section uses three different types of analytical methods to describe the state's agricultural trends, shifts and linkages during the decades of the 70' s and 80's. The following is a

sampling of possible ways that the research results may be utilized by the policy maker:

1) How might the results of the trend chapter IV be utilized, and what types of policy questions are relevant to the trend analysis?.
   - Recognize the trend analysis is a historical benchmark or proxy for being able to quantify specific objectives, during the creation process of a policy.
   - In the formative process of the policy recognize that many of these trends are well entrenched and may not change rapidly. The following policy question might be asked, is it reasonable to assume, hypothetically, for the state to try and expand the production of pears? Given pear's historical production trend of an average annual decline of 6.11 from 1970 to 1990 (see Figure 114), increasing pear production in the short run is probably not a realistic goal and expectations would need to be adjusted.
   - Recognize that once a policy is implemented, it's effectiveness can be tracked and measured against the stated objective.
   - Remember the benefit of the trend analysis is the identification of ***what*** has happened. The next step (and beyond the scope of this research) is to ask the question and identify ***why*** certain trends emerged? The final step in the process is to ask ***what*** will it take in

order to make changes in certain trends, if desired?

2) How might the results of the shift-share chapter V be utilized, and what types of policy questions are relevant to the shift-share analysis?.

- Recognize that shift-share analysis is an important analytical technique that identifies the patterns of growth and the changing structure of Michigan production agriculture over time.
- Recognize that the results of the shift-share analysis is for the policy maker in understanding Michigan's competitive position (from a United States perspective) for most of it's agricultural commodities.

3) How might the results of the input-output chapter VI be utilized, and what types of policy questions are relevant to the input-output analysis?

- Recognize that the input-output analysis is useful in understanding the influential linkage of Michigan production agricultural with the State's economy.
- Recognize that the input-output results addresses specific issues concerning the patterns of Michigan production agriculture; employment, trade, supply, demand, incomes, value added and output levels.

Research Considerations

1) Future Trend Research Considerations:

- The fitted trends (linear and exponential functions) could be expanded to include other types of fitted functions.
- The time series data (1970-1990) set could be enlarged to include more recent data as well as older observations, thus enriching the results.

2) Future Shift-Share Research Considerations:

- The shift-share technique could be modified to incorporate time series coefficients (instead of the cross sectional rates of change coefficients) generated by ordinary least squares regression.
- New data sets could be gathered and the shift-share analysis could be expanded to included states such as Texas, California and Florida.
- Continue to explore the utilization of agricultural cash receipts as the basis for comparing different types of commodities.

3) Future Input-Output Research Considerations:

- The input-output results could be adapted to a database structure that would assist the policy maker in the querying and investigation of the model results.

- The input-output model could be easily adapted to analyze specific production agriculture economic development questions. For example, what are the economic implications (i.e., employment, output and incomes) of a proposed soybean milling facility in the state?

APPENDICES

Appendix A
Data Set for Chapter IV
Trend Analysis

Appendix A, Data Set for Chapter IV, Trend Analysis

	Year	Number of Farms	Land in Farms (Acres)	Average Farm Size (Acres)
General Farming	1970	84,000	12,700,000	151
	1971	82,000	12,500,000	152
	1972	81,000	12,400,000	153
	1973	78,000	12,300,000	158
	1974	76,000	12,300,000	162
	1975	70,000	11,500,000	164
	1976	70,000	11,400,000	163
	1977	68,000	11,200,000	165
	1978	66,000	11,400,000	173
	1979	66,000	11,400,000	173
	1980	65,000	11,400,000	175
	1981	65,000	11,400,000	175
	1982	64,000	11,400,000	178
	1983	63,000	11,400,000	181
	1984	63,000	11,300,000	179
	1985	61,000	11,300,000	185
	1986	59,000	11,100,000	188
	1987	57,000	11,000,000	193
	1988	56,000	10,900,000	195
	1989	55,000	10,800,000	196
	1990	54,000	10,800,000	200

Commodity	Year	Acres Harvested	Unit	Total Production	Yield	Dollars Per Unit	Value of Production
Barley	1970	24,000	Bu.	1,224,000	51	$0.79	$966,960
	1971	22,000	Bu.	946,000	43	$0.92	$870,320
	1972	21,000	Bu.	1,071,000	51	$0.85	$910,350
	1973	22,000	Bu.	897,000	39	$1.85	$1,659,450
	1974	20,000	Bu.	1,020,000	51	$2.50	$2,550,000
	1975	19,000	Bu.	893,000	47	$2.73	$2,437,890
	1976	21,000	Bu.	966,000	46	$3.25	$3,139,500
	1977	22,000	Bu.	1,144,000	52	$2.53	$2,894,320
	1978	22,000	Bu.	1,034,000	47	$2.60	$2,688,400
	1979	20,000	Bu.	940,000	47	$2.65	$2,491,000
	1980	21,000	Bu.	1,113,000	53	$3.75	$4,173,750
	1981	26,000	Bu.	1,404,000	54	$2.98	$4,183,920
	1982	36,000	Bu.	2,124,000	59	$2.39	$5,076,360
	1983	33,000	Bu.	1,617,000	49	$2.85	$4,608,450
	1984	34,000	Bu.	2,040,000	60	$2.50	$5,100,000
	1985	38,000	Bu.	2,584,000	68	$2.05	$5,297,200
	1986	55,000	Bu.	3,245,000	59	$1.60	$5,192,000
	1987	50,000	Bu.	2,750,000	55	$1.80	$4,950,000
	1988	38,000	Bu.	1,216,000	32	$3.30	$4,012,800
	1989	40,000	Bu.	2,320,000	58	$2.90	$6,728,000
	1990	43,000	Bu.	2,580,000	60	$1.68	$4,334,400
Corn	1970	1,429,000	Bu.	115,749,000	81	$1.32	$152,788,680
	1971	1,730,000	Bu.	119,370,000	69	$1.03	$122,951,100
	1972	1,722,000	Bu.	142,926,000	83	$1.26	$180,086,760
	1973	1,690,000	Bu.	133,510,000	79	$2.52	$336,445,200
	1974	1,810,000	Bu.	110,410,000	61	$2.91	$321,293,100
	1975	2,200,000	Bu.	176,000,000	80	$2.35	$413,600,000
	1976	2,340,000	Bu.	161,460,000	69	$2.04	$329,378,400
	1977	2,490,000	Bu.	211,650,000	85	$1.92	$406,368,000
	1978	2,400,000	Bu.	194,400,000	81	$2.22	$431,568,000
	1979	2,500,000	Bu.	237,500,000	95	$2.46	$584,250,000
	1980	2,560,000	Bu.	243,200,000	95	$3.05	$741,760,000
	1981	2,800,000	Bu.	268,800,000	96	$2.39	$642,432,000
	1982	2,740,000	Bu.	293,180,000	107	$2.55	$747,609,000
	1983	1,800,000	Bu.	165,600,000	92	$3.20	$529,920,000
	1984	2,620,000	Bu.	220,080,000	84	$2.56	$563,404,800
	1985	2,730,000	Bu.	286,650,000	105	$2.14	$613,431,000
	1986	2,450,000	Bu.	257,250,000	105	$1.43	$367,867,500
	1987	1,950,000	Bu.	185,250,000	95	$1.97	$364,942,500
	1988	1,600,000	Bu.	112,000,000	70	$2.53	$283,360,000
	1989	1,970,000	Bu.	222,610,000	113	$2.20	$489,742,000
	1990	2,070,000	Bu.	238,050,000	115	$2.21	$526,090,500

Commodity	Year	Acres Harvested	Unit	Total Production	Yield	Dollar Per Unit	Value of Production
Corn Silage	1970	282,000	Ton	3,469,000	12.3		
	1971	498,000	Ton	4,980,000	10.0		
	1972	339,000	Ton	4,407,000	13.0		
	1973	385,000	Ton	4,620,000	12.0		
	1974	452,000	Ton	4,294,000	9.5		
	1975	420,000	Ton	5,250,000	12.5		
	1976	430,000	Ton	4,945,000	11.5		
	1977	445,000	Ton	5,565,000	12.5		
	1978	420,000	Ton	5,250,000	12.5		
	1979	370,000	Ton	4,995,000	13.5		
	1980	365,000	Ton	5,110,000	14.0		
	1981	370,000	Ton	5,180,000	14.0		
	1982	390,000	Ton	5,460,000	14.0		
	1983	380,000	Ton	4,940,000	13.0		
	1984	400,000	Ton	4,400,000	11.0		
	1985	340,000	Ton	4,590,000	13.5		
	1986	320,000	Ton	4,320,000	13.5		
	1987	330,000	Ton	4,290,000	13.0		
	1988	450,000	Ton	3,375,000	7.5		
	1989	300,000	Ton	3,900,000	13.0		
	1990	280,000	Ton	4,060,000	14.5		
Dry Beans	1970	575,000	Cwt.	6,153,000	1,070	$9.70	$59,684,100
	1971	570,000	Cwt.	5,643,000	990	$11.50	$64,894,500
	1972	615,000	Cwt.	7,319,000	1,190	$8.70	$63,675,300
	1973	560,000	Cwt.	5,320,000	950	$27.30	$145,236,000
	1974	575,000	Cwt.	6,902,000	1,200	$14.80	$102,149,600
	1975	520,000	Cwt.	4,732,000	910	$25.90	$122,558,800
	1976	545,000	Cwt.	5,450,000	1,000	$16.10	$87,745,000
	1977	480,000	Cwt.	5,664,000	1,180	$18.30	$103,651,200
	1978	520,000	Cwt.	5,980,000	1,150	$14.80	$88,504,000
	1979	460,000	Cwt.	6,440,000	1,400	$18.50	$119,140,000
	1980	570,000	Cwt.	7,752,000	1,360	$26.40	$204,652,800
	1981	590,000	Cwt.	7,198,000	1,220	$25.60	$184,268,800
	1982	550,000	Cwt.	7,975,000	1,450	$13.70	$109,257,500
	1983	350,000	Cwt.	4,550,000	1,300	$23.20	$105,560,000
	1984	390,000	Cwt.	4,290,000	1,100	$19.60	$84,084,000
	1985	410,000	Cwt.	5,412,000	1,320	$15.00	$81,180,000
	1986	340,000	Cwt.	2,720,000	800	$23.60	$64,192,000
	1987	420,000	Cwt.	5,124,000	1,220	$14.80	$75,835,200
	1988	170,000	Cwt.	2,142,000	1,260	$31.90	$68,329,800
	1989	300,000	Cwt.	4,500,000	1,500	$26.30	$118,350,000
	1990	330,000	Cwt.	5,445,000	1,650	$18.20	$99,099,000

Commodity	Year	Acres Harvested	Unit	Total Production	Yield	Dollars Per Unit	Value of Production
Hay	1970	1,350,000	Ton	3,281,000	2.43	$22.50	$73,822,500
	1971	1,340,000	Ton	2,677,000	2.00	$28.50	$76,294,500
	1972	1,310,000	Ton	3,067,000	2.34	$30.00	$92,010,000
	1973	1,360,000	Ton	3,394,000	2.50	$31.00	$105,214,000
	1974	1,240,000	Ton	2,906,000	2.34	$39.00	$113,334,000
	1975	1,300,000	Ton	3,290,000	2.53	$44.00	$144,760,000
	1976	1,290,000	Ton	3,060,000	2.37	$43.00	$131,580,000
	1977	1,300,000	Ton	2,855,000	2.20	$58.50	$167,017,500
	1978	1,430,000	Ton	3,857,000	2.70	$45.50	$175,493,500
	1979	1,330,000	Ton	3,833,000	2.88	$36.00	$137,988,000
	1980	1,310,000	Ton	4,048,000	3.09	$36.50	$147,752,000
	1981	1,270,000	Ton	4,094,000	3.22	$56.50	$231,311,000
	1982	1,370,000	Ton	4,347,000	3.17	$54.50	$236,911,500
	1983	1,400,000	Ton	4,470,000	3.19	$57.50	$257,025,000
	1984	1,750,000	Ton	5,285,000	3.02	$61.50	$325,027,500
	1985	1,750,000	Ton	5,705,000	3.26	$53.00	$302,365,000
	1986	1,770,000	Ton	5,743,000	3.24	$52.00	$298,636,000
	1987	1,400,000	Ton	4,090,000	2.92	$60.50	$247,445,000
	1988	1,900,000	Ton	4,220,000	2.22	$94.00	$396,680,000
	1989	1,550,000	Ton	5,205,000	3.36	$69.00	$359,145,000
	1990	1,450,000	Ton	5,335,000	3.68	$63.00	$336,105,000
Oats	1970	467,000	Bu.	27,086,000	58	$0.70	$18,960,200
	1971	415,000	Bu.	19,505,000	47	$0.71	$13,848,550
	1972	320,000	Bu.	17,600,000	55	$0.84	$14,784,000
	1973	330,000	Bu.	16,500,000	50	$1.35	$22,275,000
	1974	350,000	Bu.	19,250,000	55	$1.65	$31,762,500
	1975	370,000	Bu.	20,720,000	56	$1.39	$28,800,800
	1976	385,000	Bu.	19,635,000	51	$1.56	$30,630,600
	1977	340,000	Bu.	18,700,000	55	$1.27	$23,749,000
	1978	410,000	Bu.	23,370,000	57	$1.25	$29,212,500
	1979	310,000	Bu.	18,910,000	61	$1.45	$27,419,500
	1980	335,000	Bu.	20,100,000	60	$1.85	$37,185,000
	1981	340,000	Bu.	21,080,000	62	$1.97	$41,527,600
	1982	450,000	Bu.	28,350,000	63	$1.49	$42,241,500
	1983	300,000	Bu.	15,600,000	52	$1.83	$28,548,000
	1984	350,000	Bu.	21,700,000	62	$1.84	$39,928,000
	1985	390,000	Bu.	26,130,000	67	$1.17	$30,572,100
	1986	270,000	Bu.	17,010,000	63	$1.19	$20,241,900
	1987	300,000	Bu.	17,100,000	57	$1.59	$27,189,000
	1988	200,000	Bu.	6,000,000	30	$2.65	$15,900,000
	1989	300,000	Bu.	20,100,000	67	$1.46	$29,346,000
	1990	225,000	Bu.	13,050,000	58	$1.21	$15,790,500

Commodity	Year	Acres Harvested	Unit	Total Production	Yield	Dollars Per Unit	Value of Production
Potatoes	1970	45,000	Cwt.	10,550,000	234	$2.72	$28,696,000
	1971	45,100	Cwt.	9,509,000	211	$2.47	$23,487,230
	1972	40,300	Cwt.	9,635,000	239	$3.66	$35,264,100
	1973	40,000	Cwt.	8,640,000	216	$6.13	$52,963,200
	1974	42,400	Cwt.	9,926,000	234	$4.15	$41,192,900
	1975	36,400	Cwt.	8,076,000	222	$5.56	$44,902,560
	1976	41,600	Cwt.	9,622,000	231	$4.17	$40,123,740
	1977	39,800	Cwt.	10,243,000	257	$4.14	$42,406,020
	1978	42,300	Cwt.	9,953,000	235	$4.57	$45,485,210
	1979	40,600	Cwt.	9,548,000	235	$4.44	$42,393,120
	1980	43,300	Cwt.	10,020,000	227	$6.65	$66,633,000
	1981	44,800	Cwt.	10,535,000	235	$6.30	$66,370,500
	1982	49,300	Cwt.	12,796,000	260	$4.65	$59,501,400
	1983	52,800	Cwt.	12,023,000	230	$6.60	$79,351,800
	1984	56,800	Cwt.	15,100,000	265	$5.70	$86,070,000
	1985	57,800	Cwt.	15,136,000	260	$4.40	$66,598,400
	1986	42,000	Cwt.	11,190,000	266	$6.00	$67,140,000
	1987	43,300	Cwt.	10,970,000	253	$5.10	$55,947,000
	1988	43,000	Cwt.	9,440,000	220	$7.30	$68,912,000
	1989	40,000	Cwt.	9,650,000	241	$8.20	$79,130,000
	1990	44,000	Cwt.	12,115,000	272	$6.60	$79,959,000
Soybeans	1970	500,000	Bu.	13,250,000	26.5	$2.84	$37,630,000
	1971	500,000	Bu.	10,250,000	20.5	$3.05	$31,262,500
	1972	524,000	Bu.	13,624,000	26.0	$3.45	$47,002,800
	1973	693,000	Bu.	16,632,000	24.0	$5.73	$95,301,360
	1974	630,000	Bu.	13,230,000	21.0	$6.28	$83,084,400
	1975	610,000	Bu.	15,860,000	26.0	$4.78	$75,810,800
	1976	565,000	Bu.	11,583,000	20.5	$7.22	$83,629,260
	1977	770,000	Bu.	23,870,000	31.0	$5.54	$132,239,800
	1978	900,000	Bu.	21,600,000	24.0	$6.81	$147,096,000
	1979	1,010,000	Bu.	30,300,000	30.0	$6.13	$185,739,000
	1980	970,000	Bu.	32,010,000	33.0	$7.47	$239,114,700
	1981	1,040,000	Bu.	31,200,000	30.0	$6.02	$187,824,000
	1982	1,140,000	Bu.	35,340,000	31.0	$5.46	$192,956,400
	1983	1,040,000	Bu.	33,800,000	32.5	$7.82	$264,316,000
	1984	1,190,000	Bu.	32,130,000	27.0	$5.73	$184,104,900
	1985	1,080,000	Bu.	34,560,000	32.0	$4.93	$170,380,800
	1986	950,000	Bu.	30,400,000	32.0	$4.67	$141,968,000
	1987	1,090,000	Bu.	38,150,000	35.0	$5.62	$214,403,000
	1988	1,210,000	Bu.	35,090,000	29.0	$7.28	$255,455,200
	1989	1,080,000	Bu.	38,880,000	36.0	$5.60	$217,728,000
	1990	1,140,000	Bu.	43,320,000	38.0	$5.63	$243,891,600

