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A MULTIPLE REGRESSION ANALYSIS  
OF ASPARAGUS PRICES IN MICHIGAN  
1956 to 1970

by  
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## CHAPTER I

### Introduction

#### Objectives and Plan of the Study

Michigan ranks among the top five asparagus producing states in the United States; ranking fourth in production, and second in its seasonal group.

As of 1970, the five leading states in asparagus were: (1) California, (2) New Jersey, (3) Washington, (4) Michigan, (5) Illinois. Although the total acreages employed for asparagus production has been decreasing—3,800 acres between 1969 and 1970—Michigan's has been increasing—900 acres for the same period. (Table 1 in Appendix\* and Figure 1). The marked decrease in asparagus production over the past decade may be explained by strong foreign competition, especially from Taiwan since 1964; and from competing enterprises in certain areas and from asparagus farms sharing in the natural attrition of all farms in the U.S.

Processed asparagus represents the major asparagus utilization in Michigan, averaging 94.3 percent for the past decade versus 5.7 percent utilization of fresh asparagus. Consequently, the major analysis will be processed asparagus.

The objective of this study is to analyze the asparagus price situation in Michigan and to develop forecast equations for Michigan asparagus prices. By employing multiple regression analysis, the study attempts to identify the most significant variables explaining the level of Michigan asparagus prices. Hence, the dependent variables are: (1) price in dollars per ton of all sale asparagus received by Michigan's farmers, (2) price in

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\*Tables in Appendix are noted as 1, 2, etc., the tables located within the text will be noted as 1.1, 1.2, etc.

dollars per ton of fresh asparagus received by Michigan's farmers, (3) price in dollars per ton of processed asparagus received by Michigan's farmers and (4) price in dollars per case of No. 300 canned green asparagus (f.o.b. factory Midwest fancy cut and tips) of October 1.

The independent variables were isolated by compiling and evaluating available time series data which this investigator considered to be of greatest importance in describing the demand and supply characteristics of this industry.

The following sections discuss these dependent and independent variables in turn as a prelude to specifying the multiple regression model.

#### Asparagus Price Trend

Asparagus is marketed as fresh or processed where the latter form may be canned or frozen. United States prices for processed asparagus have increased steadily from 1960 at 10.95 cents per pound to 18.70 cents per pound with the exception of 1964 when prices fell from 13.15 cents per pound to 11.90 cents per pound. The same can be said of Michigan prices for processed asparagus which have followed the national trend with price declines occurring only in 1964 and 1970. Michigan processed prices have stayed above the national average from 1960 to 12.50 cents per pound to 20.70 cents per pound in 1970 with the exception of 1966 when the national average price was 16.53 cents per pound and Michigan's price was 16.25 cents per pound. (Table 2).

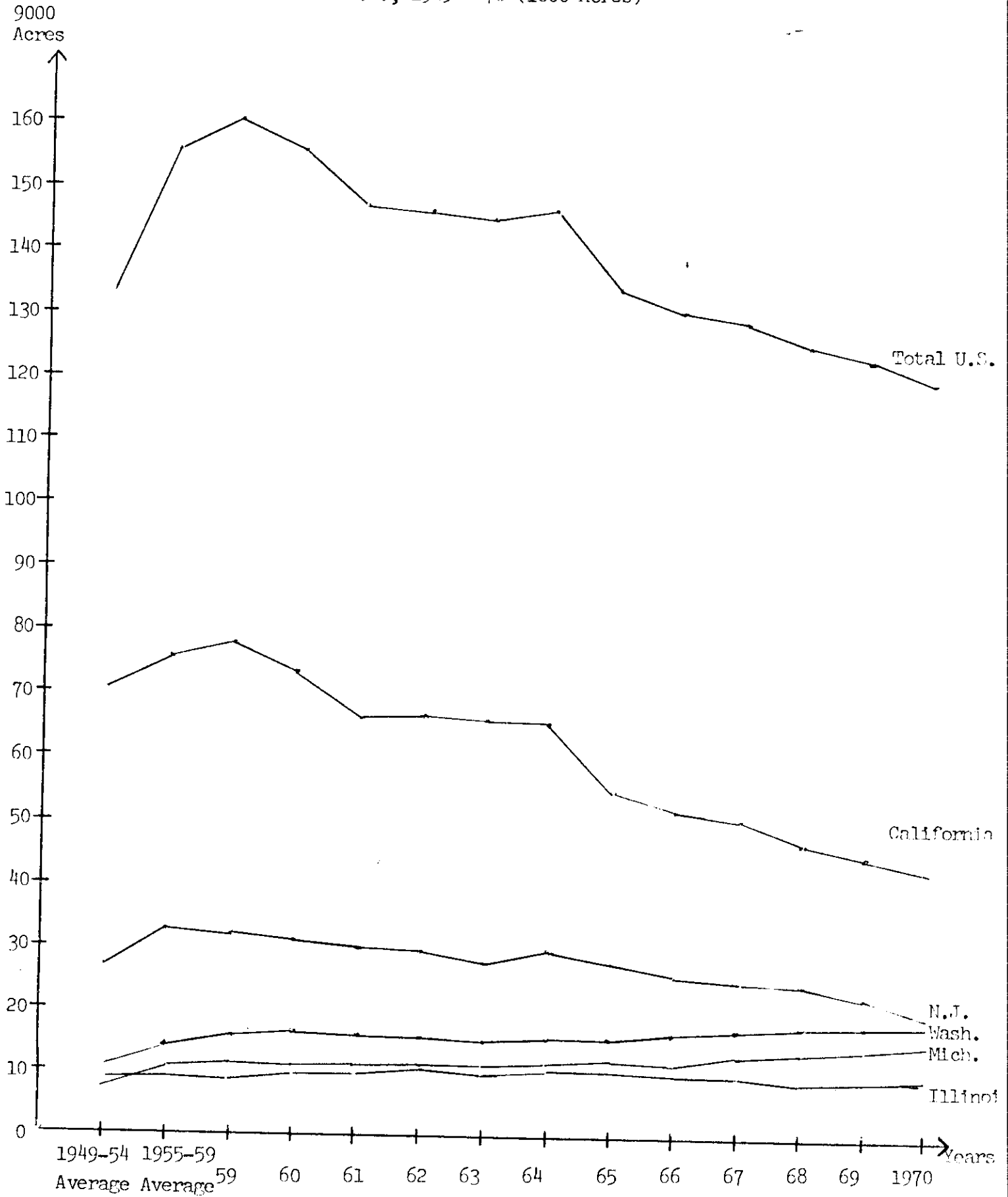
✓ Fresh asparagus prices in the United States have maintained an upward trend, from 13.65 cents per pound to 22.30 cents per pound, during the 1960 to 1970 period. With the exception of 1964 and 1970, Michigan's prices have followed the upward trend from 14.50 cents per pound in 1960 to 24.80 cents per pound in 1970 with the exception of 1962 when the price dropped from 17 cents per pound to 16.20 cents per pound, and 1967

when the price dropped from 21.50 cents per pound to 20.20 cents per pound. As is true for processed asparagus so it is that Michigan fresh asparagus prices have on the average remained above the national level, but to a lesser extent than for processed asparagus; Michigan's fresh asparagus was below the national average for 1967, 1968, and 1969 as compared with only 1966 for processed asparagus (Table 3).



Figure 1

Asparagus: Harvested Acreage, Seasonal Groups, Leading States, U.S., 1949 - 70 (1000 Acres)



Source: Crop Reporting Board / Agricultural Marketing Service, U.S.D.A.

## CHAPTER II

### Industry Supply Characteristics

#### Production by State and Market Share

Number of Farms in Asparagus Production -- As reported in the U.S. Census of agriculture, the number of farms reporting asparagus production in the top five asparagus producing states declined from 5033 to 2209 in the period 1959 to 1969 (Table 4). This represents a 56 percent decline. Michigan's decline has been more severe, from 2314 farms in 1959 to 880 farms in 1969, a drop of more than 60 percent. The period of greatest growth in the number of asparagus farms in Michigan was from the census years 1920 and 1930, where farms increased from 237 to 1401 (Table 4). Between 1930 and 1959, reporting farms increased gradually to 2314, followed by the drastic decline to the 1969 level of 880 mentioned above. (Table 5).

Acreage in Asparagus Production -- Total acres harvested in the United States has been declining gradually from 156.00 to 119.98 thousand acres in 1960 and 1970, respectively (Table 6). Among the top five states, California had the greatest acreage decline of almost 50 percent between 1959 and 1969; New Jersey has had the second largest acreage decrease since 1959. Two of the states (Michigan and Illinois) have had little change in asparagus acreage -- less than a 10 percent drop -- while Washington has had an increase (Table 7). In the case of Michigan, asparagus acreage multiplied rapidly from 1920 to 1959, but has remained relatively stable from that time to the present (Table 5).

Asparagus Acreage per Farm--For 1969, the top five states had 46.5 acres per farm reporting. This represented an increase of 12.2 acres over 1959 (Table 8). Thus, as the number of asparagus farmers has decreased, the average farm size has increased by quite a bit. California was the only state to have a decline in acres per farm, from 286.9 in 1959 to 239.2 in 1969. Illinois increased from 26.1 to 75.5 between 1959 and 1969; Washington from 19.1 to 35.0; New Jersey from 23.2 to 35.6; and Michigan from 4.7 to 11.8 in average acres of asparagus per farm. Historically, Michigan has had increases since 1930, but it was only between 1959 and 1969 that acres per farm increased substantially. Comparing the farm size in Michigan to her neighboring states and the nation, Michigan is far below average. Illinois, Michigan's chief competitor has had a fantastic growth in farm size, about seven times larger than Michigan's in 1969, whereas in 1959 it was slightly more than five times larger. In terms of economy of scale in production, Michigan might have great difficulty in the future if efficiency is significantly related to farm size.

#### Production Trends

Total United States and Leading States--Yield has remained constant at around 23 to 26 hundredweight per acre (Table 6). Since harvested acres have decreased over the years, total production has gone down from 3.7 million hundredweight in 1960 to 2.8 million hundredweight in 1970. Gross value per acre has increased from \$284.37 in 1960 to \$464.12 in 1970. California has the highest yield

per acre, averaging 30 cwt. during the last decade. This is followed by Washington with 29, New Jersey by 23, Illinois by 17, and Michigan by 15.

Michigan production trend: The yield per acre (cwt.) in Michigan has been well below the U.S. average of 23 — 26 hundred weight per acre. In Michigan, the yield has averaged around 15 hundred weight per acre since 1960. Since 1965, the yield has fallen to around 13 to 14 hundred weight per acre.

In contrast to the national trend in harvested acres, Michigan has enjoyed an increase from 11000 acres in 1960 to 14,800 acres in 1970. Total production in Michigan has increased from 187, 000 hundred weight in 1960 to 192,400 hundred weight in 1970. Gross value per acre as shown in Table 9 has been increasing gradually from 215.55 dollars in 1960 to 272.43 dollars by 1970.

#### Asparagus Processing

Production of processed asparagus -- Production of processed asparagus increased between 1949 - 1963 in the United States. However, from a peak of 135,550 tons in 1963 output of processed asparagus has been declining steadily except for 1966 and 1968 (Table 10). With a below average yield and reduced acreage, 1970 tonnage fell below the 100,000 mark at 91,500 tons. California and New Jersey, the two largest asparagus producers, have accounted for all of this decline. Washington increased from 11,020 during 1949 - 54 to 21,600 by 1970. Illinois increased from 6840 to 7700 tons, and Michigan increased from 6110 between 1949 - 54 to 8990 tons by 1970. Michigan, therefore, ranks second in terms of processed asparagus production increase among the top five states.

While production for the U.S. has been on the decline, price has been moving steadily upward from a 1949/54 price average of 212.00 dollars per ton to 374.00 dollars per ton in 1970. This is an increase of about 70 percent. Michigan is right around the average in price increases while Illinois, Michigan's chief competition had only a price increase of around 50 percent.

Asparagus Pack--Processed packed asparagus can be divided between frozen and canned. As to be expected, total asparagus pack has followed the trends of total processing production discussed above. (Table 11) Frozen pack has fluctuated from 1950 to 1970. Given an index number of 100 for the average between 1950 and 1954, we see that frozen pack was as low as 86 in 1950, as high as 154 in 1960, and a return to 100 in 1970. Since canned pack represents the bulk of processed asparagus, total United States pack had a similar trend, from 151.73 million pounds in 1950 to 247.07 million pounds in 1963 and then down to 165.67 million pounds by 1970.

It is interesting to note that the substantial drop in pack canned asparagus happened in California, the leading asparagus producer. The drop started in 1963, primarily with the introduction of Taiwanese white asparagus. California's share of the white asparagus market has since declined to a very small figure. Whereas in 1963 she produced 3,278 (1,000 cases), by 1970 she produced only 267 (1000 cases) white canned pack asparagus. This is a drop of 3,000 (1000 cases). And considering that the total U.S. canned pack of white and green asparagus in 1970 was only 5,982 (1000 cases), the magnitude of the California decline must be understood.

As for the total U. S. green asparagus canned pack, declines have been small. New Jersey has increased its green canned pack from 1048 (1000 cases) in 1963 to 1155 in 1970. Washington, Michigan and Illinois all had an increase. An exception was California which dropped from 1744 (1000 cases) in 1963 to 1402 in 1970. Nevertheless, the California trend shows an upward turn starting in 1964, from a sudden drop from 1744 (1000 cases) to 1177 in 1964, to increases back up to 1462 in 1970. All of these data are illustrated in Table 12.