Commodity	Year	Acres Harvested	Unit	Total Production	Yield	Dollars Per Unit	Value of Production
Sugarbeets	1970	89,900	Ton	1,913,000	21.3	$12.20	$23,338,600
	1971	82,600	Ton	1,415,000	17.1	$13.40	$18,961,000
	1972	86,600	Ton	1,638,000	18.9	$12.40	$20,311,200
	1973	86,700	Ton	1,524,000	17.6	$30.50	$46,482,000
	1974	80,400	Ton	1,364,000	17.0	$47.50	$64,790,000
	1975	91,400	Ton	1,755,000	19.2	$24.80	$43,524,000
	1976	91,400	Ton	1,540,000	16.8	$22.40	$34,496,000
	1977	85,500	Ton	1,796,000	21.0	$20.10	$36,099,600
	1978	91,500	Ton	1,770,000	19.3	$23.50	$41,595,000
	1979	88,000	Ton	1,550,000	17.6	$38.90	$60,295,000
	1980	98,000	Ton	1,892,000	19.3	$40.70	$77,004,400
	1981	99,000	Ton	2,030,000	20.5	$26.50	$53,795,000
	1982	96,500	Ton	1,853,000	19.2	$35.80	$66,337,400
	1983	104,000	Ton	1,976,000	19.0	$36.20	$71,531,200
	1984	108,000	Ton	2,117,000	19.6	$34.40	$72,824,800
	1985	118,000	Ton	2,325,000	19.7	$29.60	$68,820,000
	1986	109,600	Ton	2,280,000	20.8	$30.00	$68,400,000
	1987	142,000	Ton	2,911,000	20.5	$31.00	$90,241,000
	1988	145,000	Ton	2,393,000	16.5	$36.00	$86,148,000
	1989	150,000	Ton	2,565,000	17.1	$41.90	$107,473,500
	1990	157,000	Ton	3,266,000	20.8	$38.30	$125,087,800
Wheat	1970	480,000	Bu.	18,720,000	39	$1.40	$26,208,000
	1971	495,000	Bu.	17,820,000	36	$1.34	$23,878,800
	1972	535,000	Bu.	21,400,000	40	$1.65	$35,310,000
	1973	568,000	Bu.	19,880,000	35	$4.30	$85,484,000
	1974	940,000	Bu.	37,600,000	40	$3.64	$136,864,000
	1975	900,000	Bu.	34,200,000	38	$3.22	$110,124,000
	1976	870,000	Bu.	33,060,000	38	$2.53	$83,641,800
	1977	825,000	Bu.	33,000,000	40	$2.02	$66,660,000
	1978	410,000	Bu.	16,400,000	40	$3.30	$54,120,000
	1979	735,000	Bu.	31,605,000	43	$3.82	$120,731,100
	1980	800,000	Bu.	35,200,000	44	$3.60	$126,720,000
	1981	830,000	Bu.	41,500,000	50	$3.47	$144,005,000
	1982	560,000	Bu.	22,960,000	41	$3.33	$76,456,800
	1983	730,000	Bu.	35,770,000	49	$3.40	$121,618,000
	1984	800,000	Bu.	45,600,000	57	$3.18	$145,008,000
	1985	750,000	Bu.	45,000,000	60	$2.84	$127,800,000
	1986	680,000	Bu.	30,600,000	45	$2.38	$72,828,000
	1987	400,000	Bu.	19,200,000	48	$2.63	$50,496,000
	1988	620,000	Bu.	26,040,000	42	$3.59	$93,483,600
	1989	640,000	Bu.	33,920,000	53	$3.63	$123,129,600
	1990	750,000	Bu.	41,250,000	55	$2.40	$99,000,000

	Year	Acres Harvested	Value of Production
TOTAL	1970	5,241,900	$422,095,040
	1971	5,697,700	$376,448,500
	1972	5,512,900	$489,354,510
	1973	5,734,700	$891,060,210
	1974	6,139,800	$897,020,500
	1975	6,466,800	$986,518,850
	1976	6,579,000	$824,364,300
	1977	6,797,300	$981,085,440
	1978	6,645,800	$1,015,762,610
	1979	6,863,600	$1,280,446,720
	1980	7,072,300	$1,644,995,650
	1981	7,409,800	$1,555,717,820
	1982	7,381,800	$1,536,347,860
	1983	6,189,800	$1,462,478,450
	1984	7,698,800	$1,505,552,000
	1985	7,663,800	$1,466,444,500
	1986	6,986,600	$1,106,465,400
	1987	6,125,300	$1,131,448,700
	1988	6,376,000	$1,272,281,400
	1989	6,370,000	$1,530,772,100
	1990	6,489,000	$1,529,357,800

Commodity	Year	Number of Head	Unit	Total Production	Yield	Dollars Per Cwt. Calves	Value of Production
All Cattle & Calves	1970	1,500,000	lbs.			$37.60	
	1971	1,560,000	lbs.			$40.30	
	1972	1,576,000	lbs.			$49.70	
	1973	1,576,000	lbs.	491,140,000		$62.40	$197,760,000
	1974	1,550,000	lbs.	449,380,000		$45.00	$164,433,000
	1975	1,580,000	lbs.	476,385,000		$30.40	$159,569,000
	1976	1,550,000	lbs.	489,970,000		$35.40	$162,105,000
	1977	1,570,000	lbs.	513,715,000		$38.80	$168,197,000
	1978	1,470,000	lbs.	502,195,000		$61.60	$221,997,000
	1979	1,250,000	lbs.	356,865,000		$86.60	$215,754,000
	1980	1,310,000	lbs.	393,420,000		$82.50	$227,471,000
	1981	1,340,000	lbs.	431,540,000		$65.20	$216,348,000
	1982	1,450,000	lbs.	461,780,000		$57.20	$223,558,000
	1983	1,500,000	lbs.	461,000,000		$57.00	$218,661,000
	1984	1,450,000	lbs.	454,130,000		$54.10	$219,996,000
	1985	1,410,000	lbs.	463,485,000		$53.30	$215,373,000
	1986	1,325,000	lbs.	466,085,000		$55.00	$208,730,000
	1987	1,225,000	lbs.	462,130,000		$71.90	$247,245,000
	1988	1,225,000	lbs.	440,635,000		$85.40	$252,155,000
	1989	1,225,000	lbs.	436,555,000		$93.70	$262,090,000
	1990	1,200,000	lbs.	389,305,000		$99.00	$249,257,000
						Cattle	
Beef	1970	170,000	lbs.			$25.80	
	1971	187,000	lbs.			$26.40	
	1972	194,000	lbs.			$30.50	
	1973	196,000	lbs.			$40.20	
	1974	199,000	lbs.			$36.30	
	1975	205,000	lbs.			$33.50	
	1976	208,000	lbs.			$33.00	
	1977	239,000	lbs.			$32.80	
	1978	196,000	lbs.			$44.20	
	1979	138,000	lbs.			$58.20	
	1980	140,000	lbs.			$55.90	
	1981	160,000	lbs.			$49.50	
	1982	194,000	lbs.			$48.00	
	1983	195,000	lbs.			$47.20	
	1984	158,000	lbs.			$48.20	
	1985	160,000	lbs.			$46.30	
	1986	153,000	lbs.			$44.50	
	1987	150,000	lbs.			$52.50	
	1988	130,000	lbs.			$56.10	
	1989	125,000	lbs.			$58.50	
	1990	131,000	lbs.			$63.20	

Commodity	Year	Number of Head	Production No. Eggs	Yield/ Bird	Dollars Per Doz.	Value of Production
Hens & Layers	1970	6,495,000	1,450,000,000	223	$0.34	$40,715,000
	1971	6,550,000	1,505,000,000	230	$0.27	$34,479,000
	1972	6,812,000	1,523,000,000	224	$0.28	$35,997,000
	1973	6,608,000	1,539,000,000	233	$0.49	$62,581,000
	1974	6,252,000	1,375,000,000	220	$0.47	$53,813,000
	1975	6,440,000	1,303,000,000	202	$0.51	$55,556,000
	1976	6,440,000	1,520,000,000	236	$0.53	$67,312,000
	1977	6,300,000	1,530,000,000	243	$0.49	$61,898,000
	1978	6,350,000	1,497,000,000	236	$0.46	$57,811,000
	1979	6,250,000	1,491,000,000	239	$0.49	$61,336,000
	1980	6,400,000	1,459,000,000	228	$0.48	$57,760,000
	1981	6,300,000	1,541,000,000	245	$0.53	$68,670,000
	1982	6,300,000	1,532,000,000	243	$0.51	$64,473,000
	1983	6,200,000	1,484,000,000	239	$0.52	$63,743,000
	1984	6,700,000	1,519,000,000	227	$0.60	$75,350,000
	1985	7,100,000	1,693,000,000	238	$0.42	$59,255,000
	1986	6,700,000	1,644,000,000	245	$0.47	$64,116,000
	1987	6,600,000	1,656,000,000	251	$0.40	$54,648,000
	1988	5,800,000	1,553,000,000	268	$0.36	$47,237,000
	1989	5,600,000	1,454,000,000	260	$0.56	$68,338,000
	1990	5,500,000	1,406,000,000	256	$0.58	$67,977,000

Commodity	Year	Number of Head	Pounds Sold	Dollars Per Lb.	
Chickens	1970	4,340,000		$0.081	
	1971	4,346,000		$0.080	
	1972	4,552,000		$0.085	
	1973	5,226,000		$0.118	
	1974	5,900,000	19,598,000	$0.083	$1,606,000
	1975	6,000,000	23,453,000	$0.145	$3,588,000
	1976	5,600,000	22,370,000	$0.120	$2,772,000
	1977	5,400,000	20,851,000	$0.100	$2,073,000
	1978	5,600,000	22,338,000	$0.110	$2,411,000
	1979	5,000,000	20,284,000	$0.120	$2,504,000
	1980	5,250,000	21,333,000	$0.090	$1,833,000
	1981	5,650,000	22,787,000	$0.085	$1,993,000
	1982	5,100,000	20,526,000	$0.085	$1,739,000
	1983	5,100,000	20,147,000	$0.105	$2,297,000
	1984	5,500,000	21,202,000	$0.115	$1,850,000
	1985	5,500,000	24,750,000	$0.150	$3,713,000
	1986	5,300,000	23,850,000	$0.120	$2,862,000
	1987	4,400,000	20,240,000	$0.090	$1,822,000
	1988	5,300,000	24,380,000	$0.075	$1,829,000
	1989	3,900,000	18,330,000	$0.130	$2,383,000
	1990	4,100,000	19,720,000	$0.080	$1,542,000

Commodity	Year	Number of Head	Unit	Total Production	Dollars Per Unit	Value of Production
Broilers	1970	699,000	lbs.		$0.17	
	1971	1,085,000	lbs.		$0.18	
	1972	566,000	lbs.		$0.19	
	1973	571,500	lbs.		$0.23	
	1974	577,000	lbs.	2,943,000	$0.28	$815,000
	1975	510,000	lbs.	2,601,000	$0.27	$702,000
	1976	756,000	lbs.	3,856,000	$0.26	$1,003,000
	1977	910,000	lbs.	3,913,000	$0.26	$1,017,000
	1978	1,190,000	lbs.	5,355,000	$0.29	$1,564,000
	1979	2,570,000	lbs.	10,794,000	$0.28	$3,022,000
	1980	1,552,000	lbs.	6,053,000	$0.31	$1,876,000
	1981	1,130,000	lbs.	4,520,000	$0.32	$1,446,000
	1982	1,180,000	lbs.	4,720,000	$0.27	$1,274,000
	1983	1,130,000	lbs.	4,633,000	$0.30	$1,390,000
	1984	1,130,000	lbs.	4,746,000	$0.33	$1,566,000
	1985	1,300,000	lbs.	5,460,000	$0.31	$1,693,000
	1986	600,000	lbs.	2,520,000	$0.35	$882,000
	1987	675,000	lbs.	2,903,000	$0.29	$842,000
	1988	770,000	lbs.	3,311,000	$0.29	$1,159,000
	1989	760,000	lbs.	3,268,000	$0.37	$1,209,000
	1990	780,000	lbs.	3,432,000	$0.35	$1,184,000
Sheep & Lambs	1970	264,000	lbs.		$27.20	
	1971	255,000	lbs.		$26.60	
	1972	222,000	lbs.		$29.50	
	1973	206,000	lbs.	9,399,000	$36.60	$3,441,000
	1974	177,000	lbs.	8,610,000	$38.60	$3,223,000
	1975	147,000	lbs.	7,655,000	$43.80	$3,122,000
	1976	138,000	lbs.	7,385,000	$47.80	$3,271,000
	1977	149,000	lbs.	7,500,000	$51.60	$3,553,000
	1978	138,000	lbs.	8,045,000	$62.10	$4,802,000
	1979	121,000	lbs.	7,905,000	$66.60	$4,651,000
	1980	132,000	lbs.	8,955,000	$63.20	$5,058,000
	1981	124,000	lbs.	8,140,000	$51.90	$3,693,000
	1982	125,000	lbs.	7,580,000	$54.50	$3,516,000
	1983	110,000	lbs.	8,045,000	$53.00	$3,722,000
	1984	110,000	lbs.	9,369,000	$59.00	$4,772,000
	1985	110,000	lbs.	8,674,000	$67.00	$5,068,000
	1986	108,000	lbs.	8,690,000	$67.50	$5,157,000
	1987	106,000	lbs.	8,755,000	$75.00	$5,894,000
	1988	105,000	lbs.	8,647,000	$66.00	$5,082,000
	1989	115,000	lbs.	9,325,000	$62.00	$5,277,000
	1990	121,000	lbs.	8,345,000	$55.00	$4,094,000

Commodity	Year	Number of Head	Unit	Total Production	Yield	Dollars Per Unit	Value of Production
Dairy	1970	433,000	lbs.	4,602,000,000	10,628	$5.81	
	1971	430,000	lbs.	4,796,000,000	11,153	$5.96	
	1972	427,000	lbs.	4,966,000,000	11,630	$6.17	
	1973	423,000	lbs.	4,636,000,000	10,690	$7.20	$333,328,000
	1974	420,000	lbs.	4,350,000,000	10,407	$8.22	$359,310,000
	1975	412,000	lbs.	4,411,000,000	10,732	$8.55	$382,875,000
	1976	405,000	lbs.	4,620,000,000	11,407	$9.85	$455,994,000
	1977	403,000	lbs.	4,761,000,000	11,814	$9.65	$460,865,000
	1978	403,000	lbs.	4,793,000,000	11,893	$10.50	$506,141,000
	1979	397,000	lbs.	4,830,000,000	12,166	$12.00	$582,498,000
	1980	395,000	lbs.	4,970,000,000	12,582	$13.20	$658,028,000
	1981	393,000	lbs.	5,103,000,000	12,985	$13.80	$706,255,000
	1982	395,000	lbs.	5,253,000,000	13,299	$13.60	$716,176,000
	1983	404,000	lbs.	5,528,000,000	13,683	$13.60	$753,578,000
	1984	394,000	lbs.	5,350,000,000	13,579	$13.50	$723,743,000
	1985	394,000	lbs.	5,568,000,000	14,132	$12.70	$708,531,000
	1986	379,000	lbs.	5,404,000,000	14,259	$12.60	$682,418,000
	1987	361,000	lbs.	5,248,000,000	14,537	$12.60	$662,653,000
	1988	350,000	lbs.	5,228,000,000	14,937	$12.40	$650,011,000
	1989	345,000	lbs.	5,152,000,000	14,933	$13.60	$702,127,000
	1990	344,000	lbs.	5,233,000,000	15,212	$14.10	$739,366,000
						Price Per Cwt.	
Hog &	1970	870,000	lbs.			$41.00	
Pigs	1971	766,000	lbs.			$24.50	
	1972	720,000	lbs.			$29.00	
	1973	727,000	lbs.	251,754,000		$42.00	$99,443,000
	1974	715,000	lbs.	248,333,000		$61.00	$88,903,000
	1975	700,000	lbs.	208,124,000		$48.00	$99,900,000
	1976	720,000	lbs.	246,543,000		$44.70	$110,205,000
	1977	640,000	lbs.	228,729,000		$40.50	$92,635,000
	1978	925,000	lbs.	236,376,000		$47.60	$112,514,000
	1979	1,040,000	lbs.	306,997,000		$42.90	$132,029,000
	1980	830,000	lbs.	331,304,000		$38.80	$128,138,000
	1981	690,000	lbs.	288,235,000		$43.70	$125,441,000
	1982	900,000	lbs.	287,905,000		$52.50	$150,753,000
	1983	1,250,000	lbs.	386,003,000		$47.00	$181,077,000
	1984	1,310,000	lbs.	444,608,000		$46.80	$207,746,000
	1985	1,190,000	lbs.	386,535,000		$43.90	$169,979,000
	1986	1,250,000	lbs.	417,195,000		$48.30	$202,132,000
	1987	1,350,000	lbs.	434,290,000		$50.00	$217,557,000
	1988	1,250,000	lbs.	454,515,000		$41.40	$188,214,000
	1989	1,260,000	lbs.	471,985,000		$41.50	$195,988,000
	1990	1,250,000	lbs.	480,809,000		$52.30	$251,359,000

Commodity	Year	Number of Head	Unit	Total Production	Dollars Per Unit	Gross Income
Turkeys	1970					
	1971					
	1972					
	1973	1,088,000	lbs.	26,112,000	$0.39	$10,183,680
	1974	971,000	lbs.	22,333,000	$0.28	$6,297,906
	1975	700,000	lbs.	16,100,000	$0.31	$5,007,000
	1976	1,170,000	lbs.	26,910,000	$0.31	$8,207,550
	1977	1,210,000	lbs.	29,040,000	$0.35	$10,134,960
	1978	1,210,000	lbs.	30,250,000	$0.48	$14,520,000
	1979	1,200,000	lbs.	31,200,000	$0.45	$14,040,000
	1980	1,450,000	lbs.	37,700,000	$0.44	$16,588,000
	1981	1,550,000	lbs.	40,300,000	$0.41	$16,523,000
	1982	1,800,000	lbs.	46,800,000	$0.41	$19,188,000
	1983	1,900,000	lbs.	47,500,000	$0.42	$19,950,000
	1984	2,100,000	lbs.	52,500,000	$0.53	$27,825,000
	1985	2,300,000	lbs.	59,800,000	$0.52	$31,096,000
	1986	2,700,000	lbs.	70,200,000	$0.51	$35,802,000
	1987	3,000,000	lbs.	79,500,000	$0.36	$28,620,000
	1988	3,000,000	lbs.	84,000,000	$0.38	$31,920,000
	1989	3,500,000	lbs.	101,500,000	$0.42	$42,630,000
	1990	4,300,000	lbs.	124,700,000	$0.41	$51,127,000
TOTAL	1970					
	1971					
	1972					
	1973					$706,736,680
	1974					$678,400,906
	1975					$710,319,000
	1976					$810,869,550
	1977					$800,372,960
	1978					$921,760,000
	1979					$1,015,834,000
	1980					$1,096,752,000
	1981					$1,140,369,000
	1982					$1,180,677,000
	1983					$1,244,418,000
	1984					$1,262,848,000
	1985					$1,194,708,000
	1986					$1,202,099,000
	1987					$1,219,281,000
	1988					$1,177,607,000
	1989					$1,280,042,000
	1990					$1,365,906,000

Apples Year	Fruit Bearing Trees	Acres Harvested	Unit	Total Production (000's)	Tons Per Acre	Dollars Per Unit	Value of Production (000's)
1970	2,920,000	56,000	lbs.	690,000	6.16	$0.037	$25,737
1971	3,000,000	55,500	lbs.	700,000	6.31	$0.036	$26,061
1972	3,050,000	54,500	lbs.	730,000	6.70	$0.043	$31,390
1973	3,050,000	53,500	lbs.	470,000	4.39	$0.093	$43,710
1974	3,100,000	52,500	lbs.	670,000	6.38	$0.062	$41,540
1975	3,100,000	51,700	lbs.	700,000	6.77	$0.051	$34,680
1976	3,000,000	48,900	lbs.	480,000	4.91	$0.088	$42,240
1977	2,900,000	46,100	lbs.	570,000	6.18	$0.079	$45,030
1978	2,800,000	43,300	lbs.	920,000	10.62	$0.076	$67,640
1979	2,900,000	42,500	lbs.	680,000	8.00	$0.078	$53,040
1980	3,100,000	43,000	lbs.	900,000	10.47	$0.062	$55,600
1981	3,300,000	44,000	lbs.	660,000	7.50	$0.091	$59,760
1982	3,500,000	44,500	lbs.	980,000	11.01	$0.069	$68,000
1983	3,700,000	44,600	lbs.	750,000	8.41	$0.077	$57,540
1984	3,900,000	44,800	lbs.	770,000	8.59	$0.080	$61,960
1985	4,200,000	46,200	lbs.	1,100,000	11.90	$0.075	$79,800
1986	4,450,000	47,300	lbs.	700,000	7.40	$0.093	$65,075
1987	4,800,000	49,500	lbs.	1,050,000	10.61	$0.076	$79,860
1988	5,100,000	51,000	lbs.	830,000	8.14	$0.088	$72,960
1989	5,350,000	51,900	lbs.	950,000	9.15	$0.082	$78,080
1990	5,500,000	52,100	lbs.	750,000	7.20	$0.103	$77,500
Tart Cherries							
1970	3,450,000	39,500	lbs.	158,000	2.00	$0.072	$11,297
1971	3,400,000	39,100	lbs.	178,000	2.28	$0.099	$17,622
1972	3,400,000	39,100	lbs.	214,000	2.74	$0.081	$17,227
1973	3,200,000	36,800	lbs.	116,000	1.58	$0.195	$22,620
1974	3,100,000	36,000	lbs.	206,000	2.86	$0.184	$37,801
1975	3,000,000	34,900	lbs.	222,000	3.18	$0.100	$18,200
1976	2,900,000	30,900	lbs.	90,000	1.46	$0.254	$22,860
1977	2,750,000	29,300	lbs.	162,000	2.76	$0.295	$47,790
1978	2,600,000	27,700	lbs.	128,000	2.31	$0.444	$56,832
1979	2,650,000	28,200	lbs.	100,000	1.77	$0.485	$48,500
1980	2,700,000	29,400	lbs.	150,000	2.55	$0.204	$30,396
1981	2,650,000	27,800	lbs.	88,000	1.58	$0.464	$40,788
1982	2,600,000	27,000	lbs.	260,000	4.81	$0.137	$26,805
1983	2,750,000	28,100	lbs.	87,000	1.55	$0.491	$42,721
1984	3,000,000	30,000	lbs.	210,000	3.50	$0.254	$49,555
1985	3,250,000	31,600	lbs.	220,000	3.48	$0.219	$47,145
1986	3,500,000	33,300	lbs.	170,000	2.55	$0.198	$32,751
1987	3,600,000	34,000	lbs.	265,000	3.90	$0.075	$16,890
1988	3,500,000	33,300	lbs.	180,000	2.70	$0.183	$32,859
1989	3,500,000	33,300	lbs.	180,000	2.70	$0.129	$25,385
1990	3,450,000	32,900	lbs.	160,000	2.43	$0.185	$29,520

Sweet Cherries Year	Fruit Bearing Trees	Acres Harvested	Unit	Total Production (000's)	Tons Per Acre	Dollars Per Unit	Value of Production (000's)
1970	920,000	11,400	lbs.	42,000	1.84	$0.101	$4,242
1971	950,000	11,600	lbs.	47,000	2.03	$0.096	$4,489
1972	970,000	11,700	lbs.	56,000	2.39	$0.098	$5,460
1973	980,000	11,500	lbs.	34,000	1.48	$0.140	$4,480
1974	980,000	11,800	lbs.	56,000	2.37	$0.180	$10,080
1975	980,000	12,100	lbs.	62,000	2.56	$0.118	$7,316
1976	980,000	11,600	lbs.	27,000	1.16	$0.186	$5,022
1977	900,000	10,900	lbs.	50,000	2.29	$0.205	$9,430
1978	850,000	10,200	lbs.	75,000	3.68	$0.229	$17,175
1979	775,000	9,300	lbs.	54,000	2.90	$0.204	$10,989
1980	700,000	8,400	lbs.	58,000	3.45	$0.177	$10,266
1981	675,000	8,100	lbs.	46,000	2.84	$0.188	$8,635
1982	625,000	7,500	lbs.	62,000	4.13	$0.199	$10,160
1983	640,000	7,700	lbs.	36,000	2.34	$0.230	$8,272
1984	670,000	8,000	lbs.	66,000	4.13	$0.212	$13,120
1985	700,000	8,200	lbs.	62,000	3.78	$0.250	$15,500
1986	740,000	8,600	lbs.	40,000	2.33	$0.288	$11,520
1987	780,000	9,100	lbs.	64,000	3.52	$0.288	$18,436
1988	810,000	9,400	lbs.	56,000	2.98	$0.329	$18,395
1989	840,000	9,700	lbs.	50,000	2.58	$0.234	$11,705
1990	860,000	9,900	lbs.	32,000	1.62	$0.256	$6,913
Peaches							
1970	1,550,000	16,100	lbs.	75,000	2.33	$0.072	$5,415
1971	1,600,000	16,500	lbs.	82,000	2.48	$0.058	$4,756
1972	1,530,000	15,600	lbs.	10,000	0.32	$0.107	$1,070
1973	1,430,000	14,300	lbs.	50,000	1.75	$0.115	$5,750
1974	1,350,000	13,500	lbs.	70,000	2.59	$0.117	$8,190
1975	1,260,000	12,700	lbs.	65,000	2.56	$0.134	$7,370
1976	1,200,000	11,900	lbs.	40,000	1.68	$0.141	$5,640
1977	1,000,000	9,900	lbs.	55,000	2.78	$0.156	$8,580
1978	700,000	6,900	lbs.	60,000	4.35	$0.160	$9,600
1979	500,000	4,900	lbs.	35,000	3.57	$0.194	$6,790
1980	450,000	4,400	lbs.	40,000	4.55	$0.192	$7,680
1981	425,000	4,100	lbs.	35,000	4.27	$0.192	$6,734
1982	500,000	4,700	lbs.	50,000	5.32	$0.209	$10,459
1983	570,000	5,300	lbs.	35,000	3.30	$0.215	$7,526
1984	660,000	5,900	lbs.	45,000	3.81	$0.171	$7,700
1985	720,000	6,300	lbs.	55,000	4.37	$0.209	$11,515
1986	790,000	6,600	lbs.	50,000	3.79	$0.177	$8,864
1987	875,000	7,300	lbs.	60,000	4.11	$0.161	$9,526
1988	925,000	7,700	lbs.	45,000	2.92	$0.178	$8,028
1989	950,000	7,900	lbs.	55,000	3.48	$0.191	$10,490
1990	975,000	8,000	lbs.	45,000	2.81	$0.178	$9,447

Grapes	Year	Fruit Bearing Vines	Acres Harvested	Unit	Total Production (000's)	Tons Per Acre	Dollars Per Unit	Value of Production (000's)
	1970	7,850,000	15,900	lbs.	124,000	3.90	$0.710	$8,804
	1971	7,900,000	15,900	lbs.	138,000	4.34	$0.600	$8,280
	1972	7,900,000	15,800	lbs.	106,000	3.35	$0.860	$8,798
	1973	7,900,000	15,800	lbs.	47,000	1.49	$0.985	$4,630
	1974	7,900,000	15,800	lbs.	95,000	3.01	$0.920	$8,740
	1975	7,900,000	15,800	lbs.	112,000	3.54	$0.655	$7,205
	1976	7,500,000	15,000	lbs.	29,000	0.97	$0.765	$2,219
	1977	7,000,000	14,000	lbs.	66,000	2.36	$1.080	$7,128
	1978	7,000,000	14,000	lbs.	135,000	4.82	$1.115	$15,053
	1979	6,600,000	13,500	lbs.	117,000	4.33	$1.185	$13,865
	1980	6,300,000	13,000	lbs.	99,000	3.81	$1.200	$11,858
	1981	6,100,000	12,700	lbs.	106,000	4.17	$1.260	$13,370
	1982	5,900,000	12,500	lbs.	117,000	4.68	$1.010	$11,815
	1983	5,750,000	12,200	lbs.	120,000	4.92	$0.970	$11,662
	1984	5,650,000	12,000	lbs.	98,000	4.08	$0.830	$8,131
	1985	5,500,000	11,800	lbs.	102,000	4.32	$1.075	$10,952
	1986	5,400,000	11,500	lbs.	64,000	2.78	$1.235	$7,916
	1987	5,300,000	11,300	lbs.	120,000	5.31	$1.300	$15,609
	1988	5,200,000	11,100	lbs.	106,000	4.77	$1.280	$13,548
	1989	5,100,000	11,000	lbs.	86,000	3.91	$1.325	$11,415
	1990	5,100,000	11,000	lbs.	92,000	4.18	$1.280	$13,372
Pears		Trees						
	1970	1,000,000	10,600	lbs.	34,000	1.60	$0.470	$1,598
	1971	1,000,000	10,500	lbs.	37,000	1.76	$0.405	$1,497
	1972	970,000	10,200	lbs.	45,000	2.21	$0.445	$2,000
	1973	940,000	9,900	lbs.	23,000	1.16	$0.770	$1,463
	1974	830,000	8,700	lbs.	26,000	1.49	$0.800	$2,080
	1975	750,000	7,900	lbs.	30,000	1.90	$0.700	$2,100
	1976	600,000	6,400	lbs.	12,000	0.94	$1.100	$1,568
	1977	450,000	4,800	lbs.	16,000	1.67	$1.105	$2,760
	1978	290,000	3,000	lbs.	20,000	3.33	$1.005	$2,010
	1979	250,000	2,700	lbs.	18,000	3.33	$0.990	$1,782
	1980	225,000	2,400	lbs.	20,000	4.17	$1.115	$2,230
	1981	200,000	2,100	lbs.	18,000	4.29	$1.120	$2,016
	1982	180,000	1,900	lbs.	20,000	5.26	$1.040	$1,868
	1983	175,000	1,800	lbs.	12,000	3.33	$1.085	$1,301
	1984	165,000	1,700	lbs.	18,000	5.29	$1.050	$1,890
	1985	160,000	1,700	lbs.	12,000	3.53	$1.115	$1,335
	1986	155,000	1,600	lbs.	20,000	6.25	$1.135	$2,270
	1987	150,000	1,500	lbs.	10,000	3.33	$1.085	$1,083
	1988	146,000	1,500	lbs.	12,000	4.00	$1.205	$1,445
	1989	145,000	1,500	lbs.	16,000	5.33	$1.280	$2,047
	1990	140,000	1,400	lbs.	5,000	1.79	$1.335	$668