In terms of frozen asparagus pack, the regional trend is illustrated in Table 13. The big drop from 42,039 in 1961 to 30,810 (1000 lbs) in 1962 came primarily from the West (California). That level was maintained until 1968 - 69, when the East, South, and Midwest dropped from 9887 (1000 lbs) to 2885 in 1969 and 4229 in 1970. Frozen asparagus pack has been affected by sudden drops in two regions, one in the West occurring around 1964 - 65 and one in the East, South, and Midwest from 1968 - 69.

#### Asparagus Carryover

⟨Canners' stocks -- As shown in Tables 14 and 15, carryover of canners' stocks fluctuates quite a bit. From a low of 669 (1000 cases) or 15654.6 (1000 lbs) in 1955, it has reached a peak of 2490 (1000 cases) or 58266.0 (1000 lbs) in 1964 and has fluctuated to 1619 (1000 cases) or 37884.6 (1000 lbs.) by 1970. No definite trend exists for canners' stocks.

✓ Cold storage -- Total frozen carryover had an upward trend from 1950 to 1957 [3007 to 19017 (1000 lbs)]7. Since that year, it has fluctuated quite a bit in both directions. It went down as low as 10,752 (1000 lbs.) in 1965 and as high again as 18,870 (1000 lbs) in 1968. In 1970, cold storage had 10,973 (1000 lbs). Table 15 shows the trend.

Distributors' stocks -- As is true of canners' stocks and cold storage, distributors' stocks appear to be directly related to their movements. As can be seen in Tables 13 and 15, distributors' stocks of March 1 fluctuate from a high of 833,000 cases to a low in 1970 of 562,000 cases.

Total can supply -- Carryover of total can supply increased from 1955 until 1963, from 7,739,000 cases to 10,473,000 cases. Since then, it has fluctuated around 10.3 million cases to 7.8 million cases. In 1970 it was 7.6 million cases (Table 14).

Chapter III  
Demand Characteristics

Income Levels

Price changes result from shifts in either demand or supply curves or both. In the previous chapter, attention was given to some of the contributors to changes in asparagus supply over time. Our attention is now directed toward some of the characteristics of the asparagus industry which could account for shifts in the demand curve.

An increase in demand may be due to any one or a combination of the following four causes: (1) An increase in consumer incomes, (2) An increase in the number of consumers, (3) An increased consumer preference for the product in question, and (4) A higher price of some substitute product or a lower price for a complementary product. For this study it was assumed that the first two causes mentioned should receive primary consideration.

Total U. S. disposable income increased in current dollars nearly three and one-third times (from 206.9 to 687.8 billion during the period 1950 to 1970 (Table 17). However, total disposable income in real dollars (1957 - 59 = 100) increased only slightly more than two times during the same period. Current dollars were deflated by the consumer price index. With the indicated increases in disposable income, and assuming a positive income elasticity, it is reasonable to expect asparagus consumption to increase with income:

The U. S. personal disposable income for this study can be divided into four categories: (1) total current disposable personal income in billion dollars (2) current disposable income per capita in dollars, (3) total real disposable



personal income in billion dollars (1957/59 = 100), (4) real disposable income per capita in dollars (1957/59 = 100).

From (Table 17), total current disposable income is distinguished from total real disposable income by the consumer price index, a measure that adjusts for inflation in the economy. Total real disposable income adjusts for inflation, while total current disposable income does not. A measure that accounts for the effects of inflation appears to be more representative than one that does not.

Current per capita income is total disposable personal income adjusted for population; i.e., current per capita is the amount of disposable personal income available for each individual in America. Real per capita is current per capita disposable income divided by the consumer price index to adjust for inflation.

Real per capita income is used in this study because it reflects the amount of real income available to each American for buying goods and services. Other measures were not used because they either do not reflect the effect of inflation or do not reflect the disposable income of each individual, thus not accounting for changes in population.

As shown in Table 17, real per capita disposable personal income in the U.S. has generally advanced since 1950 when it was only \$1633.60. In 1970, real per capita disposable income was measured at \$2503.00.

#### Consumption per Capita

Fresh Asparagus--There has been a general downward trend in the consumption of fresh asparagus by the average American. Beginning with 1938 (Table 18) and ending with 1970, the average American decreased his consumption of asparagus from 1.1 pounds per year to 0.5 pound per year.

Much of the decline in fresh asparagus consumption can be attributed to the emergence of canned and frozen asparagus.

Canned Asparagus--In 1938, per capita consumption of canned asparagus was 0.5 pound per year. Slightly it increased to 0.7 pound per year by 1942 and dropped as low as 0.4 pounds by 1945, the end of World War II. There was a sudden increase to 1.0 pound in 1946, a leveling off between 0.6 and 0.7 pound from 1947/52, an increase to around 0.8 pound from 1953/62, a drop back to 0.7-0.8 pound in 1963/69, and an increase to 0.9 pound by 1970. It appears, therefore, that canned asparagus consumption has been fairly steady over the past 30 years.

Frozen Asparagus--From 1938/42, frozen asparagus per capita consumption was around 0.03-0.06 pounds. Suddenly it rose to 0.11 in 1944, and since then has crept steadily upward to around 0.15-0.17 pound in the 1960s, although a sudden increase to 0.28 pound per year must be noted.

#### Competing Crops and Their Supply Characteristics

Asparagus industry spokesmen single out three vegetables that could affect the demand for asparagus. There are: 1) green peas, 2) snap beans, and 3) sweet corn. Should any of these crops be highly substitutable for asparagus, changes in the prices of these crops will result in shifts in the demand for asparagus. Should sweet corn be significant, for example, decrease in price of sweet corn will decrease the demand for asparagus and vice versa.

The supply characteristics of these competing crops are exhibited in Table 19-21. These are concerned with: 1) production for processing, 2) processed packs and 3) carryover.

In terms of production for processing, sweet corn appeared to fluctuate and not increase between 1956 and 1970. From 3420 million pounds in 1956, it fell as low as 2659.8 million pounds in 1958, it went as high as 4958.6 million

pounds in 1968 and back down to 3742.1 million pounds in 1970. Snap beans had a steady upward trend from 1956/70, from a low of 677.26 million pounds in 1956 to a high of 1139.3 million pounds in 1970. Green peas were more similar to sweet corn. In 1956 there were 1090.72 million pounds. It went as low as 890.70 million pounds in 1960, as high as 1203.82 million pounds in 1965, and back down to 952.5 million pounds by 1970.

Processed pack of sweet corn fluctuated, but mostly in the upward direction. In 1956 there were 1156.826 million pounds. In 1968 there were 1798.012 million pounds, and in 1970 there were 1396.67 million pounds. Most processed pack of sweet corn consisted of canned pack which mostly determined the trend of processed pack, although frozen pack appeared to have caused a significant portion of the rise in processed pack. Processed pack of snap beans has gone up since 1956 when there were 822.38 million pounds. By 1970 there were 1340.22 million pounds. Both canned pack and frozen pack increased substantially for snap beans. For green peas, processed pack fluctuated with no definite trend. They were somewhat higher from 1965 to 1967, but then they steadily decreased, and by 1970 there were only 1016.03 million pounds as compared with 1194.62 million pounds in 1956. Both canned pack and frozen pack fluctuated without definite trends.

Table 21 illustrates the supply characteristics of the three competing crops in terms of carryover. Sweet corn reached a high in carryover in the latter years, 4106.91 million pounds in 1970 as compared with 1448.65 million pounds in 1956. Since carryover is the sum of cold storage, canners' stocks and distributors' stocks, an examination of the most significant upward force appears to be in canners' stocks and cold storage in 1969/70. Carryover of snap beans stayed around 200 million pounds from 1956/67, but has since gone

up to 349.28 million pounds by 1970. Almost all the increase can be attributed to canners' stocks. Carryover of green peas was unusually high between 1957 and 1960, at around 300 million pounds, but fell to the mid-200 million pounds since 1961 until 1967 but went back to over 300 million pounds from 1968 to 1970. The high level from 1957 to 1960 was mainly caused by cold storage and canners' stocks. From 1968 to 1970, much of the increase was due to canners' stocks.

#### Exports of Asparagus

Exports of canned asparagus had an upward trend from 1950 to 1962 as shown in Table 22, with several fluctuations in between. From 1963 to 1970, net quantity exported fell. In 1950, there were 7.9 million pounds exported. By 1962, exports amounted to 64.1 million pounds, gradually declining to 61.7 million pounds in 1964. There were huge declines since then. In 1970, exports had fallen to 7.5 million pounds, less than 1950 level. In terms of dollar value, exports continued upward from 1950 to 1964, 2.1 million dollars in 1950 to 15.6 million dollars in 1964. It had declined to 2.4 million dollars in 1970.

Table 23 illustrates the leading export market for U.S. canned asparagus. West Germany had accounted for the largest share of asparagus exports. Between 1952/56, West Germany had little over a third of total canned asparagus exports. At its peak in 1963, West Germany had 60 percent of the export market. Switzerland was the second biggest market. Between 1952/56, it averaged 130 thousand cases a year, about 15 percent of the total of 827 thousand cases. In 1964, a peak of 213 thousand cases was reported, less than 10 percent of the total of 2718 thousand cases. Since 1963/64, most of the canned asparagus exports have declined substantially, primarily because of the competition from Taiwan. By 1970, West Germany was only buying 83,000 cases, whereas in 1963 she was buying 1,641,000 cases. Switzerland in 1970 fell to 32,000 cases, and Sweden

became the top buyer at 89,000 cases. The total exports for 1970 was 479,000 cases, a far cry from 2,718,000 cases in 1964.

## CHAPTER IV

### The Model

#### General Form of the Model

Multiple least squares regression analysis was used in this study.

Thus, for each price being estimated, the model takes on the form:

$$P = a_0 + \sum_{j=1}^n B_j X_j + E \quad \text{where}$$

$a_0$  = a constant

$B_j$  = the increase or decrease in price as a result of one unit change in the predetermined variables  $X_j$

$X_j$  = the predetermined variables hypothesized to affect the dependent variable, asparagus price.

$E$  = the unexplained error

#### The Dependent Variables

Although most of the Michigan asparagus crop is sold to the market for processing, it was assumed that the industry would be interested in a variety of price predictions. Therefore, estimating equations were developed for each of the following asparagus prices:

- 1) Price received by Michigan farmers for all asparagus sales ( $P_a$ ) in dollars per ton.
- 2) Price received by Michigan farmers for fresh asparagus ( $P_f$ ) in dollars per ton.
- 3) Price received by Michigan farmers for processed asparagus ( $P_p$ ) in dollars per ton.
- 4) Canned green asparagus price, in dollars per 24 can case,

for No. 300 can, Midwest fancy cut and tips, F.O.B. factory,  
October 1. (P<sub>c</sub>)

The Independent Variables and Expected Relationships

In the previous chapter, the asparagus industry was described in terms of a variety of supply and demand characteristics. Thoughtful consideration was given to these supply and demand data and the following seven variables were hypothesized to have significant effect on the four dependent variables identified above:

(1) U. S. total asparagus crop ( $X_1$ ): The annual production of asparagus is relatively small compared with the total U. S. asparagus output. As seen before, Michigan asparagus is produced primarily for processing. Likewise, processed asparagus dominates the national scene for this commodity. Since processed asparagus is easily transported, Michigan farmers are participants in the national and the total supply of asparagus in the United States should be a primary determinant of asparagus prices in Michigan. Increasing total supply of asparagus, other factors held constant, should result in lower asparagus prices. Therefore, the sign associated with the coefficient for this variable is expected to be negative.

(2) U. S. real per capita disposable income ( $X_2$ ): Patterns of food consumption change with changes in the level of income. In general, rising income result in a lower proportion of the income being spent for food. Thus, the income elasticity for all food is negative. However, certain food items will be in greater demand with higher income level than with lower income levels. In these cases, with other factors constant, rising incomes would cause higher prices. It is hypothesized that asparagus would be in this category and that rising income would increase its demand. Therefore, the sign on the coefficient for this variable is expected to be positive.

(3) U. S. production of substitute vegetables: The consumer demand for asparagus will diminish if the price of suitable substitute vegetables appear to be a "better buy." Asparagus industry representatives have suggested that possible substitute vegetables for asparagus are sweet corn, snap beans, and green peas. U. S. total production of the crops were selected as relevant variables (identified as  $X_3$ ,  $X_4$  and  $X_5$  respectively). Production rather than prices for these commodities was used because (a) there is some problem of selecting the appropriate price to use and (b) production data are quite readily available to industry people who may use the results of this analysis. The expected relationship is a negative sign on the coefficients of the variables because the higher the production for the substitute commodities, the lower the price for the substitutes and hence a lower price for asparagus.

(4) U. S. total per capita consumption of asparagus: It is not easy to say whether increasing per capita consumption is a supply or a demand variable. With many vegetable substitutes it may be that changing per capita consumption of asparagus could be explained by varying price relationships among the substitutes which in turn were explained by their varying supplies. On the other hand, as a demand variable, it could represent real shifts in the demand function where a different quality will be taken for a given price. The latter view is held in this analysis and it was expected that an increase in per capita consumption would be associated with an increase in price.

(5) U. S. export of canned asparagus ( $X_7$ ): This variable likewise may behave as either a demand or a supply variable. One could justifiably assume that if the industry were to take an aggressive marketing stance with regard to developing foreign markets, then this action would serve to shift the total demand curve to the right and result in higher average



prices for the production of a given year. However, inspection of the export data would suggest that since the rather recent expansion of asparagus production in Taiwan, the export situation in the United States has been more related to total domestic supplies than to total world demand. Exports appear to be highest in years with large supply and low price rather than maintaining or expanding their share of the world market which would call for increasing prices associated with increasing exports.