Prunes & Plums Year	Fruit Bearing Trees	Acres Harvested	Unit	Total Production (000's)	Tons Per Acre	Dollars Per Unit	Value of Production (000's)
1970	650,000	6,800	lbs.	23,000	1.69	$0.640	$1,472
1971	665,000	7,000	lbs.	40,000	2.86	$0.360	$1,440
1972	675,000	7,100	lbs.	28,000	1.97	$0.695	$1,946
1973	680,000	7,200	lbs.	36,000	2.50	$0.615	$2,214
1974	695,000	7,300	lbs.	32,000	2.19	$0.875	$2,800
1975	700,000	7,400	lbs.	40,000	2.70	$0.595	$2,380
1976	600,000	6,400	lbs.	32,000	2.50	$0.665	$2,128
1977	500,000	5,400	lbs.	28,000	2.59	$0.705	$1,974
1978	450,000	4,800	lbs.	48,000	5.00	$0.690	$3,312
1979	400,000	4,200	lbs.	28,000	3.33	$1.035	$2,898
1980	350,000	3,700	lbs.	25,000	3.38	$1.040	$2,602
1981	300,000	3,100	lbs.	32,000	5.16	$0.700	$2,237
1982	275,000	2,800	lbs.	20,000	3.57	$1.280	$2,565
1983	280,000	2,800	lbs.	24,000	4.29	$0.985	$2,366
1984	300,000	2,900	lbs.	24,000	4.14	$1.380	$3,310
1985	315,000	3,000	lbs.	22,000	3.67	$1.495	$3,285
1986	335,000	3,200	lbs.	22,000	3.44	$1.215	$2,668
1987	345,000	3,300	lbs.	28,000	4.24	$0.675	$1,624
1988	365,000	3,500	lbs.	22,000	3.14	$0.990	$2,173
1989	375,000	3,600	lbs.	26,000	3.61	$0.875	$2,281
1990	390,000	3,700	lbs.	12,000	1.62	$1.480	$1,778

TOTAL		
1970	156,300	$58,565
1971	156,100	$64,145
1972	154,000	$67,891
1973	149,000	$84,867
1974	145,600	$111,231
1975	142,500	$79,251
1976	131,100	$81,677
1977	120,400	$122,692
1978	109,900	$171,622
1979	105,300	$137,864
1980	104,300	$120,632
1981	101,900	$133,540
1982	100,900	$131,672
1983	102,500	$131,388
1984	105,300	$145,666
1985	108,800	$169,532
1986	112,100	$131,064
1987	116,000	$143,028
1988	117,500	$149,408
1989	118,900	$141,403
1990	119,000	$139,198

Commodity	Year	Acres Harvested	Unit	Total Production (000's)	Yield	Dollars Per Unit	Value of Production
Asparagus	1970	12,400	Cwt.	198	16.0	$21.00	$4,158,000
	1971	13,500	Cwt.	189	14.0	$24.20	$4,573,800
	1972	14,500	Cwt.	218	15.0	$27.00	$5,886,000
	1973	15,400	Cwt.	246	16.0	$28.90	$7,109,400
	1974	17,000	Cwt.	255	15.0	$33.70	$8,593,500
	1975	17,800	Cwt.	196	11.0	$24.30	$4,762,800
	1976	18,000	Cwt.	180	10.0	$33.00	$5,940,000
	1977	19,000	Cwt.	209	11.0	$44.60	$9,321,400
	1978	19,500	Cwt.	254	13.0	$56.70	$14,401,800
	1979	19,500	Cwt.	254	13.0	$61.20	$15,544,800
	1980	19,500	Cwt.	234	12.0	$51.30	$12,004,200
	1981	19,000	Cwt.	171	9.0	$62.50	$10,687,500
	1982	21,371	Cwt.	223	10.4	$63.58	$14,152,937
	1983	22,030	Cwt.	223	10.1	$67.39	$15,059,382
	1984	19,200	Cwt.	230	12.0	$57.90	$13,317,000
	1985	19,200	Cwt.	230	12.0	$58.40	$13,432,000
	1986	20,500	Cwt.	246	12.0	$58.20	$14,317,200
	1987	22,000	Cwt.	242	11.0	$58.60	$14,181,200
	1988	22,500	Cwt.	248	11.0	$59.00	$14,632,000
	1989	23,000	Cwt.	253	11.0	$58.40	$14,775,200
	1990	23,500	Cwt.	259	11.0	$56.70	$14,685,300
Carrots	1970	4,800	Cwt.	1,104	230	$4.83	$5,332,320
	1971	5,200	Cwt.	1,222	235	$6.90	$8,431,800
	1972	4,800	Cwt.	1,008	210	$7.53	$7,590,240
	1973	6,100	Cwt.	1,524	250	$7.12	$10,850,880
	1974	6,000	Cwt.	1,327	221	$9.05	$12,009,350
	1975	5,800	Cwt.	1,133	195	$8.27	$9,369,910
	1976	6,000	Cwt.	1,641	274	$7.70	$12,635,700
	1977	5,600	Cwt.	1,301	232	$9.83	$12,788,830
	1978	6,100	Cwt.	1,614	265	$9.69	$15,639,660
	1979	6,600	Cwt.	1,713	260	$7.88	$13,498,440
	1980	5,600	Cwt.	1,340	239	$11.70	$15,678,000
	1981	5,600	Cwt.	1,316	235	$9.43	$12,409,880
	1982	6,700	Cwt.	1,709	255	$7.53	$12,868,770
	1983	7,200	Cwt.	1,656	230	$11.20	$18,547,200
	1984	7,500	Cwt.	2,025	270	$10.10	$20,452,500
	1985	6,400	Cwt.	1,664	260	$9.76	$16,240,640
	1986	3,700	Cwt.	925	250	$9.93	$9,185,250
	1987	7,000	Cwt.	1,925	275	$7.36	$14,168,000
	1988	6,700	Cwt.	1,709	255	$12.50	$21,362,500
	1989	6,800	Cwt.	1,666	245	$8.43	$14,044,380
	1990	6,700	Cwt.	1,876	280	$9.20	$17,259,200

Commodity	Year	Acres Harvested	Unit	Total Production (000's)	Yield	Dollars Per Unit	Value of Production
Cauliflower	1970	1,200	Cwt.	79	66	$6.70	$529,300
	1971	800	Cwt.	49	61	$13.00	$637,000
	1972	800	Cwt.	44	55	$11.75	$517,000
	1973	930	Cwt.	38	41	$15.69	$596,220
	1974	1,000	Cwt.	51	51	$14.70	$749,700
	1975	1,100	Cwt.	49	45	$14.50	$710,500
	1976	700	Cwt.	39	56	$22.00	$858,000
	1977	1,000	Cwt.	50	50	$16.60	$830,000
	1978	1,100	Cwt.	55	50	$28.50	$1,567,500
	1979	1,100	Cwt.	77	70	$27.70	$2,132,900
	1980	1,000	Cwt.	50	50	$36.50	$1,825,000
	1981	1,200	Cwt.	74	62	$38.60	$2,856,400
	1982	1,500	Cwt.	87	58	$29.50	$2,566,500
	1983	1,400	Cwt.	77	55	$35.30	$2,718,100
	1984	1,500	Cwt.	98	65	$35.10	$3,439,800
	1985	1,500	Cwt.	98	65	$33.90	$3,322,200
	1986	700	Cwt.	39	56	$39.50	$1,540,500
	1987	1,200	Cwt.	72	60	$28.80	$2,073,600
	1988	1,100	Cwt.	61	55	$39.00	$2,379,000
	1989	1,200	Cwt.	72	60	$33.00	$2,376,000
	1990	1,000	Cwt.	70	70	$39.40	$2,758,000
Celery	1970	2,300	Cwt.	874	380	$5.98	$5,226,520
	1971	2,400	Cwt.	888	370	$6.65	$5,905,200
	1972	2,300	Cwt.	794	345	$7.01	$5,565,940
	1973	2,300	Cwt.	1,041	453	$7.88	$8,203,080
	1974	2,500	Cwt.	1,074	430	$7.01	$7,528,740
	1975	2,400	Cwt.	905	377	$7.84	$7,095,200
	1976	2,300	Cwt.	1,016	442	$8.52	$8,656,320
	1977	2,400	Cwt.	1,074	448	$8.24	$8,849,760
	1978	2,300	Cwt.	936	407	$14.10	$13,197,600
	1979	2,600	Cwt.	1,153	443	$9.52	$10,976,560
	1980	3,100	Cwt.	1,387	447	$9.29	$12,885,230
	1981	3,200	Cwt.	1,440	450	$11.00	$15,840,000
	1982	3,300	Cwt.	1,551	470	$10.60	$16,440,600
	1983	3,500	Cwt.	1,295	370	$12.70	$16,446,500
	1984	3,900	Cwt.	1,560	400	$9.87	$15,397,200
	1985	3,200	Cwt.	1,312	410	$10.60	$13,907,200
	1986	2,600	Cwt.	1,040	400	$14.00	$14,560,000
	1987	3,100	Cwt.	1,147	370	$11.50	$13,190,500
	1988	3,100	Cwt.	1,178	380	$13.70	$16,138,600
	1989	2,800	Cwt.	1,064	380	$13.30	$14,151,200
	1990	3,000	Cwt.	1,290	430	$9.99	$12,887,100

Commodity	Year	Acres Harvested	Unit	Total Production (000's)	Yield	Dollars Per Unit	Value of Production
Strawberries	1970	5,800	Cwt.	255	44	$20.10	$5,125,500
	1971	5,200	Cwt.	250	48	$20.20	$5,050,000
	1972	4,000	Cwt.	212	53	$24.60	$5,215,200
	1973	3,400	Cwt.	150	44	$31.50	$4,725,000
	1974	3,100	Cwt.	177	57	$31.10	$5,504,700
	1975	3,000	Cwt.	195	65	$32.70	$6,376,500
	1976	2,900	Cwt.	232	80	$34.00	$7,888,000
	1977	2,800	Cwt.	196	70	$32.00	$6,272,000
	1978	2,800	Cwt.	210	75	$38.00	$7,980,000
	1979	2,800	Cwt.	196	70	$51.20	$10,035,200
	1980	2,700	Cwt.	176	65	$47.50	$8,360,000
	1981	2,700	Cwt.	176	65	$47.10	$8,289,600
	1982	2,700	Cwt.	216	80	$53.10	$11,469,600
	1983	2,700	Cwt.	162	60	$51.90	$8,407,800
	1984	2,700	Cwt.	189	70	$37.40	$7,068,600
	1985	2,500	Cwt.	163	65	$38.70	$6,308,100
	1986	2,400	Cwt.	144	60	$44.20	$6,364,800
	1987	2,400	Cwt.	144	60	$47.10	$6,782,400
	1988	2,300	Cwt.	127	55	$47.90	$6,083,300
	1989	2,200	Cwt.	117	53	$49.00	$5,733,000
	1990	2,200	Cwt.	143	65	$50.50	$7,221,500
Snap Beans Processing	1970	10,100	Tons	20	1.98	$95	$1,894,000
	1971	12,400	Tons	25	2.02	$91	$2,274,540
	1972	14,400	Tons	36	2.50	$97	$3,484,800
	1973	18,300	Tons	47	2.55	$102	$4,758,300
	1974	13,800	Tons	36	2.58	$124	$4,414,400
	1975	13,100	Tons	30	2.29	$129	$3,870,000
	1976	14,000	Tons	30	2.17	$122	$3,708,800
	1977	16,800	Tons	41	2.46	$125	$5,162,500
	1978	16,400	Tons	34	2.10	$148	$5,098,600
	1979	17,300	Tons	36	2.08	$162	$5,828,760
	1980	13,700	Tons	38	2.80	$156	$5,974,800
	1981	14,300	Tons	36	2.53	$160	$5,792,000
	1982	14,200	Tons	37	2.58	$145	$5,307,000
	1983	14,800	Tons	41	2.80	$144	$5,961,600
	1984	17,500	Tons	49	2.80	$136	$6,664,000
	1985	18,700	Tons	49	2.60	$158	$7,678,800
	1986	17,600	Tons	42	2.40	$143	$6,034,600
	1987	19,500	Tons	43	2.20	$149	$6,392,100
	1988	21,000	Tons	38	1.80	$175	$6,615,000
	1989	21,500	Tons	62	2.90	$166	$10,341,800
	1990	27,000	Tons	80	2.95	$170	$13,540,500

Commodity	Year	Acres Harvested	Unit	Total Production (000's)	Yield	Dollars Per Unit	Value of Production
Cucumbers Processing	1970	23,200	Tons	104	4.48	$100	$10,353,420
	1971	24,500	Tons	83	3.38	$92	$7,617,600
	1972	26,000	Tons	98	3.76	$86	$8,391,240
	1973	26,400	Tons	107	4.07	$88	$9,477,090
	1974	27,400	Tons	116	4.23	$125	$14,487,500
	1975	27,600	Tons	129	4.68	$124	$16,020,800
	1976	25,500	Tons	103	4.05	$112	$11,569,600
	1977	24,500	Tons	114	4.65	$109	$12,426,000
	1978	26,500	Tons	126	4.75	$120	$15,120,000
	1979	25,500	Tons	118	4.62	$132	$15,550,920
	1980	18,900	Tons	105	5.56	$125	$13,135,000
	1981	15,500	Tons	101	6.50	$135	$13,601,250
	1982	23,710	Tons	124	5.23	$137	$16,979,775
	1983	23,513	Tons	126	5.37	$141	$17,746,590
	1984	21,300	Tons	118	5.52	$147	$17,272,500
	1985	24,000	Tons	134	5.60	$158	$21,235,200
	1986	24,000	Tons	139	5.80	$146	$20,323,200
	1987	24,000	Tons	161	6.70	$139	$22,351,200
	1988	23,000	Tons	127	5.50	$156	$19,734,000
	1989	24,500	Tons	147	6.00	$168	$24,696,000
	1990	24,000	Tons	142	5.90	$167	$23,647,200
Tomatoes Processing	1970	3,300	Tons	55	16.7	$36.90	$2,035,035
	1971	4,300	Tons	65	15.1	$37.30	$2,426,365
	1972	4,000	Tons	54	13.4	$37.50	$2,010,000
	1973	3,600	Tons	53	14.8	$43.40	$2,317,560
	1974	5,300	Tons	60	11.4	$69.30	$4,185,720
	1975	4,400	Tons	63	14.4	$64.00	$4,051,200
	1976	4,000	Tons	75	18.6	$65.20	$4,857,400
	1977	4,100	Tons	64	15.5	$65.80	$4,178,300
	1978	4,500	Tons	81	18.0	$67.30	$5,464,760
	1979	5,600	Tons	101	18.1	$68.30	$6,926,986
	1980	6,000	Tons	74	12.3	$72.90	$5,365,440
	1981	6,200	Tons	118	19.1	$86.00	$10,173,800
	1982	9,700	Tons	205	21.1	$92.60	$18,945,960
	1983	9,200	Tons	183	19.9	$84.00	$15,372,000
	1984	7,400	Tons	174	23.5	$84.00	$14,607,600
	1985	6,600	Tons	166	25.2	$80.00	$13,304,000
	1986	5,400	Tons	133	24.7	$76.00	$10,130,800
	1987	5,000	Tons	119	23.7	$69.20	$8,200,200
	1988	5,200	Tons	112	21.6	$68.20	$7,658,860
	1989	5,400	Tons	133	24.6	$72.80	$9,667,840
	1990	5,700	Tons	170	29.8	$75.50	$12,824,430

Commodity	Year	Acres Harvested	Unit	Total Production (000's)	Yield	Dollars Per Unit	Value of Production
Sweet Corn	1970	12,700	Cwt.	1,016	80	$3.13	$3,180,080
	1971	12,000	Cwt.	876	73	$4.60	$4,029,600
	1972	12,200	Cwt.	854	70	$4.16	$3,552,640
	1973	12,100	Cwt.	781	65	$5.35	$4,178,350
	1974	12,000	Cwt.	617	51	$7.85	$4,843,450
	1975	12,000	Cwt.	728	61	$5.71	$4,156,880
	1976	12,300	Cwt.	701	57	$7.33	$5,138,330
	1977	12,300	Cwt.	775	63	$7.07	$5,479,250
	1978	11,700	Cwt.	702	60	$9.28	$6,514,560
	1979	11,500	Cwt.	667	58	$8.28	$5,522,760
	1980	11,500	Cwt.	771	67	$8.92	$6,877,320
	1981	12,000	Cwt.	732	61	$9.84	$7,202,880
	1982	13,000	Cwt.	858	66	$8.81	$7,558,980
	1983	12,800	Cwt.	896	70	$11.10	$9,945,600
	1984	12,300	Cwt.	800	65	$10.80	$8,640,000
	1985	12,000	Cwt.	780	65	$12.40	$9,672,000
	1986	11,700	Cwt.	702	60	$10.50	$7,371,000
	1987	11,500	Cwt.	713	62	$10.20	$7,272,600
	1988	9,000	Cwt.	540	60	$16.90	$9,126,000
	1989	11,800	Cwt.	802	68	$17.50	$14,035,000
	1990	12,500	Cwt.	788	63	$14.30	$11,268,400
Lettuce	1970	1,500	Cwt.	263	175	$6.14	$1,614,820
	1971	1,600	Cwt.	328	205	$6.27	$2,056,560
	1972	1,500	Cwt.	255	170	$5.76	$1,468,800
	1973	1,400	Cwt.	273	195	$7.68	$2,096,640
	1974	1,500	Cwt.	263	175	$8.60	$2,261,800
	1975	1,300	Cwt.	195	150	$9.67	$1,885,650
	1976	1,400	Cwt.	238	170	$13.90	$3,308,200
	1977	1,300	Cwt.	260	200	$9.60	$2,496,000
	1978	1,300	Cwt.	286	220	$13.70	$3,918,200
	1979	1,400	Cwt.	280	200	$22.00	$6,160,000
	1980	1,200	Cwt.	252	210	$19.30	$4,863,600
	1981	1,200	Cwt.	258	215	$18.00	$4,644,000
	1982	1,500	Cwt.	375	250	$13.80	$5,175,000
	1983	1,200	Cwt.	228	190	$15.00	$3,420,000
	1984	1,100	Cwt.	259	235	$15.70	$4,066,300
	1985	1,200	Cwt.	300	250	$17.50	$5,250,000
	1986	1,200	Cwt.	240	200	$16.70	$4,008,000
	1987	1,000	Cwt.	215	215	$20.20	$4,343,000
	1988	800	Cwt.	140	175	$18.90	$2,646,000
	1989	1,100	Cwt.	209	190	$20.40	$4,263,600
	1990	900	Cwt.	207	230	$22.30	$4,616,100

Commodity	Year	Acres Harvested	Unit	Total Production (000's)	Yield	Dollars Per Unit	Value of Production
Onions	1970	6,900	Cwt.	2,208	320	$2.84	$4,828,000
	1971	6,200	Cwt.	1,674	270	$4.28	$6,420,000
	1972	6,400	Cwt.	2,144	335	$8.74	$13,342,000
	1973	6,600	Cwt.	2,046	310	$7.40	$13,320,000
	1974	6,900	Cwt.	2,139	310	$5.00	$9,585,000
	1975	6,800	Cwt.	1,768	260	$8.59	$12,372,000
	1976	7,400	Cwt.	2,257	305	$9.40	$18,424,000
	1977	7,700	Cwt.	2,272	295	$6.30	$11,466,000
	1978	7,900	Cwt.	2,686	340	$5.77	$12,983,000
	1979	7,900	Cwt.	2,686	340	$4.69	$10,506,000
	1980	7,200	Cwt.	1,800	250	$13.20	$18,995,000
	1981	7,700	Cwt.	2,580	335	$10.70	$22,973,000
	1982	8,000	Cwt.	2,560	320	$6.11	$12,941,000
	1983	8,300	Cwt.	2,573	310	$14.30	$30,373,000
	1984	8,500	Cwt.	2,933	345	$6.80	$16,989,000
	1985	7,800	Cwt.	2,535	325	$6.96	$14,164,000
	1986	5,700	Cwt.	1,653	290	$13.00	$14,989,000
	1987	7,600	Cwt.	1,900	250	$12.70	$18,898,000
	1988	8,000	Cwt.	2,000	250	$11.00	$16,962,000
	1989	7,900	Cwt.	2,212	280	$10.70	$17,773,000
	1990	7,400	Cwt.	2,442	330	$8.42	$15,425,000
Tomatoes Fresh Mkt.	1970	3,900	Cwt.	410	105	$9.30	$3,813,000
	1971	3,800	Cwt.	399	105	$10.90	$4,349,100
	1972	4,100	Cwt.	410	100	$13.70	$5,617,000
	1973	4,200	Cwt.	483	115	$13.10	$6,327,300
	1974	4,400	Cwt.	396	90	$16.50	$6,534,000
	1975	4,300	Cwt.	387	90	$14.80	$5,727,600
	1976	4,300	Cwt.	409	95	$15.50	$6,339,500
	1977	3,900	Cwt.	390	100	$22.90	$8,931,000
	1978	3,600	Cwt.	378	105	$18.70	$7,068,600
	1979	3,400	Cwt.	408	120	$25.10	$10,240,800
	1980	3,400	Cwt.	374	110	$24.50	$9,163,000
	1981	3,400	Cwt.	391	115	$24.50	$9,579,500
	1982	3,500	Cwt.	403	115	$19.60	$7,898,800
	1983	3,300	Cwt.	396	120	$28.10	$11,127,600
	1984	3,500	Cwt.	420	120	$28.80	$12,096,000
	1985	3,200	Cwt.	320	100	$17.20	$5,504,000
	1986	3,000	Cwt.	285	95	$21.90	$6,241,500
	1987	2,800	Cwt.	252	90	$20.30	$5,115,600
	1988	2,400	Cwt.	204	85	$34.00	$6,936,000
	1989	2,500	Cwt.	250	100	$25.20	$6,300,000
	1990	2,500	Cwt.	300	120	$20.70	$6,210,000

Commodity	Year	Area Harvested 1,000 Sq. Ft.	Unit	Total Production (000's)	Yield	Dollars Per Unit	Value of Production
Mushrooms	1970						
	1971						
	1972						
	1973						
	1974						
	1975						
	1976						
	1977						
	1978						
	1979						
	1980						
	1981	7,363,000	lbs.	21,221	2.88	$0.77	$16,318,949
	1982	5,292,000	lbs.	19,044	3.60	$0.71	$13,445,064
	1983	5,911,000	lbs.	18,865	3.19	$0.83	$15,657,950
	1984	4,709,000	lbs.	17,506	3.72	$0.94	$16,368,110
	1985	4,504,000	lbs.	19,501	4.33	$0.84	$16,283,335
	1986	4,060,000	lbs.	20,171	4.97	$0.83	$16,762,101
	1987	4,400,000	lbs.	20,306	4.62	$0.87	$17,727,138
	1988	4,279,000	lbs.	23,359	5.46	$0.89	$20,719,433
	1989	4,498,000	lbs.	22,512	5.00	$0.92	$20,666,016
	1990	4,010,000	lbs.	19,408	4.84	$1.02	$19,796,160
		Acres					
TOTAL	1970	88,100					$48,089,995
	1971	91,900					$53,771,565
	1972	95,000					$62,640,860
	1973	100,730					$73,959,820
	1974	100,900					$80,697,860
	1975	99,600					$76,399,040
	1976	98,800					$89,323,850
	1977	101,400					$88,201,040
	1978	103,700					$108,954,280
	1979	105,200					$112,924,126
	1980	93,800					$115,126,590
	1981	92,000					$124,049,810
	1982	64,100					$101,172,210
	1983	64,400					$122,319,400
	1984	106,400					$140,010,500
	1985	106,300					$130,018,140
	1986	98,500					$115,065,850
	1987	107,100					$122,968,400
	1988	105,100					$130,273,260
	1989	110,700					$138,157,020
	1990	116,400					$142,342,730

Appendix B
Regression Results for Chapter IV
Trend Analysis

Appendix B
Regression Results for Chapter IV
Estimated Trends: Linear (L) and Exponential (E)[189]

General Overview	Trend Function	R^2
Number of Farms: (L)	$NF_t = 82{,}310 - 1{,}409T$	.9465
Number of Farms: (E)	$NF_t = 83{,}378 \times 0.9793^T$	.9606*
Land in Farms: (L)	$LF_t = 12{,}424{,}762 - 82{,}338T$	.8016
Land in Farms: (E)	$LF_t = 12{,}434{,}929 \times .9930^T$	.8095*
Average Size of Farms: (L)	$ASF_t = 147.8 + 2.4074T$	.9852
Average Size of Farms: (E)	$ASF_t = 149.1 \times 1.0139^T$	.9860*

Field Crop Overview

Total

Value of Production: (L)	$VP_t = 587{,}676{,}918 + 50{,}054{,}083T$	.6269*
Value of Production: (E)	$VP_t = 573{,}138{,}700 \times 1.0570^T$	.4598
Acres Harvested: (L)	$AH_t = 5{,}917{,}728 + 57{,}015T$	.2676*
Acres Harvested: (E)	$AH_t = 5{,}889{,}080 \times 1.0092^T$	.2479

Barley

Value of Production: (L)	$VP_t = 910{,}021 + 238{,}765T$	.8073*
Value of Production: (E)	$VP_t = 1{,}188{,}926 \times 1.0898^T$	.6066
Acres Harvested: (L)	$AH_t = 14{,}029 + 1{,}439T$	.6771
Acres Harvested: (E)	$AH_t = 16{,}947 \times 1.0474^T$	.7045*
Quantity Produced: (L)	$QP_t = 574{,}367 + 91{,}T$	.5874
Quantity Produced: (E)	$QP_t = 782{,}394 \times 1.0568^T$	.5926*
Yield: (L)	$Y_t = 45.5 + 0.5403T$	.1730*
Yield: (E)	$Y_t = 45.9 \times 1.0094^T$	.1636
Price: (L)	$P_t = 1.81 + 0.0455T$	.1195*
Price: (E)	$P_t = 1.52 \times 1.0312^T$	.0115

[189] Note: the linear or exponential equations with the (*) designation, represent the calculated "best fit" correlation coefficient R^2 for each commodity category, and the "best fit" trend utilized in the graphical analysis chapter four.

Corn for Grain	Trend Function	R^2
Value of Production: (L)	$VP_t = 273,745,688 + 14,721,338T$	.2627*
Value of Production: (E)	$VP_t = 236,073,777 \times 1.0478^T$	.1119
Acres Harvested: (L)	$AH_t = 1,943,848 + 20,694T$	.0909*
Acres Harvested: (E)	$AH_t = 1,899,119 \times 1.0105^T$	.0689
Quantity Produced: (L)	$QP_t = 137,510,400 + 5,229,119T$	.3008*
Quantity Produced: (E)	$QP_t = 135,611,064 \times 1.0291^T$	.2462
Yield: (L)	$Y_t = 70.5 + 1.6455T$	.4551*
Yield: (E)	$Y_t = 71.4 \times 1.0185^T$	.4515
Price: (L)	$P_t = 1.88 + 0.0290T$	.0981*
Price: (E)	$P_t = 1.74 \times 1.0181^T$	.0511
Corn Silage		
Acres Harvested: (L)	$AH_t = 420,276 - 3,722T$	.1518*
Acres Harvested: (E)	$AH_t = 417,149 \times 0.9903^T$	.1400
Quantity Produced: (L)	$QP_t = 4,937,667 - 27,234T$	.0759*
Quantity Produced: (E)	$QP_t = 2463.1 \times 26.70^T$	.0650
Yield: (L)	$Y_t = 11.77 + 0.0571T$	.0431*
Yield: (E)	$Y_t = 11.77 \times 1.0037^T$	.0347
Dry Beans		
Value of Production: (L)	$VP_t = 101,196,207 + 116,568^T$	.0004
Value of Production: (E)	$VP_t = 93,489,618 \times 1.0031^T$	.0259*
Acres Harvested: (L)	$AH_t = 642,857 - 15,844T$	.6781*
Acres Harvested: (E)	$AH_t = 689,980 \times 0.9619^T$	.6137
Quantity Produced: (L)	$QP_t = 6,773,110 - 110,495T$	.2136*
Quantity Produced: (E)	$QP_t = 7,007,922 \times 0.9754^T$	.1689
Yield: (L)	$Y_t = 1,005.7 + 17.75T$	.2790*
Yield: (E)	$Y_t = 2463.1 \times 1.0140^T$	.2754
Price: (L)	$P_t = 14.26 + 0.4522T$	.1901*
Price: (E)	$P_t = 13.34 \times 1.0284^T$	.1556

Hay	Trend Function	R^2
Value of Production: (L)	$VP_t = 39{,}406{,}548 + 15{,}274{,}370T$	.8963*
Value of Production: (E)	$VP_t = 75{,}363{,}164 \times 1.0843^T$	.8709
Acres Harvested: (L)	$AH_t = 1{,}218{,}381 + 19{,}844T$	.4132
Acres Harvested: (E)	$AH_t = 1{,}233{,}446 \times 1.0132^T$	.4167*
Quantity Produced: (L)	$QP_t = 2{,}586{,}700 + 131{,}781T$	.7166*
Quantity Produced: (E)	$QP_t = 2{,}734{,}039 \times 1.0335^T$	.7083
Yield: (L)	$Y_t = 2.18 + 0.0554T$	.5404*
Yield: (E)	$Y_t = 2.22 \times 1.0200^T$	.5276
Price: (L)	$P_t = 24.35 + 2.2929T$	.6999*
Price: (E)	$P_t = 27.41 \times 1.0500^T$	.6821
Oats		
Value of Production: (L)	$VP_t = 24{,}530{,}226 + 237{,}132T$	.0290
Value of Production: (E)	$VP_t = 23{,}215{,}522 \times 1.0095^T$	.0559*
Acres Harvested: (L)	$AH_t = 414{,}452 - 6{,}695T$	.3908*
Acres Harvested: (E)	$AH_t = 422{,}612 \times .9789^T$	.3707
Quantity Produced: (L)	$QP_t = 22{,}246{,}071 - 258{,}318T$	.1096*
Quantity Produced: (E)	$QP_t = 22{,}981{,}676 \times .9812^T$	.0637
Yield: (L)	$Y_t = 53.9 + 0.2338T$	.0325*
Yield: (E)	$Y_t = 54.4 \times 1.0023^T$	.0185
Price: (L)	$P_t = 1.05 + 0.0362T$	.2529*
Price: (E)	$P_t = 1.01 \times 1.0288^T$	.2048
All Potatoes		
Value of Production: (L)	$VP_t = 28{,}487{,}789 + 2{,}486{,}076T$	.7310*
Value of Production: (E)	$VP_t = 30{,}794{,}499 \times 1.0502^T$	.6811
Acres Harvested: (L)	$AH_t = 41{,}294 + 275T$	.0951*
Acres Harvested: (E)	$AH_t = 41{,}260 \times 1.0059^T$	.0905
Quantity Produced: (L)	$QP_t = 9{,}149{,}219 + 140{,}881T$	.2240*
Quantity Produced: (E)	$QP_t = 9{,}186{,}458 \times 1.0128^T$	.2147
Yield: (L)	$Y_t = 223.3 + 1.4870T$	.3200*
Yield: (E)	$Y_t = 223.5 \times 1.0061^T$	.3159
Price: (L)	$P_t = 3.31 + 0.1729T$	.5263*
Price: (E)	$P_t = 3.35 \times 1.0370^T$	.5086

Soybeans	Trend Function	R^2
Value of Production: (L)	$VP_t = 40{,}136{,}719 + 10{,}337{,}954T$	.7440*
Value of Production: (E)	$VP_t = 49{,}346{,}352 \times 1.0929^T$	.5258
Acres Harvested: (L)	$AH_t = 487{,}567 + 36{,}334T$	.8185*
Acres Harvested: (E)	$AH_t = 517{,}281 \times 1.0462^T$	.7412
Quantity Produced: (L)	$QP_t = 9{,}038{,}019 + 1{,}581{,}301T$	.8747*
Quantity Produced: (E)	$QP_t = 11{,}438{,}997 \times 1.0702^T$	.8003
Yield: (L)	$Y_t = 21.7 + 0.6442T$	.6286
Yield: (E)	$Y_t = 22.1 \times 1.0230^T$	.6314*
Price: (L)	$P_t = 4.63 + 0.0896T$	.1712*
Price: (E)	$P_t = 4.32 \times 0.1160^T$	.1160
Sugarbeets		
Value of Production: (L)	$VP_t = 16{,}581{,}023 + 4{,}023{,}178T$	.8026
Value of Production: (E)	$VP_t = 23{,}978{,}839 \times 1.0768^T$	.8242*
Acres Harvested: (L)	$AH_t = 67{,}914 + 3{,}355T$	.7678
Acres Harvested: (E)	$AH_t = 73{,}693 \times 1.0305^T$	.8154*
Quantity Produced: (L)	$QP_t = 1{,}258{,}681 + 66{,}843T$	.7140
Quantity Produced: (E)	$QP_t = 1{,}365{,}094 \times 1.0326^T$	.7575*
Yield: (L)	$Y_t = 18.6 + 0.0381T$	.0234*
Yield: (E)	$Y_t = 18.5 \times 1.0020^T$	.0218
Price: (L)	$P_t = 19.28 + 0.9575T$	.3569*
Price: (E)	$P_t = 17.57 \times 1.0430^T$	.2833
Wheat		
Value of Production: (L)	$VP_t = 62{,}682{,}696 + 2{,}628{,}702T$	.1788*
Value of Production: (E)	$VP_t = 50{,}159{,}950 \times 1.0451^T$	.0488
Acres Harvested: (L)	$AH_t = 667{,}110 + 1{,}336T$	.0027
Acres Harvested: (E)	$AH_t = 637{,}266 \times 1.0035^T$	.0233*
Quantity Produced: (L)	$QP_t = 23{,}424{,}357 + 644{,}214T$	.1866*
Quantity Produced: (E)	$QP_t = 22{,}605{,}596 \times 1.0232^T$	.1534
Yield: (L)	$Y_t = 34.8 + 0.8727T$	.5743*
Yield: (E)	$Y_t = 35.5 \times 1.0196^T$	.5705
Price: (L)	$P_t = 2.49 + 0.0411T$	.0938*
Price: (E)	$P_t = 2.22 \times 1.0215^T$	.0300