The above seven variables were used initially to serve as independent variables for predicting the four asparagus prices.

Alternative measures for the independent variables.

Several alternative measures were used for each of the predetermined variables. Some of the alternatives were chosen based on knowledge of the industry to be tested before any computer run were made. Some alternatives were added after initial regression results to try to obtain a more refined explanatory model based on the judgment, the knowledge of industry and the significance of the variables. Various combination of the alternative variables were used; at all times attention was directed toward determining the combination that would be tested most accurately for predicting the price of Michigan asparagus.

In choosing the best combination of significant variables, the following criteria were used: (1) they must be consistent with economic theory, (2) they must result in the smallest standard error of estimate based on different combinations, (3) they must have high  $R^2$  and  $\bar{R}^2$  with respect to the other combinations, and (4) they must be consistent with knowledge of how the asparagus industry operates.

The predetermined variables were organized into three categories (Table 24): group A asparagus output, group B substitution crops and group C other economic considerations.

The variables for asparagus output are: U. S. asparagus total crop ( $X_1$ ), U. S. pack of processed asparagus ( $X_9$ ), U. S. pack of canned asparagus ( $X_{10}$ ), U. S. pack of processed asparagus and U. S. asparagus carryover ( $X_{11}$ ), U. S. pack of processed asparagus and U. S. canners' stocks ( $X_{12}$ ), U. S. pack of processed asparagus and U. S. distributors' stocks ( $X_{13}$ ), last-year lagged U. S. asparagus total crop ( $X_{14}$ ), harvested acreage in Michigan processing asparagus ( $X_{15}$ ), changes in Michigan harvested processing asparagus ( $X_{16}$ ), processing asparagus production in Michigan ( $X_{17}$ ), processing asparagus production in Michigan and Illinois ( $X_{18}$ ), U. S. asparagus carryover ( $X_{19}$ ). Variables for substitution crops. Sweet corn—U. S. corn production for processing ( $X_3$ ), U. S. canned pack of sweet corn ( $X_{20}$ ), U. S. farm production for processing and U. S. carryover of sweet corn ( $X_{21}$ ), U. S. carryover and processed pack of sweet corn ( $X_{23}$ ), U. S. carryover of sweet corn ( $X_{24}$ ), U. S. processed pack of sweet corn ( $X_{25}$ ); snap bean—U. S. snap bean production for processing ( $X_4$ ), U. S. canned pack of snap bean ( $X_{26}$ ), U. S. farm production for processing and U. S. carryover of snap bean ( $X_{27}$ ), U. S. carryover of snap bean and U. S. canned pack of snap bean ( $X_{28}$ ), U. S. carryover and processed pack of snap bean ( $X_{29}$ ), U. S. carryover of snap bean ( $X_{30}$ ), U. S. processed pack of snap bean ( $X_{31}$ ); Green peas—U. S. green pea production for processing ( $X_5$ ), U. S. canned pack of green peas ( $X_{32}$ ), U. S. farm production for processing and U. S. carryover of green peas ( $X_{33}$ ), U. S. carryover of green peas and U. S. canned pack of green peas ( $X_{34}$ ), U. S. carryover and processed pack of green peas ( $X_{35}$ ), U. S. carryover of green peas ( $X_{36}$ ), U. S. processed pack of green peas ( $X_{37}$ ).

Variables for other economic consideration. - U.S. real per capita disposable income ( $X_2$ ), U. S. total consumption per capita of asparagus ( $X_6$ ), U. S. export of canned asparagus ( $X_7$ ), last-year lagged canned green asparagus price f.o.b. factory midwest fancy cut and tip No. 300 ( $X_8$ ), canned green asparagus price f.o.b. factory, Midwest fancy cut and tips No 300 October 1 ( $X_{38}$ ), canned sweet corn price f.o.b. factory Midwest standard gold ( $X_{39}$ ), canned green snap bean price f.o.b. factory extra standard cut ( $X_{40}$ ), canned pea price f.o.b. factory Alaska Midwest extra standard cut ( $X_{41}$ ), last-year lagged total U. S. consumption per capita of asparagus ( $X_{42}$ ), consumption per capita for canned asparagus ( $X_{43}$ ), consumption per capita for processed asparagus ( $X_{44}$ ).

The analysis of these relationships will be explained in the next chapter.

Table 4.1: Classification of Hypothesized Predetermined Variables Affecting Michigan Asparagus Prices

Group A: Asparagus Output	Group B: Substitution Crops
X <sub>1</sub> U.S. asparagus total crop	<u>Sweet corn</u>
X <sub>9</sub> U.S. pack of processed asparagus	X <sub>3</sub> U.S. corn production for processing
X <sub>10</sub> U.S. pack of canned asparagus	X <sub>20</sub> U.S. canned pack of sweet corn
X <sub>11</sub> U.S. pack of processed asparagus and U.S. asparagus carryover	X <sub>21</sub> U.S. farm production for processing and U.S. carryover of sweet corn
X <sub>12</sub> U.S. pack of processed asparagus and U.S. canners' stock	X <sub>22</sub> U.S. carryover of sweetcorn and U.S. canned pack of sweet corn
X <sub>13</sub> U.S. pack of processed asparagus and U.S. distributors' stock	X <sub>23</sub> U.S. carryover and processed pack of sweet corn
X <sub>14</sub> last-year lagged U.S. asparagus total crop	X <sub>24</sub> U.S. carryover of sweet corn
X <sub>15</sub> harvested acreage in Michigan processing asparagus	X <sub>25</sub> U.S. processed pack of sweet corn
X <sub>16</sub> changes in Michigan harvested processing asparagus	<u>Snap bean</u>
X <sub>17</sub> processing asparagus production in Michigan	X <sub>4</sub> U.S. snap bean production for processing
X <sub>18</sub> processing asparagus production in Michigan and Illinois	X <sub>26</sub> U.S. canned pack of snap bean
X <sub>19</sub> U.S. asparagus carryover	X <sub>27</sub> U.S. farm production for processing and U.S. carryover of snap bean
	X <sub>28</sub> U.S. carryover of snap bean and U.S. canned pack of snap bean
	X <sub>29</sub> U.S. carryover and processed pack of snap bean
	X <sub>30</sub> U.S. carryover of snap bean
	X <sub>31</sub> U.S. processed pack of snap bean

Table 4.1— Continued

Group B: Substitution Crops	Group C. Other Economic Considerations
<u>Green Peas</u>	X <sub>2</sub> U.S. real per capita disposable income
X <sub>5</sub> U.S. green pea farm production for processing	X <sub>6</sub> U.S. total consumption per capita of asparagus
X <sub>32</sub> U.S. canned pack of green peas	X <sub>7</sub> U.S. export of canned asparagus
X <sub>33</sub> U.S. farm production for processing and U.S. carryover of green peas	X <sub>8</sub> Last-year lagged canned green asparagus price f.o.b. factory Midwest, fancy cut and tip
X <sub>34</sub> U.S. carryover of green peas and U.S. canned pack of green peas	X <sub>38</sub> Canned green asparagus price f.o.b. factory, Midwest fancy cut and tips No. 300 October 1
X <sub>35</sub> U.S. carryover and processed pack of green peas	X <sub>39</sub> Canned sweet corn price f.o.b. factory Midwest standard gold
X <sub>36</sub> U.S. carryover of green peas	X <sub>40</sub> Canned green snap bean price f.o.b. factory extra standard cut
X <sub>37</sub> U.S. processed pack of green peas	X <sub>41</sub> Canned pea price f.o.b. factory Alaska Midwest extra standard cut
	X <sub>42</sub> Last-year lagged total U.S. consumption per capita of asparagus
	X <sub>43</sub> Consumption per capita for canned asparagus
	X <sub>44</sub> Consumption per capita for processed asparagus
	X <sub>45</sub> Michigan asparagus all sale price at farm level (\$/ton)

## CHAPTER V

### Analysis of Results

#### Farm Price of Michigan Asparagus (All Sales)

The seven variables in the model were originally used to obtain a predicting equation for the Michigan all sale price at farm level during the 1956 to 1970 period. Of these, only three are significant at  $d = .05$ . They are: (1)  $X_{15}$  = acreage change in Michigan harvested processing asparagus (acres), (2)  $X_2$  = U.S. real disposable per capita income (1957-59 = 100), dollars, (3)  $X_{36}$  = U.S. carryover of green peas 1000 pounds (June). Variable  $X_8$  or last-year lagged canned green asparagus price f.o.b. factory Midwest fancy cut and tips No. 300 per case October 1, was added because it was hypothesized that this year's price is affected by last year's price by assuming that buyers will consider last year's price so last year's price was decided to be placed in the model; and since Michigan is primarily engaged in processing asparagus, especially in canned asparagus, the lagged canned asparagus price was chosen. Variable  $X_8$  is significant at  $\alpha = .05$ . The further advantage of using  $X_8$  is the ease of obtaining data for use in prediction.

Variables  $X_{15}$ ,  $X_2$ ,  $X_{36}$  and  $X_8$  explained 98.62 percent of the annual variations in the all sale price of Michigan asparagus at the farm level. That is, historical movements in variables  $X_{15}$ ,  $X_2$ ,  $X_{36}$  and  $X_8$  explained 98.62 percent of past variations in the all sale price of Michigan asparagus.

The relationships of each of the variables are illustrated in Table 5.1 below:

Table 5.1: Relationship of the variables to the all sale asparagus price ( $P_f$ ) received by Michigan farmers

Variables	Regression Coefficients	Standard Error of Coefficient	T-Test	F-Test	Significance	
$\alpha_0$	-199.6126	24.4071	-8.1785	66.8871	<0.0005	
$X_{15}$	- .0254	0.0087	-2.9066	8.4484	0.016	Acreage Mich processing harvested
$X_2$	0.1626	0.0177	9.1748	84.1765	< .0005	U.S. per cap. disp. income (real)
$X_{36}$	-0.0002	0.00004	-4.4211	19.5462	0.001	U.S. carryover green pea June
$X_8$	47.9018	7.1889	6.6633	44.3993	< .0005	Lagged canned price asparagus
$R^2$	= .9862					
$R$	= .9931					
$R^{-2}$	= .9807					
$\bar{R}$	= .9903					

Standard error of estimate = 9.4453

Price estimating equation for all sale price of asparagus received by Michigan farmers is:

$$P_s = -199.6126 - 0.0254X_{15} + 0.1626X_2 - 0.0002X_{36} + 47.9018X_8 \quad (1)$$

in which:

$P_s$  = Michigan all sale asparagus price at farm level, dollars per ton

$X_{15}$  = Acreage change in Michigan harvested processing asparagus, (acres)

$X_2$  = U.S. real disposable personal income (dollars)

$X_{36}$  = U.S. carryover of green peas, June (thousand pounds)

$X_8$  = Last year lagged green asparagus price f.o.b. factory Midwest fancy cut and tips No. 300 October 1, (dollars per case)

The equation can be interpreted as follows:

For a one-acre increase in acreage for Michigan harvested processing asparagus, there will be a decrease of 2.5 cents per ton in the all sale asparagus price received by Michigan farmers. On the other hand, a one dollar increase in U.S. real per capita income will result in an increase of 16 cents per ton.

Increase in the carryover of green peas by one thousand pounds a year will cause the all sale asparagus price received by Michigan farmers to drop by .02 cents per ton. Finally, for each increase of one dollar per case of canned green asparagus price during the previous year for Midwest cut and tips No. 300, the all sale price will increase by \$47.90 per ton.

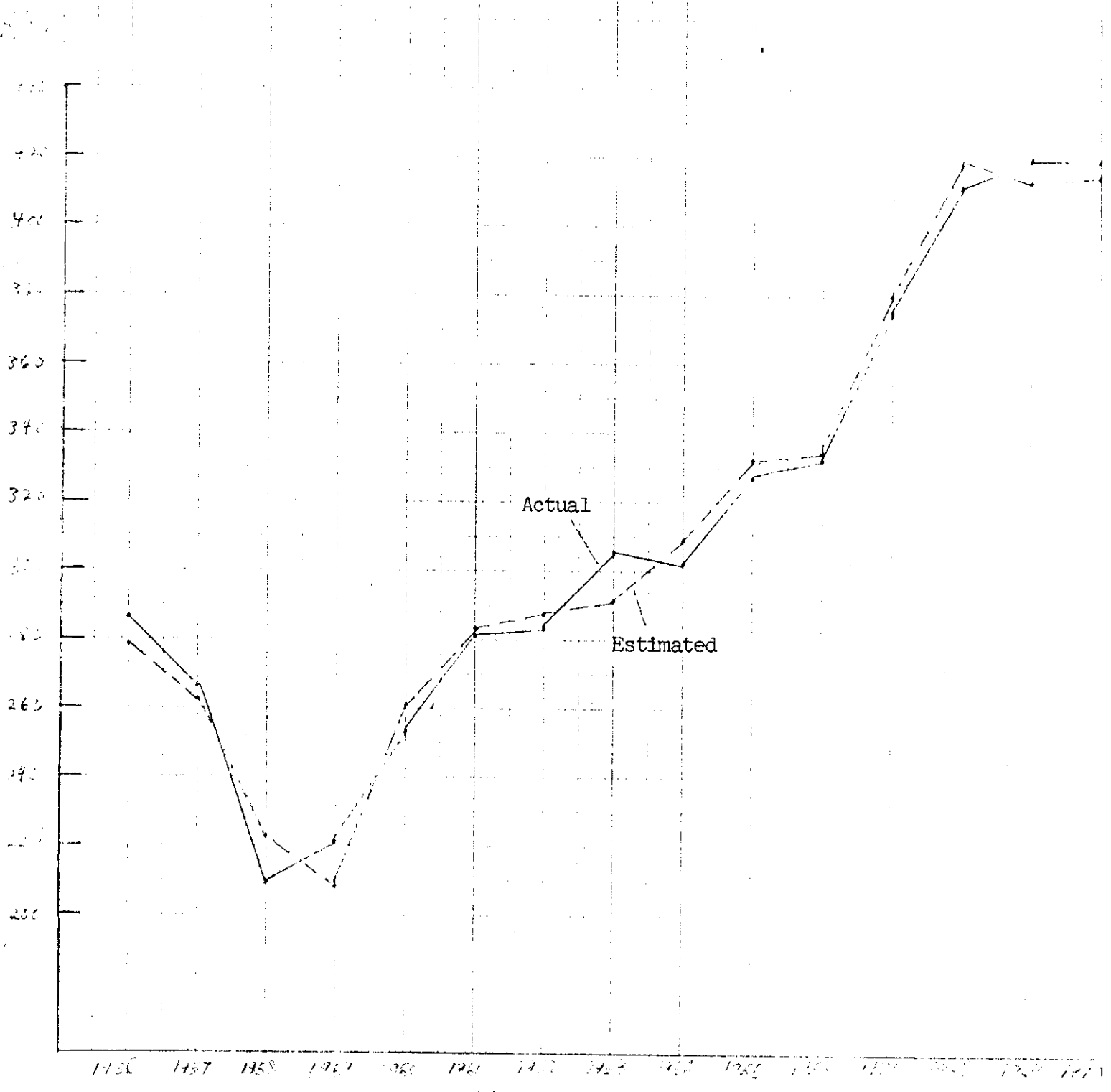
The T-test and F-test showed that each of the variables significantly affect the all sale asparagus prices received by Michigan farmers at  $\alpha = .05$ . This means that 95 times out of a 100, each of the variables tested will be truly related to the all sale price, but in five percent of the cases, the significant result will be due to chance only.

The predicting regression equation explains 98.07 ( $\bar{R}^2$ ) percent of all variations in the all sale asparagus price (adjusted for the degrees of freedom). The 1.93 percent that is not explained by the four variables mentioned above, can be attributed to other factors such as change of taste in consumers, changes of demand or supply of other competitive crops, etc.

Figure 2 compares the accuracy of the estimated all sale Michigan asparagus price at farm level with the actual prices by substituting historical values of acreage change in Michigan harvested processing asparagus ( $X_{15}$ ), U.S. real disposable personal income ( $X_2$ ), carryover of U.S. green peas ( $X_{36}$ ), and lagged canned green asparagus, f.o.b. factory, Midwest cut and tips No. 300 ( $X_8$ ) into the predicting equation. Notice the closeness of



Figure 2. Actual and Estimated Prices of All Sale Asparagus Received by Michigan Farmers, Dollars/Ton, 1956-1970.



the approximating line illustrated by a dash line to the actual plotted in solid line. (Table 5.2) Almost all of these differences between actual and estimated prices are within \$10 per ton which is the smallest change in price normally considered by the industry in pricing asparagus at the farm level.

Table 5.2: Actual and Estimated Prices of all sale asparagus received by Michigan farmers, dollars per ton, 1956/70.

Crop Year	Price		Difference Between Actual and Estimated Prices	Percentage Difference
	Actual	Estimated <sup>a</sup> From Equation (1)		
	\$/ton	\$/ton	\$/ton	percent
1970	420.00	415.80	4.20	1.00
1969	420.00	413.59	6.41	1.53
1968	412.00	414.82	-2.82	0.68
1967	375.60	380.10	-4.50	1.20
1966	332.60	334.92	-2.32	0.70
1965	327.00	332.86	-5.86	1.79
1964	302.40	308.76	-6.36	2.10
1963	305.80	291.27	14.53	4.75
1962	283.80	287.74	-3.94	1.38
1961	281.20	283.67	-2.47	0.88
1960	253.60	261.97	-8.37	3.30
1959	221.29	208.29	12.91	5.84
1958	209.80	223.06	-13.26	6.32
1957	266.20	262.45	3.75	1.41
1956	286.20	278.10	8.10	2.83

a = estimated from Equation (1)

Processing Price of Michigan Asparagus

The predicting equation for the Michigan processing asparagus price at farm level was developed in the same way as the all sale Michigan asparagus price received by farmers. The four significant variables are: (1)  $X_{15}$  = acreage change in Michigan harvested processing asparagus (acres), (2)  $X_2$  =

U.S. real disposable personal income in dollars, (3)  $X_{36}$  = U.S. carryover of green peas in thousand pounds (June), and (4)  $X_8$  = lagged canned green asparagus price f.o.b. factory Midwest fancy cut and tips No. 300 in dollars per case (October 1).

The predicting equation is as follows:

$$P_p = -212.3005 - 0.0293X_{15} + 0.1641X_2 - 0.002X'_{36} + 50.6245X_8 \quad (2)$$

Table 5.3: Relationship of the variables to the Michigan processing Asparagus prices at farm levels ( $P_p$ )

Variables	Regression Coefficients	Standard Error of Coefficient	T-Test	F-Test	Significance	
$\alpha_0$	-212.3005	28.7489	-7.3847	54.5331	<0.0005	
$X_{15}$	- 0.0293	0.01031	-2.8401	8.0659	0.018	Acreage $\Delta$ Mich harvested acres for purchasing U.S. real disp. pers. income U.S. carryover of green peas
$X_2$	0.1641	0.0209	7.8603	61.7849	<0.0005	
$X_{36}$	- 0:0002	0.00005	-4.1866	17.5279	0.002	
$X_8$	50.6245	8.4677	5.9785	35.7427	<0.0005	
$R^2$	= .9818					
$R^2$	= .9909					
$\bar{R}^2$	= .9745					
$R$	= .9872					

Standard error of estimate 11.1255  
 F-value for regression (about mean) 134.9505  
 Significance of regression a 0.0005

As illustrated in Table 5.2, the four variables ( $X_{15}$ ,  $X_2$ ,  $X_{36}$ ,  $X_8$ ) account for 98.18 percent of all the past variations in the Michigan processing asparagus price received by farmers during the 1956 to 1970 period. Adjusted for degrees of freedom, the variables explain 97.45 percent of all the past variations in the Michigan processing asparagus price at farm level.

The standard error of estimate for the equation is equal to 11.13 and the F-value for the regression about the mean is 134.95, significant at  $\alpha < 0.0005$ . also shown in Table 5.3 are the standard errors of the coefficients. All of them are very small compared to the coefficients, with the exception of  $X_{15}$  or acreage change in Michigan harvested processing asparagus in acres, which is about one-third the value of the coefficient. Finally, the regression coefficients are all significant beyond the level of  $\alpha = .05$ .

The regression coefficients can be explained as follows:

For each acreage increase in Michigan harvested processing asparagus, the Michigan processing asparagus price at farm level will fall by 2.93 cents per ton, assuming that the other variables remain constant. If  $X_{15}$ ,  $X_{36}$ , and  $X_8$  are held constant, and  $X_2$  (U.S. real disposable personal income) is allowed to increase by one dollar, the Michigan processing asparagus price will increase by 16.41 cents per ton. Increase in the U.S. carryover of green peas by one thousand pounds will cause a drop in the price of Michigan processing asparagus price by .02 cents per ton, provided everything else remains constant. Finally, an increase of one dollar per case in the lagged canned green asparagus price f.o.b. factory Midwest fancy cut and tips No. 300 will result in an increase of 50.6245 dollars per ton in the Michigan processing asparagus price at farm level.

If the variable  $X_{15}$  was not included in the model, the  $R^2$  and  $\bar{R}^2$  be reduced to .9671 and .9582 respectively. This means that if the model contains only the three variables  $X_2$ ,  $X_{36}$ , and  $X_8$ , they would explain 96.71 percent of all the past variations in the Michigan processing asparagus price received by farmers from 1956 to 1970. Adjusted for degrees of freedom, the variables explain 95.82 percent of all the past variations. Also, the standard error of estimate goes up to 14.258. Consequently, the earlier model which includes four variables is better.

Figure 3 compares the accuracy of the estimated Michigan processing asparagus price at farm level with the actual prices by substituting historical values of acreage change in Michigan harvested processing asparagus ( $X_1$ ), U.S. real disposable personal income ( $X_2$ ), U.S. carryover of green peas ( $X_{36}$ ) and lagged canned green asparagus, f.o.b. factory Midwest fancy cut and tips No. 300 ( $X_8$ ) into the prediction equation. Notice the closeness of the approximating line illustrated by the dash line to the actual plotted in a solid line for those years.

Table 5.4: Actual and estimated prices of Michigan Processing asparagus at farm level, 1956 - 70

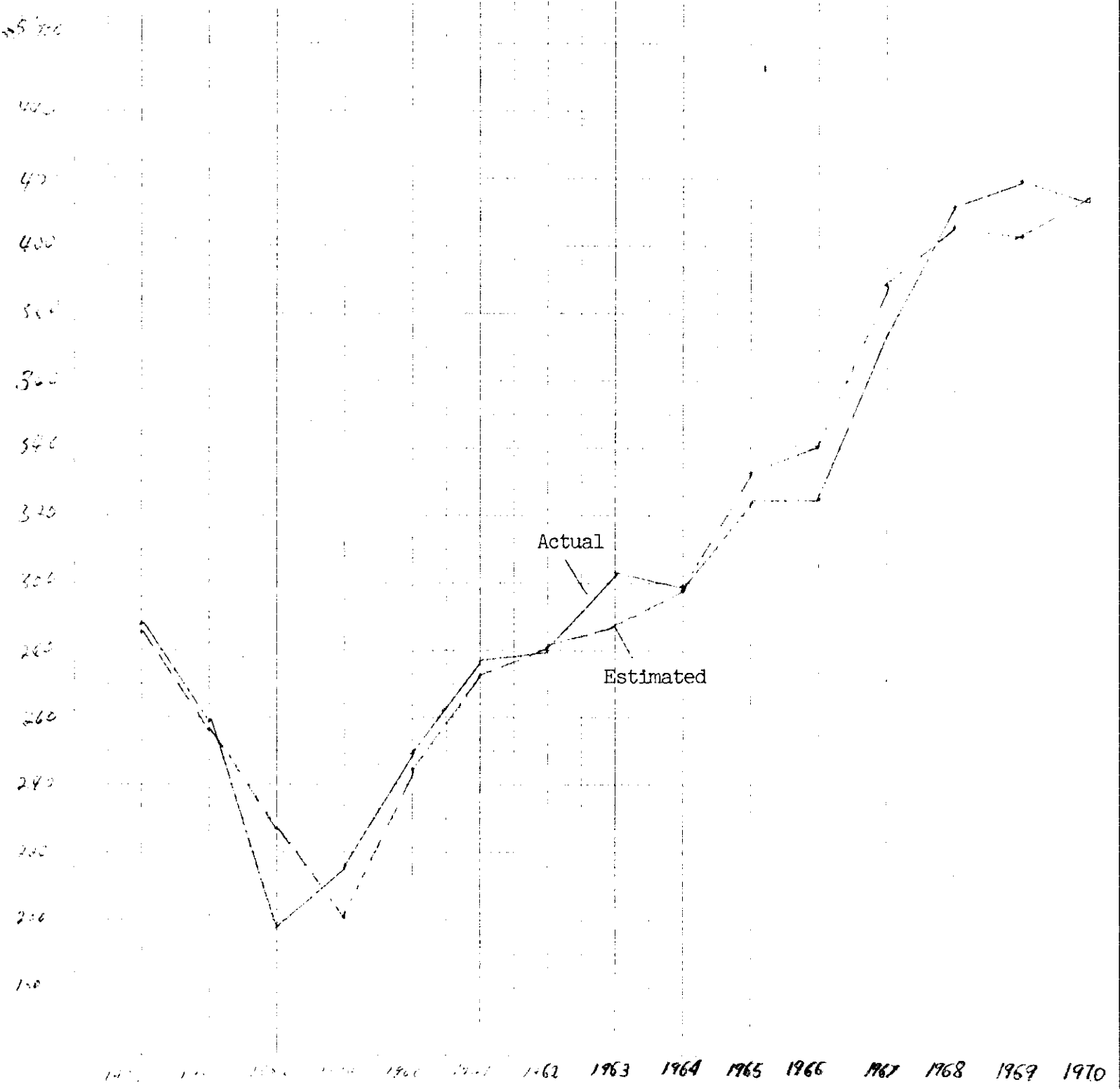
Crop Year	Price		Difference Between Actual and Estimated Prices	Percentage Difference
	Actual	Estimated <sup>a</sup>		
	\$/ton	\$/ton		
1970	414.00	415.22	-1.22	-0.29
1969	420.00	403.23	16.77	3.99
1968	412.00	405.26	6.74	1.64
1967	374.00	388.16	-14.16	-3.79
1966	325.00	340.33	-15.33	-4.72
1965	324.00	332.59	- 8.58	-2.65
1964	299.00	298.89	0.11	.04
1963	303.00	287.43	15.57	5.14
1962	280.00	281.54	- 1.54	-.55
1961	277.00	272.25	4.75	1.72
1960	250.00	244.45	5.55	2.22
1959	216.00	200.65	15.35	7.11
1958	198.00	227.18	-29.18	-14.74
1957	259.00	256.56	2.44	.94
1956	288.00	285.27	2.73	.95

a= estimated from Equation (2)

### Canned Price of Michigan Asparagus

There are three models that can be used to predict canned green asparagus

Figure 3. Actual and Estimated Prices of Michigan Processing Asparagus at Farm Levels, 1956-1970.



price, f.o.b. factory Midwest fancy cut and tips No. 300. The first one has only one variable,  $X_2$ , U. S. real disposable personal income in dollars (1957 - 59 = 100). The equation is given by  $P_c = -1.0062 + 0.0028X_2$ . (3)

For each one dollar increase in U.S. real disposable personal income, the price of canned green asparagus price, f.o.b. factory Midwest fancy cut and tips No. 300 will increase by 0.0028 dollars per case. As illustrated in Table 5.5 below, this one variable model accounts for 85.75 percent of the past variations during 1956 to 1970 period in the canned green asparagus price, f.o.b. factory Midwest fancy cut and tips No. 300, or 84.66 percent if adjusted for degree of freedom.