Livestock Overview

	Trend Function	R^2
Total		
Value of Production: (L)	$VP_t = 683{,}091{,}726 + 39{,}259{,}351T$	.8683*
Value of Production: (E)	$VP_t = 705{,}024{,}998 \times 1.0408^T$	.8096
Dairy		
Value of Production: (L)	$VP_t = 381{,}414{,}987 + 44{,}697{,}403T$	.7325*
Value of Production: (E)	$VP_t = 384{,}548{,}178 \times 1.0443^T$	.6313
Number of Head: (L)	$NH_t = 439{,}886 - 4{,}029T$	.8775*
Number of Head: (E)	$NH_t = 442{,}320 \times 0.9897^T$	.8677
Quantity Produced: (L)	$QP_t = 4{,}498{,}900{,}000 + 22{,}914{,}779T$	.6085*
Quantity Produced: (E)	$QP_t = 4{,}507{,}969{,}049 \times 1.0091^T$	.6054
Yield: (L)	$Y_t = 9{,}965 + 248T$	.9364
Yield: (E)	$Y_t = 10{,}163 \times 1.0197^T$	.9448*
Price: (L)	$P_t = 6.35 + 0.4166T$	.8005*
Price: (E)	$P_t = 6.53 \times 1.0442^T$	.6927
Hogs and Pigs		
Value of Production: (L)	$VP_t = 69{,}978{,}732 + 8{,}739{,}157T$	.8779
Value of Production: (E)	$VP_t = 83{,}381{,}420 \times 1.0603^T$	.8793*
Number of Head: (L)	$NH_t = 593{,}519 + 34{,}152T$	.6917
Number of Head: (E)	$NH_t = 639{,}417 \times 1.0354^T$	.7108*
Quantity Produced: (L)	$QP_t = 181{,}456{,}366 + 16{,}631{,}728T$	.8793
Quantity Produced: (E)	$QP_t = 203{,}826{,}585 \times 1.0510^T$	.8904*
Price: (L)	$P_t = 39.0 + 0.4714T$	.1423*
Price: (E)	$P_t = 37.5 \times 1.0134^T$	.1201
All Cattle and Calves		
Value of Production: (L)	$VP_t = 165{,}749{,}150 + 4{,}954{,}470T$	.6996*
Value of Production: (E)	$VP_t = 167{,}548{,}718 \times 1.0243^T$	.6949
Number of Head: (L)	$NH_t = 209{,}862 - 3{,}373T$	.4462*
Number of Head: (E)	$NH_t = 212{,}803 \times 0.9798^T$	.4179
Quantity Produced: (L)	$QP_t = 478{,}430{,}850 - 2{,}760{,}470T$	.1332*
Quantity Produced: (E)	$QP_t = 476{,}438{,}998 \times 0.9941^T$	.1319
Price: (L)	$P_t = 35.5 + 2.2343T$	.4826
Price: (E)	$P_t = 37.6 \times 1.0384^T$	.4942*

Beef	Trend Function	R^2
Number of Head: (L)	$NH_t = 209,862 - 3,373T$	.4462*
Number of Head: (E)	$NH_t = 212,803 \times 0.9798^T$	.4179
Price: (L)	$P_t = 27.6 + 1.5194T$	.7191*
Price: (E)	$P_t = 28.6 \times 1.0375^T$	.6893
Sheep and Lambs		
Value of Production: (L)	$VP_t = 3,231,523 + 112,448T$	.4762*
Value of Production: (E)	$VP_t = 3,265,964 \times 1.0272^T$	.4571
Number of Head: (L)	$NH_t = 220,767 - 6,723T$	.7220
Number of Head: (E)	$NH_t = 211,891 \times 0.9593^T$	.7866*
Quantity Produced: (L)	$QP_t = 7,998,889 + 41,193T$	.1154
Quantity Produced: (E)	$QP_t = 7,971,067 \times 1.0051^T$	.1167*
Price: (L)	$P_t = 31.7 + 1.9038T$	.6879*
Price: (E)	$P_t = 31.9 \times 1.0425^T$	.5843
Layers		
Value of Production: (L)	$VP_t = 47,521,219 + 974,543T$	.3106*
Value of Production: (E)	$VP_t = 46,268,654 \times 1.0193^T$	.2696
Number of Head: (L)	$NH_t = 6,651,867 - 25,940T$	.1811*
Number of Head: (E)	$NH_t = 6,668,253 \times 0.9956^T$	.1765
Quantity Produced: (L)	$QP_t = 1,455,400,000 + 4,807,792T$	.1112*
Quantity Produced: (E)	$QP_t = 1,454,644,857 \times 1.0031^T$	.1097
Yield: (L)	$Y_t = 217.7 + 1.7905T$	.5702
Yield: (E)	$Y_t = 218.1 \times 1.0075^T$	.5755*
Price: (L)	$P_t = 0.3926 + 0.0065T$	.2067*
Price: (E)	$P_t = 0.3817 \times 1.0161^T$	.1792

Chickens	Trend Function	R^2
Value of Production: (L)	$VP_t = 2{,}505{,}949 - 24{,}733T$	.0353*
Value of Production: (E)	$VP_t = 2{,}427{,}299 \times 0.9895^T$	.0233
Number of Head: (L)	$NH_t = 5{,}297{,}743 - 18{,}132T$	.0353*
Number of Head: (E)	$NH_t = 5{,}278{,}507 \times 0.9962^T$	.0288
Quantity Produced: (L)	$QP_t = 21{,}744{,}706 - 22{,}882T$	.0039*
Quantity Produced: (E)	$QP_t = 21{,}743{,}507 \times 0.9986^T$	.0017
Price: (L)	$P_t = 0.0986 + 0.0004T$	.0133*
Price: (E)	$P_t = 0.0970 \times 1.0037^T$	.0026
Broilers		
Value of Production: (L)	$VP_t = 1{,}350{,}287 - 2{,}032T$	.0004
Value of Production: (E)	$VP_t = 1{,}186{,}736 \times 1.0056^T$	.0289*
Number of Head: (L)	$NH_t = 901{,}612 + 6{,}527T$	.0075
Number of Head: (E)	$NH_t = 799{,}691 \times 1.0102^T$	.0435*
Quantity Produced: (L)	$QP_t = 5{,}065{,}956 - 72{,}505T$	.0352*
Quantity Produced: (E)	$QP_t = 4{,}608{,}009 \times 0.9876^T$	.0053
Price: (L)	$P_t = 0.1978 + 0.0075T$	.7337*
Price: (E)	$P_t = 0.1996 \times 1.0295^T$	.6869
Turkeys		
Value of Production: (L)	$VP_t = -353{,}542 + 2{,}315{,}929T$	.8926
Value of Production: (E)	$VP_t = 5{,}808{,}190 \times 1.1257^T$	.9392*
Number of Head: (L)	$NH_t = 288{,}908 + 175{,}138T$	.8845
Number of Head: (E)	$NH_t = 737{,}542 \times 1.0943^T$	.9632*
Quantity Produced: (L)	$QP_t = 2{,}014{,}451 + 5{,}205{,}760T$	.8642
Quantity Produced: (E)	$QP_t = 16{,}818{,}098 \times 1.1074^T$	.9612*
Price: (L)	$P_t = 0.3512 + 0.0062T$	.2018
Price: (E)	$P_t = 0.3454 \times 1.0166^T$	.2256*

Fruit Overview

	Trend Function	R^2
Total		
Value of Production: (L)	$VP_t = 72{,}266{,}410 + 4{,}323{,}556T$	.6273*
Value of Production: (E)	$VP_t = 71{,}991{,}072 \times 1.0431^T$	.5266
Acres Harvested: (L)	$AH_t = 148{,}142 - 2{,}310T$	.5310
Acres Harvested: (E)	$AH_t = 147{,}267 \times 0.9825^T$	.5649*
Apples		
Value of Production: (L)	$VP_t = 26{,}122{,}938 + 2{,}678{,}014T$	.8718*
Value of Production: (E)	$VP_t = 29{,}181{,}807 \times 1.0549^T$	.8121
Acres Harvested: (L)	$AH_t = 51{,}635 - 264T$	.1359
Acres Harvested: (E)	$AH_t = 51{,}358 \times 0.9949^T$	.1423*
Number of Trees: (L)	$NT_t = 2{,}267{,}619 + 125{,}974T$	.7762
Number of Trees: (E)	$NT_t = 2{,}496{,}836 \times 1.0328^T$	.8296*
Quantity Produced: (L)	$QP_t = 597{,}285{,}714 + 15{,}181{,}818T$	.3092*
Quantity Produced: (E)	$QP_t = 597{,}402{,}417 \times 1.0204^T$	.3012
Yield: (L)	$Y_t = 5.88 + 0.1876T$	.3186*
Yield: (E)	$Y_t = 5.82 \times 1.0257^T$	.2833
Price: (L)	$P_t = 0.0507 + 0.0021T$	.4636*
Price: (E)	$P_t = 0.0488 \times 1.0341^T$	.4134
Grapes		
Value of Production: (L)	$VP_t = 6{,}882{,}124 + 302{,}361T$	.2940*
Value of Production: (E)	$VP_t = 6{,}457{,}086 \times 1.0353^T$	.2563
Acres Harvested: (L)	$AH_t = 16{,}684 - 298T$	.9598
Acres Harvested: (E)	$AH_t = 16{,}967 \times 0.9780^T$	.9618*
Number of Vines: (L)	$NV_t = 8{,}416{,}905 - 173{,}182T$	.9529*
Number of Vines: (E)	$NV_t = 8{,}624{,}903 \times 0.9736^T$	.9510
Quantity Produced: (L)	$QP_t = 100{,}742{,}857 - 158{,}442T$	.0013
Quantity Produced: (E)	$QP_t = 90{,}160{,}479 \times 1.0036^T$	.0422*
Yield: (L)	$Y_t = 2.92 + 0.0770T$	.1836*
Yield: (E)	$Y_t = 2.66 \times 1.0262^T$	.1463
Price: (L)	$P_t = 0.7223 + 0.0280T$	.5871*
Price: (E)	$P_t = 0.7307 \times 1.0293^T$	.5662

Peaches	Trend Function	R^2
Value of Production: (L)	$VP_t = 4{,}736{,}700 + 266{,}923T$	.4978*
Value of Production: (E)	$VP_t = 4{,}235{,}893 \times 1.0479^T$	.3862
Acres Harvested: (L)	$AH_t = 14{,}600 - 503T$	.5567
Acres Harvested: (E)	$AH_t = 14{,}007 \times 0.9526^T$	.6060*
Number of Trees: (L)	$NT_t = 1{,}383{,}476 - 39{,}364T$	.4007
Number of Trees: (E)	$NT_t = 1{,}298{,}969 \times 0.9649^T$	.4279*
Quantity Produced: (L)	$QP_t = 56{,}376{,}190 - 549{,}351T$	.0456*
Quantity Produced: (E)	$QP_t = 46{,}679{,}601 \times 1.0007^T$	.0455
Yield: (L)	$Y_t = 2.05 + 0.1040T$	.3079*
Yield: (E)	$Y_t = 1.67 \times 1.0505^T$	.1138
Price: (L)	$P_t = 0.0974 + 0.0055T$	.6104*
Price: (E)	$P_t = 0.0940 \times 1.0440^T$	.4582
Pears		
Value of Production: (L)	$VP_t = 2{,}009{,}200 - 22{,}434T$	.0889*
Value of Production: (E)	$VP_t = 2{,}064{,}590 \times 0.9821^T$	.0414
Acres Harvested: (L)	$AH_t = 10{,}261 - 527T$	.8276
Acres Harvested: (E)	$AH_t = 12{,}518 \times 0.8856^T$	.9185*
Number of Trees: (L)	$NT_t = 971{,}267 - 49{,}678T$	.8226
Number of Trees: (E)	$NT_t = 1{,}171{,}566 \times 0.8874^T$	.9135*
Quantity Produced: (L)	$QP_t = 33{,}733{,}333 - 1{,}231{,}169T$	.6211
Quantity Produced: (E)	$QP_t = 36{,}155{,}185 \times 0.9389^T$	.6632*
Yield: (L)	$Y_t = 1.32 + 0.1655T$	.4288*
Yield: (E)	$Y_t = 1.44 \times 1.0602^T$	.3325
Price: (L)	$P_t = 0.5572 + 0.0375T$	.7511*
Price: (E)	$P_t = 0.5551 \times 1.0473^T$	.6441

Prunes and Plums	Trend Function	R^2
Value of Production: (L)	$VP_t = 2{,}129{,}233 + 20{,}516T$	.6855
Value of Production: (E)	$VP_t = 2{,}054{,}198 \times 1.0099^T$	.7302*
Acres Harvested: (L)	$AH_t = 7{,}455 - 248T$	.7400
Acres Harvested: (E)	$AH_t = 7{,}729 \times 0.9504^T$	.7808*
Number of Trees: (L)	$NT_t = 694{,}000 - 21{,}338T$	.6855
Number of Trees: (E)	$NT_t = 706{,}526 \times 0.9567^T$	.7302*
Quantity Produced: (L)	$QP_t = 36{,}561{,}905 - 761{,}039T$	.3438*
Quantity Produced: (E)	$QP_t = 37{,}377{,}862 \times 0.9712^T$	.3079
Yield: (L)	$Y_t = 2.50 + 0.0657T$	.1671*
Yield: (E)	$Y_t = 2.42 \times 1.0218^T$	.1206
Price: (L)	$P_t = 0.5200 + 0.0349T$	.4648*
Price: (E)	$P_t = 0.5452 \times 1.0414^T$	.4307
Sweet Cherries		
Value of Production: (L)	$VP_t = 5{,}006{,}143 + 460{,}935T$	.4084*
Value of Production: (E)	$VP_t = 5{,}166{,}214 \times 1.0531^T$	.3358
Acres Harvested: (L)	$AH_t = 11{,}794 - 177T$	.4959*
Acres Harvested: (E)	$AH_t = 11{,}798 \times 0.9826^T$	.5191
Number of Trees: (L)	$NT_t = 963{,}286 - 12{,}571T$	.3882
Number of Trees: (E)	$NT_t = 961{,}185 \times 0.9852^T$	.4071*
Quantity Produced: (L)	$QP_t = 49{,}461{,}905 + 157{,}143T$	.0060
Quantity Produced: (E)	$QP_t = 47{,}977{,}157 \times 1.0030^T$	.0225*
Yield: (L)	$Y_t = 2.11 + 0.0523T$	.1458*
Yield: (E)	$Y_t = 2.03 \times 1.0208^T$	.1049
Price: (L)	$P_t = 0.0989 + 0.0092T$	.7818*
Price: (E)	$P_t = 0.1080 \times 1.0522^T$	.7285