Table 5.5 Relationship of the variables to the canned green asparagus price, F.O.B. factory Midwest fancy cut and tips No. 303 (one-variable model) ( $P_c$ )

Vari- ables	Regression Coefficients	Standard Error of Coefficient	T-test	F-test	Signi- ficance
$a_0$	-1.006	0.6786	-1.4827	2.1984	0.162
$X_2$	0.003	0.0003	8.8456	78.2440	< 0.0005
$R^2 =$	.8575				
$R =$	.9260				
$\bar{R}^2 =$	.8466				
$\bar{R} =$	.9201				

Standard error of estimate = 0.3124

The standard error of estimate for the equation is equal to 0.31 and the regression about the mean is significant at  $\alpha = .0005$ . The standard error of the coefficients are 0.6786 and 0.0003 respectively (for  $X_0$  and  $X_2$ ). The constant  $X_0 = 1$  has a regression coefficient equal to -1.0062, which is significant at  $\alpha = .162$ . Variable  $X_2$  is significant at  $\alpha = .005$ .

Model 2 has two variables,  $X_1$  (lagged U.S. asparagus total crop in hundred weight and  $X_2$  (U.S. real disposable personal income in dollars. The addition of lagged U.S. asparagus total crop decreases the percentage of unexplained variations in the price of canned asparagus. The equation is as follows:  $P_c = 4.7329 - 0.0011 X_{14} + 0.002X_2$ . (4)

Increases of 1000 hundred weight in last year lagged U.S. asparagus total crop results in a decrease in the canned green asparagus price, f.o.b. factory Midwest fancy cut and tips by 0.0011 dollars per case, provided everything else remains constant. A one dollar increase in U.S. real disposable personal income results in an increase in price of 0.002 dollars per case of canned green asparagus, f.o.b. factory Midwest fancy cut and tips.

This two-variable model accounts for 90.48 percent of past variations (1956 - 1970) in the canned green asparagus price, f.o.b. factory Midwest cut and tips. Adjusted for degree of freedom, this model explains 88.89 percent of past variations. The addition of  $X_{14}$  increases  $\bar{R}^2$  from 84.66 percent to 88.89 percent, a 4.23 percent increase.

Table 5.6: Actual and estimated prices of canned green asparagus, F.O.B. factory Midwest fancy cut and tips No. 303, 1956 - 1970 (one-variable model)

Crop Year	Price		Difference Between Actual and Estimated Prices	Percentage Difference
	Actual	Estimated <sup>a</sup> (3)		
	\$/case	\$/case	\$/case	
1970	6.12	6.07	.05	.81
1969	6.12	5.99	.13	2.12



Table 5.6-- con't.

Year	Price		Difference	Percentage Difference
1968	6.25	5.95	.30	4.80
1967	6.00	5.74	.26	4.33
1966	5.32	5.56	-.24	4.51
1965	4.80	5.30	-.50	10.41
1964	4.50	4.95	-.45	10.00
1963	4.50	4.65	-.15	3.33
1962	4.50	4.54	-.04	.88
1961	4.35	4.37	-.02	.45
1960	4.35	4.31	.04	.91
1959	4.30	4.30	.00	0
1958	3.80	4.10	-.30	7.89
1957	4.80	4.25	.57	11.87
1956	4.60	4.24	.36	7.82

a=estimated from Equation (3)

Table 5.7: Relationship of the variables to the canned green asparagus price, F.O.B. factory Midwest fancy cut and tips No. 303 (two variable -model) ( $P_c$ )

Vari- ables	Regression Coefficients	Standard Error of Coefficient	T-test	F-test	Significance
$a_0$	4.7328	2.4208	1.9550	3.8222	0.074
$X_1$	-0.0011	-0.0004	-2.4411	5.9591	0.031
$X_2$	0.0020	0.0004	4.4096	19.4449	0.001
$R^2 =$	.9048				
$R =$	.9412				
$\bar{R}^2 =$	.8889				
$\bar{R} =$	.9428				

Standard error of estimate = 0.2658

The standard error for this two-variable equation is 0.2658 as illustrated in Table 5.6. The regression about the mean is significant

at  $\alpha = .0005$ . The standard error of the coefficients ( $X_1$  and  $X_2$ ) are 0.00045 and 0.00046 respectively. The variables are both significant at  $\alpha = .05$ . Figure 4 shows the movement of price with the estimation made by the predicting equation.

Table 5.8: Actual and Estimated prices of canned green asparagus, F.O.B. factory Midwest fancy cut and tips No. 303 (two variable - model), 1956 - 1970 ( $P_c$ )

Crop Year	Prices		Difference Between Actual and Estimated Prices	Percentage Difference
	Actual	Estimated (4)		
	\$/case	\$/case	\$/case	percent
1970	6.12	6.37	-0.25	4.08
1969	6.12	5.96	0.16	2.61
1968	6.25	6.15	0.10	1.60
1967	6.00	5.59	0.41	6.83
1966	5.32	5.46	-0.14	2.63
1965	4.80	5.16	-0.36	7.50
1964	4.50	4.65	-0.15	3.33
1963	4.50	4.48	0.01	.22
1962	4.50	4.44	0.06	1.33
1961	4.35	4.24	0.11	2.52
1960	4.35	4.35	-0.00	0
1959	4.30	4.45	-0.15	3.48
1958	3.80	4.21	-0.41	10.78
1957	4.80	4.44	0.36	7.50
1956	4.60	4.34	0.26	5.65

a = estimated from Equation (4)

The third model has three variables,  $X_{14}$  (lagged U.S. asparagus total crop in 1000 hundredweight,  $X_2$  (U.S. real disposable personal income in dollars and  $X_{36}$  (U.S. carryover of green peas 1000 pounds, June).  $X_1$  and  $X_2$  are the same as model 2. The equation is given by  $P_c = 6.9591844 - 0.0015007X_{14} + 0.0017796X_2 - 0.0000018X_{36}$  (5). This model results in an  $\bar{R}^2 = 90.30$  percent; an increase from 88.89 percent, or 0.41 percent.

Figure 4. Actual and Estimated Prices of Canned Green Asparagus f.o.b. Factory Midwest Fancy Cut and Tips No. 303, 1956-1970 (Pc) (Two Variable Model).

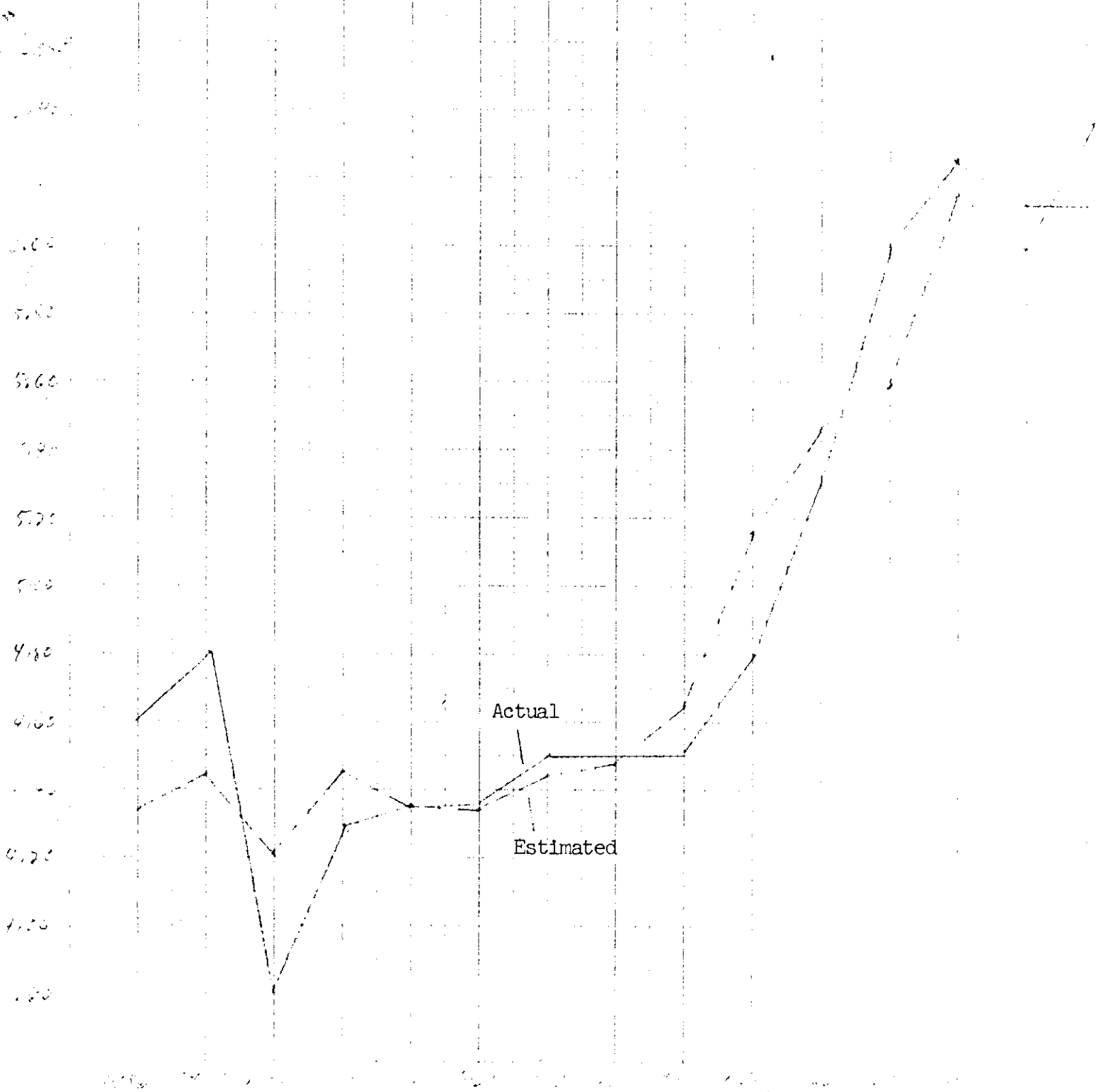


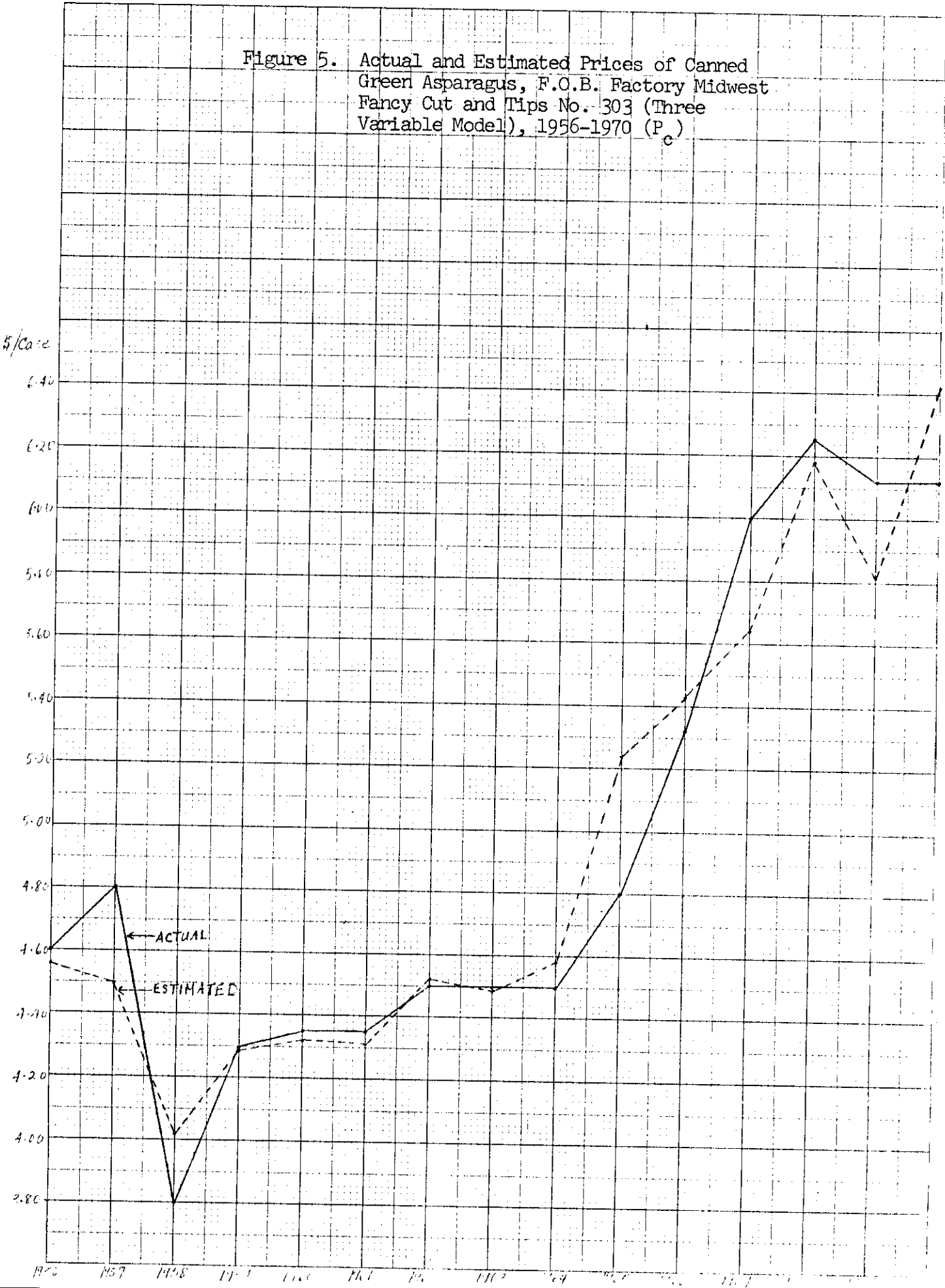
Table 5.9: Relationship of the variables to the canned green asparagus price, f.o.b. factory Midwest fancy cut and tips No. 303.

Variables	Regression Coefficients	Standard Error of Coefficient	T-Test	F-Test	Significance
$\alpha_0$	6.9592	2.6311	2.6449	6.9957	0.023
$X_{14}$	-0.0015	0.00048	-3.0839	9.5103	0.010
$X_2$	0.0018	0.00043	4.1239	17.0067	0.002
$X_{36}$	-0.000002	0.0000011	-1.6566	2.7443	0.126
$R^2$	= .9238				
$R$	= .9611				
$\bar{R}^2$	= .9030				
$\bar{R}$	= .9503				

Standard error of estimate = 0.2484

The standard error of estimate for the equation is equal to 6.248 and the regression about the mean is significant at  $\alpha = 0.0005$ . The standard error of the coefficients are 0.00048 for  $X_{14}$ , 0.0004315 for  $X_2$  and 0.0000011 for  $X_{36}$ . Variables  $X_{14}$  and  $X_2$  are significant at  $\alpha = .05$ , but  $X_{36}$  is only significant at  $\alpha = .126$ . If everything is held constant, increase of 1000 hundredweight of last-year lagged U.S. asparagus total crop will result in a decrease of canned price by 0.15 cents per case. Increase of a one dollar U.S. real disposable personal income will result in an increase of 0.18 cents per case in the canned green asparagus price, f.o.b. factory Midwest fancy cut and tips. Finally, an increase in the carryover of green peas by 1000 pounds will decrease canned price by 0.0000018 dollar per case. Figure 5 illustrates the estimated and actual results for 1956-1970.

Figure 5. Actual and Estimated Prices of Canned Green Asparagus, F.O.B. Factory Midwest Fancy Cut and Tips No. 303 (Three Variable Model), 1956-1970 (P<sub>c</sub>)



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Table 5.10: Actual and Estimated Prices of Canned green asparagus, F.O.B. factory Midwest fancy cut and tips No. 303 (Three variable-model), 1956 - 70.

Crop Year	Price		Difference Between Actual and Estimated Prices	Percentage Difference
	Actual	Estimated <sup>a</sup> (5)		
	\$/case	\$/case	\$/case	percent
1970	6.12	6.42	-0.30	4.90
1969	6.12	5.81	0.31	5.06
1968	6.25	6.18	0.07	1.12
1967	6.00	5.64	0.36	6.00
1966	5.32	5.43	-0.11	2.06
1965	4.80	5.24	-0.44	9.16
1964	4.50	4.58	-0.08	1.77
1963	4.50	4.49	0.01	.22
1962	4.50	4.52	-0.02	.44
1961	4.35	4.31	0.04	.91
1960	4.35	4.32	0.03	.68
1959	4.30	4.29	0.01	.23
1958	3.80	4.02	-0.22	5.78
1957	4.80	4.50	0.30	6.25
1956	4.60	4.56	0.04	.86

a = estimated from Equation (5)

Price of Fresh Asparagus

Two predicting equations are illustrated below for the price of fresh asparagus in Michigan. The first is a single variable model with only  $X_2$  (U.S. real disposable personal income) as the predetermined variable. The equation obtained is as follows:

$$P_{F_1} = -154.8697 + 0.2406 X_2 \quad (6)$$

As illustrated in Table 43, the variable  $X_2$  explains 86.65 percent of all past variations in the price of fresh asparagus in Michigan from 1956 to 1970. Adjusted for degrees of freedom, it explains 85.63 percent of all the past variations in the price of Michigan fresh asparagus received by farmers.

The standard error of estimate for the equation is 25.59 and the F-value for the regression about the mean is 84.40, significant at  $\alpha = 0.0005$ . Also shown in the same table are the standard error of the coefficients. Note the relative smallness of the standard error for the coefficient of  $X_2$ , 0.0262 versus 0.2406 for the values of the coefficient. The coefficient for  $X_2$  is significant at  $\alpha = 0.005$  while for the constant is significant at  $\alpha = 0.015$ .

The predicting equation can be explained as follows: For each dollar income in U.S. real disposable personal income, the price of fresh asparagus at farm level in Michigan would increase by 24.06 cents per ton.

The second model has two variables,  $X_2$  (U.S. real disposable personal income in dollars) and  $X_{41}$  (canned peas price f.o.b. factory Alaska Midwest extra standard, dollar per case, October 1). The equation is:

$$P_{F_2} = -319.9992 + 0.1335 X_2 + 127.9405 X_{41} \quad (7)$$

Variables  $X_2$  and  $X_{41}$  together account for 93.01 percent for all past variations in the price of Michigan fresh asparagus at farm level for the year 1956 - 1970. Adjusted for degree of freedom ( $\bar{R}^2$ ), the two variables explain 91.84 percent of all past variations in the price.

Table 5.11: Relationship of the variables to the Michigan fresh Asparagus prices at farm level.

Variables	Regression Coefficients	Standard Error of Coefficient	T-test	F-test	Significance
$\alpha_0$	-319.999	65.248	-4.9044	24.0527	0.0005
$X_2$	0.134	0.038	3.5149	12.3544	0.004
$X_{41}$	127.940	38.758	3.3010	10.8966	0.006
$R^2$	= .9301				
R	= .9644				
$\bar{R}^2$	= .9184				
R	= .9583				

Standard error of estimate = 19.2869

The standard error of estimate for the equation is 19.29 and the F-value for the regression about the mean is 79.78, significant at  $\alpha = 0.0005$ . Also shown in the same table are the standard error of coefficients, both quite small relative to the size of the coefficients. The model can be explained as follows:

For each one dollar increase in U.S. real disposable personal income, holding the other variable constant, the price of Michigan fresh asparagus at farm level will increase by 13.35 cents per ton. If the canned peas price f.o.b. factory Alaska Midwest extra standard No. 303 increases by one dollar per case, provided  $X_2$  is held constant, the Michigan fresh asparagus price at farm level will increase by \$127.905 per ton.

Second model is better than the first model because  $\bar{R}^2$  is greater, in other words, the explainability of the second model is greater. Also the standard error of the estimate of the regression about the mean fell from 25.59 to 19.29. Figure 6 illustrates the estimated and actual results for 1956 - 1970 of Michigan fresh asparagus price at farm level.

Table 5.12: Actual and estimated prices of Michigan fresh asparagus at farm level, 1956 - 1970

Crop Year	Price		Difference Between Actual and Estimated Prices	Percentage Difference
	Actual	Estimated <sup>a</sup> (7)		
	\$/ton	\$/ton	\$/ton	
1970	496.00	481.17	14.83	2.99
1969	420.00	445.38	-25.38	6.04
1968	410.00	411.38	- 1.38	.34
1967	404.00	410.55	- 6.55	1.62
1966	430.00	399.23	30.77	7.15



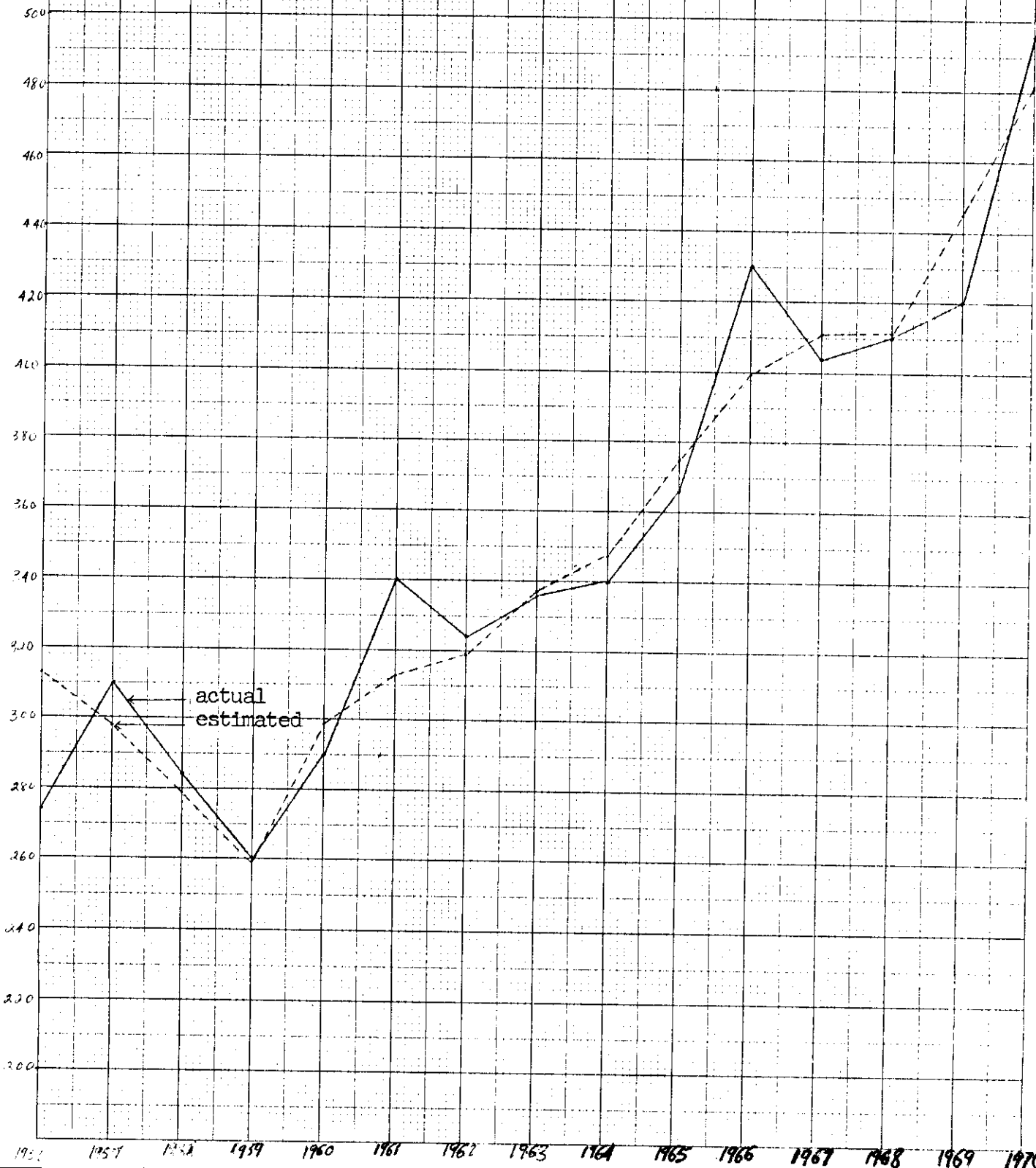
Table 5.12-- con't.

Year	Price		Difference	Percentage
1965	366.00	374.51	-8.51	2.32
1964	340.00	347.54	-7.54	2.22
1963	336.00	337.37	-1.37	.41
1962	324.00	319.37	4.63	1.43
1961	340.00	311.04	28.96	8.52
1960	290.00	298.14	-8.14	2.80
1959	260.00	259.51	0.49	.18
1958	284.00	279.51	4.49	1.58
1957	310.00	298.07	11.93	3.84
1956	274.00	311.25	-37.25	13.59

a = estimated from Equation (7)

Figure 6. Actual and Estimated Prices of Michigan Fresh Asparagus at Farm Level, 1956-1970.

\$/100



actual  
estimated

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Chapter VI  
SUMMARY AND CONCLUSIONS

Industry Characteristics

Michigan has experienced a noteworthy growth in asparagus production over the past decade. This is in contrast to a total United States' production decline since 1960. In 1960, Michigan's production level was at 187,000 hundredweight while total U. S. asparagus production was 3,744,000 hundredweight. By 1970 Michigan's had increased to 192,400 hundredweight while the United States' production level had declined to 2,759,540.

The increases in asparagus production in Michigan has resulted primarily from an increase in harvested acres. Yield in Michigan has averaged in recent years about 15 c.w.t. per acre with annual variation about  $\pm 2$  c.w.t. from this average. Illinois has averaged about 2 c.w.t. per acre more than Michigan while Washington state has averaged 29 c.w.t. per acre, nearly double that of Michigan.