Tart Cherries	Trend Function	R^2
Value of Production: (L)	$VP_t = 25{,}380{,}071 + 617{,}240T$	.0856*
Value of Production: (E)	$VP_t = 21{,}843{,}837 \times 1.0276^T$	.0093
Acres Harvested: (L)	$AH_t = 35{,}713 - 293T$	.2073
Acres Harvested: (E)	$AH_t = 35{,}337 \times 0.9917^T$	.2180*
Number of Trees: (L)	$NT_t = 2{,}970{,}714 + 11{,}104T$	.0371*
Number of Trees: (E)	$NT_t = 2{,}961{,}679 \times 1.0034^T$	.0367
Quantity Produced: (L)	$QP_t = 153{,}190{,}476 + 1{,}415{,}584T$	.0267*
Quantity Produced: (E)	$QP_t = 146{,}298{,}999 \times 1.0081^T$	.0009
Yield: (L)	$Y_t = 2.13 + 0.0430T$	.0989*
Yield: (E)	$Y_t = 2.07 \times 1.0165^T$	.0782
Price: (L)	$P_t = 0.1972 + 0.0026T$	.0142
Price: (E)	$P_t = 0.1532 \times 1.0200^T$	.0955*

Vegetable Overview

Total

Value of Production: (L)	$VP_t = 56{,}375{,}015 + 4{,}573{,}722T$	.8173*
Value of Production: (E)	$VP_t = 59{,}420{,}537 \times 1.0499^T$	.7103
Acres Harvested: (L)	$AH_t = 92{,}648 + 844.8T$	.5350*
Acres Harvested: (E)	$AH_t = 92{,}830 \times 1.0083^T$	.5340

Asparagus

Value of Production: (L)	$VP_t = 4{,}802{,}477 + 565{,}729T$	.7341*
Value of Production: (E)	$VP_t = 5{,}110{,}418 \times 1.0640^T$	.5971
Acres Harvested: (L)	$AH_t = 13{,}945 + 456.9T$	.8514*
Acres Harvested: (E)	$AH_t = 14{,}151 \times 1.0257^T$	.8192
Quantity Produced: (L)	$QP_t = 203.6 + 2.0929T$	.2339
Quantity Produced: (E)	$QP_t = 202.6 \times 1.0096^T$	.2346*
Yield: (L)	$Y_t = 14.46 - 0.2084T$	.4175
Yield: (E)	$Y_t = 14.32 \times 0.9842^T$	.4326*
Price: (L)	$P_t = 24.66 + 2.1159T$	.7005*
Price: (E)	$P_t = 25.23 \times 1.0540^T$	.5522

Carrots (Dual Purpose)	Trend Function	R^2
Value of Production: (L)	$VP_t = 8{,}172{,}055 + 470{,}780T$	.4991*
Value of Production: (E)	$VP_t = 8{,}241{,}292 \times 1.0400^T$	.4409
Acres Harvested: (L)	$AH_t = 5{,}256 + 71.6T$	.2371*
Acres Harvested: (E)	$AH_t = 5{,}277 \times 1.0113^T$	.2269
Quantity Produced: (L)	$QP_t = 1{,}170 + 29.6T$	.3520*
Quantity Produced: (E)	$QP_t = 1{,}179 \times 1.0198^T$	.3387
Yield: (L)	$Y_t = 223.7 + 2.0240T$	.3247*
Yield: (E)	$Y_t = 223.4 \times 1.0085^T$	.3230
Price: (L)	$P_t = 7.10 + 0.1592T$	.3043*
Price: (E)	$P_t = 6.99 \times 1.0198^T$	.2719
Cauliflower		
Value of Production: (L)	$VP_t = 336{,}935 + 129{,}470T$	.6587*
Value of Production: (E)	$VP_t = 523{,}206 \times 1.0976^T$	.4579
Acres Harvested: (L)	$AH_t = 934 + 14.8T$	.1429*
Acres Harvested: (E)	$AH_t = 924 \times 1.0135^T$	.1266
Quantity Produced: (L)	$QP_t = 48.4 + 1.3532T$	.1990*
Quantity Produced: (E)	$QP_t = 47.5 \times 1.0224^T$	.1803
Yield: (L)	$Y_t = 52.0 + 0.4693T$	.1384
Yield: (E)	$Y_t = 51.5 \times 1.0976^T$	.1394*
Price: (L)	$P_t = 9.74 + 1.5376T$	.7861*
Price: (E)	$P_t = 11.01 \times 1.0736^T$	.6152
Celery (Dual Purpose)		
Value of Production: (L)	$VP_t = 5{,}749{,}996 + 529{,}433T$	.7114*
Value of Production: (E)	$VP_t = 6{,}040{,}024 \times 1.0547^T$	.5751
Acres Harvested: (L)	$AH_t = 2{,}226 + 51.3T$	.4525*
Acres Harvested: (E)	$AH_t = 2{,}243 \times 1.0188^T$	.4309
Quantity Produced: (L)	$QP_t = 918.8 + 20.45T$	.3305*
Quantity Produced: (E)	$QP_t = 913.3 \times 1.0190^T$	.2979
Yield: (L)	$Y_t = 409.5 + 0.0132T$	.0000
Yield: (E)	$Y_t = 407.2 \times 1.0002^T$	.0021*
Price: (L)	$P_t = 6.43 + 0.3218T$	.6178*
Price: (E)	$P_t = 6.61 \times 1.0350^T$	.5755

Cucumbers (Processing)	Trend Function	R^2
Value of Production: (L)	$VP_t = 7{,}666{,}475 + 739{,}135T$	.8560
Value of Production: (E)	$VP_t = 8{,}736{,}629 \times 1.0505^T$	.8619*
Acres Harvested: (L)	$AH_t = 25{,}499 - 138.4T$	.0962*
Acres Harvested: (E)	$AH_t = 25{,}333 \times 0.9943^T$	.0944
Quantity Produced: (L)	$QP_t = 94.4 + 2.3319T$	.6085
Quantity Produced: (E)	$QP_t = 95.7 \times 1.0198^T$	.6121*
Yield: (L)	$Y_t = 3.71 + 0.1233T$	.7274*
Yield: (E)	$Y_t = 3.78 \times 1.0256^T$	.7082
Price: (L)	$P_t = 88.3 + 3.6920T$	.8688*
Price: (E)	$P_t = 91.3 \times 1.0301^T$	.8586
Lettuce (Fresh Market)		
Value of Production: (L)	$VP_t = 1{,}991{,}738 + 141{,}713T$	.4179*
Value of Production: (E)	$VP_t = 1{,}919{,}305 \times 1.0499^T$	.3033
Acres Harvested: (L)	$AH_t = 1{,}599 - 29.2T$	.7415*
Acres Harvested: (E)	$AH_t = 1{,}630 \times 0.960^T$	.7235
Quantity Produced: (L)	$QP_t = 288.2 - 3.1506T$	.1596*
Quantity Produced: (E)	$QP_t = 290.8 \times 0.9859^T$	.1410
Yield: (L)	$Y_t = 178.9 + 2.0084T$	.2145*
Yield: (E)	$Y_t = 178.4 \times 1.0101^T$	.2056
Price: (L)	$P_t = 5.93 + 0.7648T$	.7529*
Price: (E)	$P_t = 6.60 \times 1.0648^T$	.6565
Mushrooms		
Value of Production: (L)	$VP_t = 13{,}650{,}931 + 676{,}999T$	.7549
Value of Production: (E)	$VP_t = 13{,}912{,}513 \times 1.0397^T$	.7667*
Square Feet Harvested: (L)	$SFH_t = 6{,}411{,}467 - 274{,}339T$	.6381
Square Feet Harvested: (E)	$SFH_t = 6{,}402{,}031 \times 0.9496^T$	.6735*
Quantity Produced: (L)	$QP_t = 18{,}872 + 239.4T$	.1696
Quantity Produced: (E)	$QP_t = 18{,}878 \times 1.0117^T$	.1707*
Yield: (L)	$Y_t = 2.86 + 0.2553T$	.7989*
Yield: (E)	$Y_t = 2.95 \times 1.0653^T$	.7531
Price: (L)	$P_t = 0.73 + 0.0233T$	.6391
Price: (E)	$P_t = 0.74 \times 1.0277^T$	.6416*

Onions (Fresh Market)	Trend Function	R^2
Value of Production: (L)	$VP_t = 9{,}497{,}986 - 88.6T$	.8087*
Value of Production: (E)	$VP_t = 8{,}821{,}248 \times 0.9737^T$	.7677
Acres Harvested: (L)	$AH_t = 6{,}741 + 57.3T$	.2355*
Acres Harvested: (E)	$AH_t = 6{,}735 \times 1.0078^T$	.2260
Quantity Produced: (L)	$QP_t = 2{,}110 + 11.92T$	.0413*
Quantity Produced: (E)	$QP_t = 2{,}090 \times 1.0052^T$	.0331
Yield: (L)	$Y_t = 311.1 - 0.7077T$	.0187*
Yield: (E)	$Y_t = 310.4 \times 0.9974^T$	.0154
Price: (L)	$P_t = 5.15 + 0.2973T$	.3219*
Price: (E)	$P_t = 4.96 \times 1.0418^T$	.2762
Snap Beans (Processing)		
Value of Production: (L)	$VP_t = 1{,}910{,}635 + 349{,}236T$	.7159
Value of Production: (E)	$VP_t = 2{,}626{,}004 \times 1.0652^T$	.7567*
Acres Harvested: (L)	$AH_t = 11{,}302 + 472.1T$	.6049
Acres Harvested: (E)	$AH_t = 11{,}849 \times 1.0283^T$	.6344*
Quantity Produced: (L)	$QP_t = 24.33 + 1.4698T$	.5178
Quantity Produced: (E)	$QP_t = 26.30 \times 1.0361^T$	.5441*
Yield: (L)	$Y_t = 2.22 + 0.0194T$	.1357*
Yield: (E)	$Y_t = 2.22 \times 1.0075^T$	.1301
Price: (L)	$P_t = 98.66 + 3.5694T$	.7492*
Price: (E)	$P_t = 99.85 \times 1.0281^T$	.7071
Strawberries (Dual Purpose)		
Value of Production: (L)	$VP_t = 6{,}084{,}291 + 80{,}046T$	.0841*
Value of Production: (E)	$VP_t = 5{,}868{,}706 \times 1.0132^T$	.0584
Acres Harvested: (L)	$AH_t = 4{,}324 - 119.1T$	.6362
Acres Harvested: (E)	$AH_t = 4{,}298 \times 0.9652^T$	.6812*
Quantity Produced: (L)	$QP_t = 234.9 - 4.7779T$	.5971*
Quantity Produced: (E)	$QP_t = 239.5 \times 0.9736^T$	.5835
Yield: (L)	$Y_t = 57.31 + 0.4400T$	.0698*
Yield: (E)	$Y_t = 55.73 \times 1.0087^T$	.0504
Price: (L)	$P_t = 24.27 + 1.3855T$	.6705*
Price: (E)	$P_t = 24.50 \times 1.0407^T$	.5851

Sweet Corn (Fresh Market)	Trend Function	R^2
Value of Production: (L)	$VP_t = 2{,}487{,}499 + 404{,}018T$	.8087
Value of Production: (E)	$VP_t = 3{,}309{,}302 \times 1.0622^T$	.8129*
Acres Harvested: (L)	$AH_t = 12{,}388 - 40.0T$	.0977*
Acres Harvested: (E)	$AH_t = 12{,}420 \times 0.9963^T$	.0948
Quantity Produced: (L)	$QP_t = 824.2 - 5.2312T$	.0994*
Quantity Produced: (E)	$QP_t = 817.0 \times 0.9934^T$	.0987
Yield: (L)	$Y_t = 66.48 - 0.2226T$	.0503*
Yield: (E)	$Y_t = 65.78 \times 0.9972^T$	.0479
Price: (L)	$P_t = 2.96 + 0.5709T$	.8507*
Price: (E)	$P_t = 4.05 \times 1.0692^T$	.8486
Tomatoes (Fresh Market)		
Value of Production: (L)	$VP_t = 6{,}177{,}041 + 92{,}649T$	.0675*
Value of Production: (E)	$VP_t = 5{,}861{,}003 \times 1.0148^T$	.0347
Acres Harvested: (L)	$AH_t = 4{,}470 - 88.6T$	.8087*
Acres Harvested: (E)	$AH_t = 4{,}612 \times 0.9737^T$	.7677
Quantity Produced: (L)	$QP_t = 459.5 - 8.5870T$	.5920*
Quantity Produced: (E)	$QP_t = 477.1 \times 0.9742^T$	.5406
Yield: (L)	$Y_t = 103.6 + 0.0825T$	.0020
Yield: (E)	$Y_t = 103.5 \times 1.0004^T$	.0035*
Price: (L)	$P_t = 12.11 + 0.7401T$	.5288*
Price: (E)	$P_t = 12.29 \times 1.0417^T$	.4549
Tomatoes (Processing)		
Value of Production: (L)	$VP_t = 1{,}497{,}886 + 576{,}834T$	.5384*
Value of Production: (E)	$VP_t = 2{,}244{,}803 \times 1.0992^T$	.3375
Acres Harvested: (L)	$AH_t = 3{,}974 + 136.1T$	.2552*
Acres Harvested: (E)	$AH_t = 3{,}920 \times 1.0271^T$	.2117
Quantity Produced: (L)	$QP_t = 41.03 + 6.0446T$	.5873*
Quantity Produced: (E)	$QP_t = 49.55 \times 1.0634^T$	.5183
Yield: (L)	$Y_t = 11.73 + 0.6718T$	.7237
Yield: (E)	$Y_t = 12.64 \times 1.0353^T$	.7496*
Price: (L)	$P_t = 46.72 + 1.8831T$	.5228*
Price: (E)	$P_t = 45.30 \times 1.0337^T$	.4155

Appendix C
Data Set for Chapter V
Shift-Share Analysis

Table XXVI United States Commodity Cash Receipts for the Years 1969, 1970, and 1971

United States Commodity Cash Receipts for the Years 1969, 1970, and 1971 ($ in 000's)

	1969	1970	1971	3 Year Average
Livestock & Products				
Cattle & calves	12,566,451	13,694,550	14,971,833	13,744,278
Dairy products	6,206,144	6,533,315	6,814,992	6,518,150
Hogs	4,744,464	4,474,897	4,104,984	4,441,448
Eggs	2,261,819	2,165,881	1,832,066	2,086,589
Broilers	1,539,668	1,463,758	1,492,378	1,498,601
Turkeys	452,025	497,246	500,954	483,408
Sheep & lambs	332,948	327,557	313,502	324,669
Farm chickens	103,681	100,084	90,881	98,215
Honey	47,580	41,408	44,600	44,529
Total	28,254,780	29,298,696	30,166,190	29,239,889
Field crops				
Corn	2,801,931	3,259,460	3,593,377	3,218,256
Soybeans	2,647,298	3,141,653	3,551,114	3,113,355
Wheat	1,736,321	2,088,501	2,081,072	1,968,631
Hay	588,841	624,840	702,124	638,602
Potatoes	620,629	663,988	581,559	622,059
Sugar Beets	352,868	393,421	413,878	386,722
Barley	264,700	296,308	344,528	301,845
Oats	209,437	228,715	210,911	216,354
Dry beans	139,877	147,042	178,248	155,056
Mushrooms	70,022	80,286	99,057	83,122
Rye	24,258	28,805	37,604	30,222
Mint	31,619	28,014	21,449	27,027
Total	9,487,801	10,981,033	11,814,921	10,761,252

Table XXVI Continued, United States Commodity Cash Receipts for the Years 1969, 1970, and 1971

United States Commodity Cash Receipts for the Years 1969, 1970, and 1971 ($ in 000's)

	1969	1970	1971	3 Year Average
Vegetables & Melons				
Tomatoes	420,463	402,082	471,484	431,343
Lettuce	257,701	228,928	303,303	263,311
Sweet corn	127,525	125,862	135,156	129,514
Snap beans	105,740	101,769	106,021	104,510
Onions	91,043	114,045	104,557	103,215
Carrots	87,650	74,118	102,497	88,088
Cantaloups	87,544	93,389	93,899	91,611
Cucumbers	83,539	89,908	91,295	88,247
Celery	90,875	85,673	89,483	88,677
Cabbage	67,981	84,966	79,290	77,412
Asparagus	59,422	57,527	65,726	60,892
Peppers	60,406	53,114	62,574	58,698
Cauliflower	27,466	24,295	28,073	26,611
Total	1,567,355	1,535,676	1,733,358	1,612,130
Fruits & Other				
Grapes	281,776	296,718	372,233	316,909
Apples	312,501	277,672	310,431	300,201
Peaches	182,781	174,409	173,649	176,946
Strawberries	112,120	108,683	118,514	113,106
Cherries	66,214	61,136	72,325	66,558
Plums & prunes	68,374	66,438	68,735	67,849
Pears	73,972	71,165	63,232	69,456
Blueberries	25,287	22,642	25,460	24,463
Total	1,123,025	1,078,863	1,204,579	1,135,489
Greenhouse & nursery	884,586	906,367	974,617	921,857
TOTAL	41,317,547	43,800,635	45,893,665	43,670,616

Table XXVII United States Commodity Cash Receipts for the Years 1979, 1980, and 1981

United States Commodity Cash Receipts for the Years 1979, 1980, and 1981 ($ in 000's)

	1979	1980	1981	3 Year Average
Livestock & Products				
Cattle & calves	34,399,556	31,464,409	28,936,250	31,600,072
Dairy products	14,659,258	16,605,268	18,104,184	16,456,237
Hogs	9,026,723	8,921,091	9,799,256	9,249,023
Eggs	3,327,633	3,247,069	3,639,542	3,404,748
Broilers	4,025,358	4,303,781	4,627,817	4,318,985
Turkeys	1,215,494	1,269,683	1,247,409	1,244,195
Sheep & lambs	474,154	469,723	410,857	451,578
Farm chickens	163,613	128,068	131,860	141,180
Honey	139,865	125,213	118,097	127,725
Total	67,431,654	66,534,305	67,015,272	66,993,744
Field crops				
Corn	10,283,383	13,965,773	13,601,702	12,616,953
Soybeans	12,963,762	14,255,913	12,421,150	13,213,608
Wheat	7,823,358	8,840,996	10,473,742	9,046,032
Hay	1,670,249	1,918,185	1,916,654	1,835,029
Potatoes	1,060,531	1,302,559	1,783,063	1,382,051
Sugar Beets	745,273	1,024,771	1,259,192	1,009,745
Barley	647,228	736,204	884,391	755,941
Oats	272,184	302,684	372,547	315,805
Dry beans	390,630	608,157	764,199	587,662
Mushrooms	324,431	368,896	351,023	348,117
Rye	36,035	29,900	38,284	34,740
Mint	63,428	67,536	59,623	63,529
Total	36,280,492	43,421,574	43,925,570	41,209,212

Table XXVII Continued, United States Commodity Cash Receipts for the Years 1979, 1980, and 1981

United States Commodity Cash Receipts for the Years 1979, 1980, and 1981 ($ in 000's)

	1979	1980	1981	3 Year Average
Vegetables & Melons				
Tomatoes	1,020,979	924,490	934.671	960,047
Lettuce	564,090	564,364	622,339	583,598
Sweet corn	263,251	265,410	308,693	279,118
Snap beans	197,135	192,878	198,303	196,105
Onions	316,077	321,981	537,225	391,761
Carrots	124,415	151,422	200,326	158,721
Cantaloups	139,847	166,800	188,070	164,906
Cucumbers	184,729	184,117	185,575	184,807
Celery	161,042	169,896	201,424	177,454
Cabbage	181,840	147,139	150,484	159,821
Asparagus	96,349	79,312	99,405	91,689
Peppers	115,696	126,706	142,360	128,254
Cauliflower	81,121	95,762	118,662	98,515
Total	3,446,571	3,390,277	3,887,537	3,574,795
Fruits & Other				
Grapes	1,169,594	1,331,162	1,233,974	1,244,910
Apples	866,871	972,197	861,169	900,079
Peaches	327,893	364,918	367,704	353,505
Strawberries	241,341	231,115	333,489	268,648
Cherries	188,566	135,093	158,809	160,823
Plums & prunes	162,108	198,255	194,544	184,969
Pears	174,114	174,933	163,694	170,914
Blueberries	45,266	49,399	63,815	52,827
Total	3,175,753	3,457,072	3,377,198	3,336,674
Greenhouse & nursery	2,983,179	3,302,372	3,493,291	3,259,614
TOTAL	113,317,649	120,105,600	121,698,868	118,374,039

Table XXVIII United States Commodity Cash Receipts for the Years 1989, 1990, and 1991

United States Commodity Cash Receipts for the Years 1989, 1990, and 1991 ($ in 000's)

	1989	1990	1991	3 Year Average
Livestock & Products				
Cattle & calves	36,894,270	39,944,797	39,632,088	38,823,718
Dairy products	19,395,992	20,210,019	18,113,714	19,239,908
Hogs	9,474,956	11,552,009	11,061,441	10,696,135
Eggs	3,861,538	4,010,461	3,861,358	3,911,119
Broilers	8,777,668	8,365,470	8,385,284	8,509,474
Turkeys	2,234,424	2,378,561	2,344,016	2,319,000
Sheep & lambs	487,387	414,138	399,313	433,613
Farm chickens	138,441	90,337	67,431	98,736
Honey	89,418	107,747	124,266	107,144
Total	81,354,094	87,073,539	83,988,911	84,138,848
Field crops				
Corn	11,388,225	13,358,138	13,853,798	12,866,720
Soybeans	10,524,005	10,789,536	10,778,421	10,697,321
Wheat	7,285,810	6,420,904	5,715,687	6,474,134
Hay	3,387,802	3,285,666	3,044,049	3,239,172
Potatoes	2,335,558	2,533,660	2,047,785	2,305,668
Sugar Beets	1,056,515	1,178,231	1,216,758	1,150,501
Barley	764,960	801,965	821,519	796,148
Oats	267,593	222,495	154,432	214,840
Dry beans	687,817	690,196	511,825	629,946
Mushrooms	630,006	666,806	668,410	655,074
Rye	19,306	15,492	15,336	16,711
Mint	112,698	134,809	129,229	125,579
Total	38,460,295	40,097,898	38,957,249	39,171,814

Table XXVIII Continued. United States Commodity Cash Receipts for the Years 1989, 1990, and 1991

United States Commodity Cash Receipts for the Years 1989, 1990, and 1991 ($ in 000's)

	1989	1990	1991	3 Year Average
Vegetables & Melons				
Tomatoes	1,841,185	1,625,760	1,798,806	1,755,250
Lettuce	950,278	844,142	817,667	870,696
Sweet corn	468,433	467,998	493,720	476,717
Snap beans	228,156	204,933	207,212	213,434
Onions	538,137	541,587	603,935	561,220
Carrots	297,227	272,573	308,749	292,850
Cantaloups	209,088	194,848	99,528	167,821
Cucumbers	203,195	231,324	228,719	221,079
Celery	268,266	214,708	205,701	229,558
Cabbage	78,585	110,102	107,197	98,628
Asparagus	149,779	148,380	150,663	149,607
Peppers	174,318	218,148	265,877	219,448
Cauliflower	204,840	190,350	188,395	194,528
Total	5,611,487	5,264,853	5,476,169	5,450,836
Fruits & Other				
Grapes	1,866,520	1,676,836	1,618,558	1,720,638
Apples	1,114,213	1,162,436	1,659,334	1,311,994
Peaches	363,536	372,142	392,682	376,120
Strawberries	537,756	580,101	634,028	583,962
Cherries	172,612	156,162	226,475	185,083
Plums & prunes	251,946	295,334	258,043	268,441
Pears	259,171	260,974	271,953	264,033
Blueberries	58,278	64,596	63,498	62,124
Total	4,624,032	4,568,581	5,124,571	4,772,395
Greenhouse & nursery	7,616,702	8,226,951	8,404,722	8,082,792
TOTAL	137,666,610	145,231,822	141,951,622	141,616,685

Table XXIX Michigan Commodity Cash Receipts for the Years 1969, 1970, and 1971

Michigan Commodity Cash Receipts for the Years 1969, 1970, and 1971 ($ in 000's)

	1969	1970	1971	3 Year Average
Livestock & Products				
Cattle & calves	111,680	114,732	131,282	119,231
Dairy products	249,727	261,202	275,902	262,277
Hogs	51,082	51,255	53,778	52,038
Eggs	43,023	39,771	34,132	38,975
Broilers	993	789	983	922
Turkeys	4,179	4,946	5,263	4,796
Sheep & lambs	3,659	3,385	3,884	3,643
Farm chickens	1,495	1,537	1,609	1,547
Honey	1,602	1,123	1,586	1,437
Total	467,440	478,740	508,419	484,866
Field crops				
Corn	44,340	61,984	76,713	61,012
Soybeans	32,991	28,788	38,388	33,389
Wheat	26,890	27,850	24,985	26,575
Hay	12,589	9,482	10,239	10,770
Potatoes	20,251	23,828	19,102	21,060
Sugar Beets	19,702	23,339	24,721	22,587
Barley	427	435	308	390
Oats	6,560	7,789	6,848	7,066
Dry beans	51,761	48,533	68,406	56,233
Mushrooms	n.a.	n.a.	n.a.	n.a.
Rye	692	667	586	648
Mint	1,759	1,273	816	1,283
Total	217,962	233,968	271,112	241,014

Table XXIX Continued, Michigan Commodity Cash Receipts for the Years 1969, 1970, and 1971

Michigan Commodity Cash Receipts for the Years 1969, 1970, and 1971 ($ in 000's)

	1969	1970	1971	3 Year Average
Vegetables & Melons				
Tomatoes	7,815	6,922	7,946	7,561
Lettuce	2,191	1,996	2,591	2,259
Sweet corn	2,561	2,830	3,381	2,924
Snap beans	2,798	2,937	3,385	3,040
Onions	6,636	7,634	5,804	6,691
Carrots	9,686	6,892	10,458	9,012
Cantaloups	1,307	1,166	1,251	1,241
Cucumbers	9,558	11,120	8,522	9,733
Celery	4,950	4,590	5,701	5,080
Cabbage	3,139	2,624	2,766	2,843
Asparagus	4,389	4,032	4,516	4,312
Peppers	1,397	1,088	1,175	1,220
Cauliflower	585	620	585	597
Total	57,012	54,451	58,081	56,515
Fruits & Other				
Grapes	5,730	8,686	7,062	7,159
Apples	28,328	30,554	26,832	28,571
Peaches	4,795	5,343	4,692	4,943
Strawberries	7,102	5,096	4,968	5,722
Cherries	20,640	15,490	22,046	19,392
Plums & prunes	1,158	1,235	1,306	1,233
Pears	1,474	1,404	1,322	1,400
Blueberries	n.a.	n.a.	n.a.	n.a.
Total	69,227	67,808	68,228	68,421
Greenhouse & nursery	30,170	30,101	31,166	30,479
TOTAL	841,811	865,068	937,006	881,295

Table XXX Michigan Commodity Cash Receipts for the Years 1979, 1980, and 1981

Michigan Commodity Cash Receipts for the Years 1979, 1980, and 1981 ($ in 000's)

	1979	1980	1981	3 Year Average
Livestock & Products				
Cattle & calves	208,565	257,567	182,237	216,123
Dairy products	571,725	647,602	694,072	637,800
Hogs	124,490	135,678	129,020	129,729
Eggs	61,336	57,760	68,670	62,589
Broilers	3,021	1,876	1,446	2,114
Turkeys	14,040	16,588	16,523	15,717
Sheep & lambs	4,116	5,439	3,332	4,296
Farm chickens	2,417	1,764	1,920	2,034
Honey	3,991	2,843	3,032	3,289
Total	993,701	1,127,117	1,100,252	1,073,690
Field crops				
Corn	318,719	511,355	481,805	437,293
Soybeans	194,586	227,372	165,325	195,761
Wheat	102,468	121,899	138,162	120,843
Hay	23,267	20,210	27,077	23,518
Potatoes	38,256	56,688	55,183	50,042
Sugar Beets	60,295	77,004	79,772	72,357
Barley	1,315	1,332	1,820	1,489
Oats	16,635	22,011	25,511	21,386
Dry beans	111,234	149,250	201,240	153,908
Mushrooms	n.a.	13,049	16,319	14,684
Rye	984	866	868	906
Mint	1,475	1,498	1,829	1,601
Total	869,234	1,202,534	1,194,911	1,093,788

Table XXX Continued, Michigan Commodity Cash Receipts for the Years 1979, 1980, and 1981

Michigan Cash Receipts for the Years 1979, 1980, and 1981 ($ in 000's)

	1979	1980	1981	3 Year Average
Vegetables & Melons				
Tomatoes	17,168	14,534	19,754	17,152
Lettuce	6,160	4,864	7,224	6,083
Sweet corn	5,523	6,877	6,908	6,436
Snap beans	7,903	8,421	8,229	8,184
Onions	11,925	11,963	22,573	15,487
Carrots	n.a.	6,345	14,746	10,546
Cantaloups	2,981	3,510	3,091	3,194
Cucumbers	18,792	15,497	16,885	17,058
Celery	10,982	12,890	15,675	13,182
Cabbage	3,207	4,300	3,229	3,579
Asparagus	15,538	12,014	10,690	12,747
Peppers	3,536	3,207	3,328	3,357
Cauliflower	2,132	1,824	2,350	2,102
Total	105,847	106,246	134,682	119,107
Fruits & Other				
Grapes	13,810	11,825	14,298	13,311
Apples	75,204	73,195	79,417	75,939
Peaches	6,693	7,584	7,486	7,254
Strawberries	10,041	7,001	8,448	8,497
Cherries	59,359	40,797	52,610	50,922
Plums & prunes	2,848	2,550	3,731	3,043
Pears	1,703	2,141	1,923	1,922
Blueberries	16,164	16,400	26,572	19,712
Total	185,822	161,493	194,485	180,600
Greenhouse & nursery	105,067	109,767	110,200	108,345
TOTAL	2,259,671	2,707,157	2,734,530	2,575,529

Table XXXI Michigan Commodity Cash Receipts for the Years 1989, 1990, and 1991

Michigan Commodity Cash Receipts for the Years 1989, 1990, and 1991 ($ in 000's)

	1989	1990	1991	3 Year Average
Livestock & Products				
Cattle & calves	269,283	275,323	284,605	276,404
Dairy products	693,950	729,476	643,140	688,855
Hogs	197,907	249,825	216,234	221,322
Eggs	68,338	68,074	62,587	66,333
Broilers	1,209	1,184	702	1,032
Turkeys	42,630	51,127	49,350	47,702
Sheep & lambs	4,882	4,029	3,956	4,289
Farm chickens	2,383	1,542	606	1,510
Honey	3,998	4,480	4,369	4,282
Total	1,284,580	1,385,060	1,265,549	1,311,730
Field crops				
Corn	276,843	345,987	393,165	338,665
Soybeans	211,125	229,105	267,820	236,017
Wheat	120,105	83,448	75,952	93,168
Hay	93,011	83,826	83,464	86,767
Potatoes	72,247	71,862	71,221	71,777
Sugar Beets	107,474	125,088	98,546	110,369
Barley	2,603	2,666	1,578	2,282
Oats	15,849	9,857	6,999	10,902
Dry beans	83,228	116,041	83,196	94,155
Mushrooms	20,301	19,800	21,717	20,606
Rye	768	611	393	591
Mint	976	1,162	1,750	1,296
Total	1,004,530	1,089,453	1,105,801	1,066,595

Table XXXI Continued, Michigan Commodity Cash Receipts for the Years 1989, 1990, and 1991

Michigan Commodity Cash Receipts for the Years 1989, 1989, and 1991 ($ in 000's)

	1989	1990	1991	3 Year Average
Vegetables & Melons				
Tomatoes	15,971	19,034	20,053	18,353
Lettuce	4,264	4,616	4,060	4,313
Sweet corn	14,035	11,268	14,788	13,364
Snap beans	10,350	13,541	12,898	12,263
Onions	23,011	20,461	21,568	21,680
Carrots	14,047	17,250	17,443	16,247
Cantaloups	1,848	1,848	1,848	1,848
Cucumbers	24,696	23,647	21,888	23,410
Celery	14,103	12,891	12,515	13,170
Cabbage	2,992	2,992	2,992	2,992
Asparagus	14,784	14,685	14,126	14,532
Peppers	6,500	6,500	6,500	6,500
Cauliflower	2,378	2,755	2,215	2,449
Total	148,979	151,488	152,894	151,120
Fruits & Other				
Grapes	11,415	13,372	12,926	12,571
Apples	77,505	86,286	99,169	87,653
Peaches	10,490	9,447	6,978	8,972
Strawberries	5,736	7,215	6,430	6,460
Cherries	37,090	36,433	67,961	47,161
Plums & prunes	2,281	1,778	2,786	2,282
Pears	2,047	668	1,363	1,359
Blueberries	n.a.	n.a.	27,000	27,000
Total	173,564	182,199	224,613	193,459
Greenhouse & nursery	254,639	258,751	265,742	259,711
TOTAL	2,866,292	3,066,951	3,014,599	2,982,614

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