The differential in yield between Michigan and other states could be explained partly by varying degrees of specialization in asparagus production. Asparagus is known to be a complementary crop to fruits and vegetables. It fits the cropping pattern where labor needs utilization before work is required on other crops. California and other major producing states probably have a higher degree of specialization in asparagus production than is the case for Michigan.

As we have seen before, Michigan farms engaged in asparagus production are by far the smallest among farms in the top five producing states. In 1969, acres per farm reporting had Michigan at 11.8, in contrast to Illinois' 75.5, Washington's 35.0, New Jersey's 35.6, and California's 239.2 acres per farm

reporting. These facts point to the lesser specialization among Michigan asparagus producers as compared to the other states.

In terms of total production, Michigan is one of three states (among the top five) which experienced increases in asparagus production, Washington and Illinois being the other two. California, which accounted for the highest share in asparagus production, experienced the largest decline since 1960, followed closely by New Jersey. The major reason for the decline in California is the increasing competition from Taiwan, which has devoted special attention toward asparagus production. Markets in other countries have been lost as a result of cheaper Taiwanese asparagus. The major reason for the decline in New Jersey is disease.

#### Expectation for the Future Price

This section will be concerned primarily with processed asparagus price. Since 1960, more than 90 percent of asparagus production in Michigan has been utilized in processing. Illinois, Michigan's chief competitor has recently reached the 90 percent plus processing utilization rate.

Comparing processed price in Michigan and Illinois since 1955, Illinois' price per pound in cents has been lower than Michigan's. Illinois' yield per acre has generally been higher in the same time period. In contrast, fresh asparagus price has been lower in Michigan than in Illinois over the past decade.

Data compiled for this study do not supply the reasons for this apparent price differential between the states. Much speculation could be offered, but the only reasonable suggestion received from experts in the field is that Michigan produces a superior product and perhaps has a marketing organization more favorable to the farmer's interest.

Table 6.1: Comparison of yield per acre, price per pound and value per acre of processing asparagus between Michigan and Illinois, 1955 - 1970. (hundredweight, cents)

Year	Michigan				Illinois		
	Yield Per Acre	Price Per Pound	Value Per Acre	Yield Per Acre	Price Per Pound	Value Per Acre	
	c.w.t.	cents	cents	c.w.t.	cents	cents	
1970	13	20.70	269.10	17	15.25	259.25	
1969	15	21.00	315.00	16	16.85	269.60	
1968	13	20.60	267.80	18	15.30	275.40	
1967	15	18.70	280.50	17	13.20	224.40	
1966	14	16.25	227.50	16	12.40	198.40	
1965	17	16.20	275.40	18	11.15	200.70	
1964	15	14.95	224.25	17	10.70	181.70	
1963	13	15.15	196.95	17	10.60	180.20	
1962	15	14.00	210.00	16	10.10	161.60	
1961	15	13.65	204.75	15	10.60	159.00	
1960	17	12.50	212.50	16	10.05	160.80	
1959	15	10.80	162.00	17	9.80	166.60	
1958	14	9.90	138.60	18	9.65	173.70	
1955 - 59 Average	15	12.53	187.95	18	10.35	186.30	

SOURCE: U.S.D.A.

Considering both price and yield Michigan has the favored position with regard to total value of crop per acre. With the high price received by Michigan farmers for their asparagus, more acreage and more mechanization are being brought into asparagus production. This is evidenced by the increase in harvested acreage in Michigan, the larger acreage per farm, as well as a decrease in total number of farms in asparagus production.'

Future production in asparagus, should it follow the present trend, will be more mechanized. The use of labor for harvesting will be taken over by the sled method. Lack of available labor and legislation improving working conditions for migrant laborers which increase producers costs may accelerate the rate of mechanization.

Dynamic changes in land use for Michigan asparagus production affect the stability of yields. New land devoted to asparagus is expected to produce less yield than one that has been used over time. Only time will produce stability in yield. If the trend continues, acreage increases will continue, thus resulting in less stable yields in the short run. In the long run, land increases will be stabilized, and yield should increase.

Since Michigan is an industrial state, rural workers tend to migrate toward urban areas. Farmers will either get out of asparagus production or become more efficient. The drop in numbers of farms reporting asparagus production is likely a matter of the marginal producers being forced out of asparagus production.

In summary, numbers of farms have decreased over the years, while acres per farm have substantially increased. On balance, asparagus production has surged upward. While new acreage is devoted to asparagus production, yields will be lower until maturity in land utilization. Then, increased mechanization and higher yielding crops will take place.

As supply of asparagus increase, the demand for asparagus becomes critical. While New Jersey was losing its share of the market due to disease, Michigan and Illinois increased its share. Since asparagus is a superior good, increasing affluence should increase the demand for asparagus. All in all, the price of asparagus in Michigan appears to be fairly strong in relation to competing production areas and should provide farmers with good profitability prospects with a growing demand and improved farming methods, Michigan farmers should be able to maintain or expand their share of the asparagus market.

#### Implication of Regression Analysis

In the past, the lack of knowledge regarding the major factors that influence asparagus prices hampered the asparagus industry. Planning was more an art based on incomplete information and guess work. The present study seeks to provide a formal analysis of the most important variables that affect asparagus prices in Michigan.

The analysis of asparagus prices in Michigan provided several important variables that affect Michigan asparagus prices. Four types of asparagus prices were studied: (1) price in dollars per ton of all sale asparagus received by Michigan's farmers, (2) price in dollars per ton of fresh asparagus received by Michigan's farmers, (3) price in dollars per ton of processed asparagus received by Michigan's farmers and (4) price in dollars per case of No. 300 canned green asparagus (f.o.b. factory Midwest fancy cut and tins) of October 1.

The four independent variables which influenced considerably the all sale price of Michigan asparagus at the farm level and the processing price of Michigan asparagus were as follows:

1. Acreage change in Michigan harvested processing asparagus
2. U. S. real disposable personal income, dollars
3. U. S. carryover of green peas (June), 1000 pounds
4. Last-year lagged canned green asparagus price f.o.b. factory, Midwest fancy cut and tips, October 1, dollars per case.

These variables explain 98.62 percent of the annual variation in the all sale price of Michigan asparagus at the farm level and 98.18 percent of all the past variations in the Michigan processing asparagus price. The most important variable in the predicting equation is U. S. real disposable personal income.

Three models were used to obtain a predicting equation for the price of canned asparagus. The best one is the one with the following:

1. Lagged U. S. asparagus total crop, 1000 hundredweight.
2. U. S. real disposable personal income, dollars
3. U. S. carryover of green peas (June), 1000 pounds.

These variables explain 92.38 percent of the annual variation in in the canned green price of asparagus, f.o.b. factory Midwest fancy cut and tips No. 300. As is true earlier, the most important variable in the predicting equation in U. S. real disposable personal income.

For the fresh price of Michigan asparagus, the better model had two variables, namely the U. S. real disposable personal income and U. S. carryover of green peas. These two variables explain 93.01 percent of the annual variation in the price of fresh asparagus in Michigan. U. S. real disposable personal income is the most important variable.

The result of the multiple regression analysis of asparagus prices in Michigan showed that U. S. real disposable personal income is the most important variables. The income level has a very high correlation to all the four prices that we have been studying. Expectation of the U. S. real disposable personal income will increase, this might be an optimistic sign for asparagus.



Asparagus is a superior food, which means if an income increases, the consumption of food increases, and the income elasticity coefficient is positive. Therefore, we expect the demand of asparagus will go up if the income level goes up. Especially if asparagus is in the high rank luxury item category within the group of vegetables, the consumption of asparagus will be affected more. The asparagus prices will be affected too.

#### Recommendations and Implications for Further Research

These results might be helpful to the Cooperative Extension Services and bargaining asparagus cooperatives to advise farmers with regard to the price prospects for asparagus. Cooperative Extension services and bargaining cooperatives can aid asparagus farmers considerably once they know the important variables that determine asparagus prices in Michigan. Without any undue hardship they can obtain the expected values of the price determining variables such as expected per capita income, acreages changes in asparagus. They can then set about determining the price of asparagus should certain key variables take a certain course. By directing and planning asparagus production, Cooperative Extension Services and bargaining cooperatives can assist Michigan farmers in predicting the future price of asparagus.

This research can also be replicated in other asparagus producing states by using their own data to enable asparagus cooperatives and other organizations to determine their plans for future asparagus production within their states.

With regard to future research needs, this experience would suggest the desirability of further exploration of the following:

1. The absolute and comparative advantage for asparagus in the several competing areas of the United States. Such a study would include difference in yield, production technology and costs, marketing organization, transportation, competing enterprises in production as well as competing foods in processing and consumption.

2. Measurement of income and price elasticity for asparagus as well as measurement of cross elasticities for competing foods.
3. The role of asparagus in the optimum organization of a Michigan farm. Consideration would be given to such matters as size of enterprise and degree of specialization on the individual farm.

APPENDIX

Table 1. ASPARAGUS HARVESTED ACREAGE, SEASONAL GROUPS, LEADING STATES, U.S. 1949 - 70 (Acres)

	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	1959	1955- 1959 Ave.	1949- 1954 Ave
Early Spring:														
California	42900	44700	46700	50200	51900	54900	65400	65900	66600	66000	73500	77800	76560	70430
Mid - Spring:														
Washington	17900	17400	17100	16700	16500	15200	15200	14900	15300	15400	16100	15800	13920	10550
Oregon	1200	1300	1300	1200	1300	1300	1600	1400	1400	1900	1600	1300	620	400
Late Spring:														
New Jersey	19800	22700	24300	24800	25700	27400	29100	27400	29100	29800	30700	31500	32240	26730
Delaware	(a)	(a)	4300	4000	3900	3500	3300	3100	2700	2700	2800	2800	2584	1500
Maryland	3800	3900	3400	3800	3300	3300	3400	3200	3300	3300	3300	3600	3020	1850
Illinois	9600	9000	8800	9900	10000	10200	10300	9600	10200	9800	9700	8600	8920	8250
Michigan	14800	13900	13200	12700	11900	11200	11000	11000	10800	10800	11000	11200	10560	7280
Other States	10000	10900	6300	5800	6000	7000	7300	7400	7320	7250	7300	7700	7260	6430
TOTAL														
United States	120000	123800	125400	129100	130500	134100	146600	145000	146200	146950	156000	160300	155684	133420

Source: Crop Reporting Board Agricultural Marketing Service, U.S.D.A.

Table 3: Fresh Asparagus, Price per pound, Leading Five States, U.S., 1960-1970 (Cents)

	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960
Total United States	22.30	23.50	21.90	21.08	20.12	16.56	14.94	16.36	15.83	15.17	13.65
California	21.60	23.90	21.50	21.60	20.40	16.80	14.70	16.80	16.80	15.70	14.00
New Jersey	22.70	22.20	22.70	19.80	19.70	15.10	14.30	15.40	14.10	14.40	12.90
Washington	24.00	22.50	21.70	20.10	19.00	16.80	15.30	13.40	13.30	12.90	11.40
Michigan	24.80	21.00	20.50	20.20	21.50	18.30	17.00	16.80	16.20	17.00	14.50
Illinois	28.90	26.40	25.30	21.60	20.10	18.60	18.00	18.30	18.00	15.50	15.50

Source: U.S.D.A., Crop Reporting Board Agricultural Marketing Service.

Table 2: Asparagus for Processing, Price per pound, Leading Five States, U.S., 1960-1970 (Cents)

	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	1959	1958	1957	1956	1955		
									Cents									
Total United States	18.70	18.10	17.60	16.60	16.53	14.35	11.90	13.15	12.45	12.05	10.95							
California	18.60	17.90	17.60	16.80	17.85	15.10	11.45	13.45	12.55	12.05	10.60	9.50	9.50	8.40	10.45	12.20		
New Jersey	21.85	18.20	18.15	17.95	16.50	14.50	11.85	12.70	12.00	11.90	10.95	10.25	9.95	9.95	12.80	12.90		
Washington	17.80	17.25	16.45	15.45	14.90	13.10	11.90	12.85	12.75	12.10	11.40	9.95	9.50	8.50	10.55	11.15		
Michigan*	20.70	21.00	20.60	18.70	16.25	16.20	14.95	15.15	14.00	13.65	12.50	10.86	9.90	12.95	14.40	14.60		
Illinois*	15.25	16.85	15.30	13.20	12.40	11.15	10.70	10.60	10.10	10.60	10.05	9.80	9.65	10.40	10.85	11.05		

\*Michigan and Illinois harvest on snap all green basis; other states harvest on cut basis

Source: U.S.D.A., Crop Reporting Board Agricultural Marketing Service.

Table 4. Asparagus: Farm Reporting and Percentage, Top 11 States, U.S.  
1959, 1964, 1969

	Numbers of Farms and Percentage				
	1959		1964		1969
	No.	%	No.	%	No.
Total United States	8348	100	5609	100	NA
California	288	3.45	248	4.42	200
New Jersey	1236	14.81	859	15.32	532
Washington	822	9.85	583	10.39	480
Michigan	2314	27.72	1742	31.06	880
Illinois	373	4.47	195	3.48	117
"Top 5" Subtotal	5033	60.30	3627	64.67	2209
Maryland	113	1.35	50	.89	NA
Delaware	60	.72	43	.77	NA
Minnesota	126	1.51	76	1.36	24
Indiana	232	2.78	159	2.83	89
Massachusetts	398	4.77	311	5.54	NA
Oregon	58	.69	40	.72	15
"2nd 6" Subtotal	987	11.82	679	12.11	NA
"Top 11 Total	6020	72.12	4306	76.78	NA
New England & Atlantic	1807	21.64	1263	22.52	532*
North Central	3045	36.48	2172	38.72	1110
Pacific	1168	14.00	871	15.54	695

NA = Not Available

\* Data for Maryland, Delaware & Massachusetts unavailable

Source: 1964 and 1969 Census of Agriculture

Table 5. Michigan Asparagus Production, Farms Reporting, Acres Reported, Acres Per Farm, Michigan 1920-1969 by Decade, Census Years

	1969	1959	1950	1940	1930	1920
Farms Reporting	880	2314	2180	1677	1401	237
Total Acres Reported	10351	10890	5394	2531	1467	256
Acres Per Farm Reporting	11.8	4.7	2.5	1.5	1.05	1.08

Source: U.S. Census



Table 7. Asparagus Acreage Reporting, Top Eleven States, U.S., 1959, 1964, 1969

	Asparagus Acreage					
	1959		1964		1969	
	Acres	%	Acres	%	Acres	
Total United States	162914	100	139439	100	NA	
California	82618	50.71	65144	46.72	47837	
New Jersey	28660	17.59	24948	17.89	18954	
Washington	15724	9.65	13807	9.90	16818	
Michigan	10890	6.68	10529	7.55	10351	
Illinois	9725	5.97	10030	7.19	8835	
"Top 5" subtotal	147617	90.60	124458	89.25	102795	
Maryland	3225	1.98	3748	2.69	NA	
Delaware	2550	1.56	2700	1.94	NA	
Minnesota	1762	1.08	2198	1.58	2329	
Indiana	860	.53	1024	.73	1107	
Massachusetts	1041	.64	884	.63	NA	
Oregon	1048	.64	778	.56	228	
"2nd 6" subtotal	10485	6.43	11332	8.13	NA	
"Top 11" total	158103	97.03	135790	97.38	NA	
New England & Atlantic	35476	21.78	32280	23.1	18954*	
North Central	23237	14.25	23781	17.1	22622	
Pacific	99390	61.00	79729	57.2	64883	

NA = Not Available

\* = Data for Maryland, Delaware and Massachusetts unavailable.

Source: 1964 and 1969 Census of Agriculture

Table 6: Asparagus: Acreage and Yield Per Acre, Leading Five States, U.S., 1950-70 (Acres, Hundred Weight)

Year	Total U.S.		California		New Jersey		Washington		Michigan		Illinois	
	Harvested (Acres)	Yield per Acre (CWT)	Harvested (Acres)	Yield per Acre (cwt)	Harvested (Acres)	Yield per Acre (cwt)	Harvested (Acres)	Yield per Acre (cwt)	Harvested (Acres)	Yield per Acre (cwt)	Harvested (Acres)	Yield per Acre (cwt)
1970	119,980	23	42,900	31	19,800	17	17,900	29	14,800	13	9,600	17
1969	123,830	24	44,700	29	22,700	21	17,400	29	13,900	15	9,000	16
1968	125,400	26	46,700	32	24,300	24	17,100	31	13,200	13	8,800	18
1967	129,100	24	50,200	28	24,800	22	16,700	27	12,700	15	9,900	17
1966	130,510	26	51,900	33	25,700	23	16,500	30	11,900	14	10,000	16
1965	134,140	25	54,900	30	27,400	22	15,200	32	11,200	17	10,200	18
1964	146,560	24	65,400	28	29,100	23	15,200	29	11,000	15	10,300	17
1963	145,000	26	65,900	31	28,500	25	14,900	28	11,000	13	9,600	17
1962	146,220	25	66,600	20	28,600	23	15,300	31	10,800	15	10,200	16
1961	147,250	25	66,000	20	29,800	23	15,400	28	10,800	15	10,200	15
1960	156,000	24	73,500	26	30,700	26	16,100	26	11,000	17	9,700	16
1958	160,300	23	77,800	24	31,500	25	15,800	23	11,200	15	8,600	17
1958	157,990	22	76,300	24	32,200	23	15,800	25	10,900	14	8,700	18
Average	155,684	21	76,560	25	32,240	23	13,920	28	10,560	15	8,920	18
1949-54	133,420	24	70,430	23	26,730	26	10,550	32	7,280	20	8,250	20

Source: Crop Reporting Board Agricultural Marketing Service, U.S.D.A.

Table 8. Asparagus Acres per Farm Reporting, Top Eleven States, U.S., 1959, 1964, 1969

	Acres Per Farm <sup>1</sup>		
	1959	1964	1969
Total United States	19.5	24.8	NA
California	286.9	262.7	239.2
New Jersey	23.2	29.0	35.6
Washington	19.1	23.7	35.0
Michigan	4.7	6.0	11.8
Illinois	26.1	51.4	75.5
"Top 5" subtotal	29.3	34.3	46.5
Maryland	28.5	75.0	NA
Delaware	42.5	62.8	NA
Minnesota	14.0	28.9	97.0
Indiana	3.7	6.4	12.4
Massachusetts	2.6	2.8	NA
Oregon	18.1	19.4	15.2
"2nd 6" subtotal	10.6	16.7	NA
"Top 11" total	26.3	31.5	NA
New England & Atlantic	19.6	25.6	35.6*
North Central	7.6	10.9	20.4
Pacific	85.1	91.5	93.4

NA= Not Available

\* = Data for Maryland, Delaware and Massachusetts unavailable.

Source: 1964 and 1969 Census of Agriculture.

Table 9 : Percent Utilization of Asparagus, Leading Five States, U.S., 1960-1970

Year	Total U.S.		California		New Jersey		Washington		Michigan		Illinois	
	Fresh Processed	Percent	Fresh Processed	Percent	Fresh Processed	Percent	Fresh Processed	Percent	Fresh Processed	Percent	Fresh Processed	Percent
1970	34.2	65.8	51.1	48.9	35.0	65.0	17.0	83.0	7.3	92.7	6.1	93.9
1969	29.1	70.9	41.4	58.6	24.0	76.0	14.1	85.9	6.7	93.3	7.6	92.4
1968	28.4	71.6	40.0	60.0	29.2	70.8	16.2	83.8	7.0	93.0	5.1	94.9
1967	27.0	73.0	37.4	62.6	30.2	69.8	14.6	85.4	5.3	94.7	6.0	94.0
1966	24.0	75.3	29.3	70.7	30.5	69.5	23.2	76.8	7.2	92.8	7.5	92.5
1965	30.0	70.0	40.9	59.1	33.7	66.3	19.8	80.2	7.4	92.6	7.1	92.9
1964	29.0	71.0	31.9	68.1	38.7	61.3	17.5	82.5	8.5	91.5	12.6	87.4
1963	27.8	72.2	30.1	69.9	37.1	62.9	15.8	84.2	8.4	91.6	10.4	89.6
1962	28.1	71.9	28.9	71.1	38.1	61.9	22.4	77.6	8.6	91.4	17.8	82.2
1961	29.7	70.3	30.5	69.5	39.3	60.7	24.6	75.4	6.8	93.2	15.0	85.0
1960	32.8	67.2	33.0	67.0	44.9	55.1	23.6	76.4	9.1	90.9	23.6	76.4

Source: U.S.D.A., Crop Reporting Board Agricultural Marketing Service.

TABLE 10: Processing Asparagus: Production, Price per Ton and Total Value, Leading Five States  
U.S., 1949 - 1970 (tons, dollars, 1000 dollars)

	Total U. S.			California			New Jersey			Washington			Michigan			Illinois			
	Production	Price per Ton	Total Value	Production	Price per Ton	Total Value	Production	Price per Ton	Total Value	Production	Price per Ton	Total Value	Production	Price per Ton	Total Value	Production	Price per Ton	Total Value	
	Tons	\$	\$1000	Tons	\$	\$1000	Tons	\$	\$1000	Tons	\$	\$1000	Tons	\$	\$1000	Tons	\$	\$1000	
1970	91500	374.00	34203	32600	372.00	12109	11000	437.00	4785	21600	356.00	7672	6900	414.00	2881	7700	395.00	2333	
1969	103400	362.00	37476	38000	358.00	13604	16500	364.00	5988	21700	345.00	7487	9700	420.00	4121	5700	337.00	2241	
1968	115900	352.00	40743	44500	352.00	15770	20700	363.00	7496	22200	329.00	7304	6000	412.00	2522	7500	365.00	2295	
1967	111000	332.00	36826	44000	336.00	14784	19100	349.00	6648	19300	309.00	5948	9000	374.00	3393	7300	284.00	2086	
1966	128500	330.57	40974	*61900	357.00	20474	20600	330.00	6782	19000	298.00	5662	7600	325.00	2513	7400	248.00	1835	
1965	119150	287.00	324904	*51150	302.00	13635	20000	290.00	5800	19500	262.00	5109	8900	324.00	2851	8000	223.00	1907	
1964	126200	238.00	300464	62300	229.00	14267	20500	237.00	4858	18200	238.00	4332	7550	299.00	2257	7650	214.00	1637	
1963	135550	263.00	35616	71450	269.00	19220	22400	254.00	5690	17550	257.00	4510	6500	303.00	1981	7300	212.00	1548	
1962	133850	247.00	33339	71000	251.00	17821	20350	240.00	4864	18400	255.00	4692	7400	253.00	2011	5700	202.00	1353	
1961	128170	242.00	31201	68880	241.00	16851	20800	238.00	4950	16250	242.00	3932.5	7550	277.00	2011	5620	212.00	1255	
1960	125920	219.00	27558	64000	212.00	13568	22000	219.00	4818	16000	228.00	3648	9500	250.00	2145	5920	201.00	1190	
1959	118520	198.50	23518	60000	190.00	11400	22600	205.00	4633	13000	205.00	2665	7400	216.00	1593	5800	196.00	1137	
1958	111300	193.60	21541	59400	190.00	11286	19300	199.00	3841	11300	190.00	2147	6600	198.00	1321	5200	193.00	1197	
1957	114460	186.00	21363	56600	168.00	9509	20070	199.00	3994	15000	170.00	2550	7300	259.00	1821	6500	208.00	1352	
Ave.	118210	210.00	24954	62220	200.00	12608	20932	223.00	4688	13394	200.00	2871	6850	244.10	1710	6431	207.00	1335	
- 59																			
Ave.	101780	212.10	21598	52860	202.00	10712	20490	238.00	4384	11020	196.00	2157	6110	242.00	1466	6840	200.00	1358	
- 54																			

\* Includes some quantities not marketed and excluded in computing value: 6000 tons in 1965 and 4550 tons in 1966

+ Not strictly comparable with earlier years. Beginning in 1964, the price used is the per unit value at the processing plant door. In earlier years, price referred to the average price received by growers at the receiving point.

SOURCE: The Almanac of the Cannabis, Freening, Preserving Industries, 1962 - 1970

TABLE 11: Pack Processed Asparagus, Thousand Pounds, U. S., 1950 - 1970 (Thousands of Pounds)

	U. S. Canned Pack of Asparagus  (1000 lbs.)	U. S. Frozen Pack of Asparagus  (1000 lbs.)	U. S. Pack of Processed Asparagus  (1000 lbs.)	Frozen as Pct. of Total	Index: 1950 - 54 = 100			
					Canned Pack	Frozen Pack	Total Pack	
1970	139744.8	25925	165669.8	16	108	100	106	
1969	159517.8	23033	162550.8	14	123	88	104	
1968	162045.0	34355	196400.0	17	125	132	126	
1967	155329.2	32460	187789.2	17	120	125	121	
1966	184766.4	34532	219298.4	16	143	133	141	
1965	168667.2	30867	199534.2	15	130	119	128	
1964	192277.8	31054	223331.8	14	148	119	144	
1963	216754.2	30315	247069.2	12	167	116	159	
1962	211840.2	30810	242650.2	13	164	118	156	
1961	195553.8	34157	229710.8	15	151	131	148	
1960	186521.4	40026	226547.4	18	144	154	146	
1959	165812.4	32739	198551.4	16	128	126	128	
1958	176436.0	24365	200801.0	12	136	94	129	
1957	165976.2	31201	197177.2	16	128	120	127	
1956	154791.0	37674	192465.0	19	120	145	124	
1955	178378.2	28669	207047.2	14	138	110	133	
1954	142108.2	25780	167888.2	15	110	99	108	
1953	114706.8	32945	147651.8	22	89	127	95	
1952	124300.8	25460	149760.8	17	96	98	96	
1951	136890.0	23562	160452.0	15	106	91	103	
1950	129425.4	22309	151734.4	15	100	86	98	
							151.734400	

Source: U.S.D.A., Agricultural Statistics.

Table 12: Pack Canned Asparagus, Actual Cases, Leading Five States, U.S., 1955-1970 (Thousands of Actual Cases)

Year	Green Canned Pack					Total U.S. (Green)	California		U.S. Total in White & Green
	N.J.	Wash & Ore	Mich	Ill	Calif		White	Total	
							White	Total	
1970	1155	985	1058	847	1402	5714	267	1669	5982
1969	773	1003	1066	795	1593	6098	607	2200	6710
1968	856	1000	963	838	1538	6028	783	2321	6811
1967	822	942	995	805	1668	6010	505	2173	6514
1966	966	950	926	711	1458	5817	1822	3280	7639
1965	832	1000	1082	790	1271	5718	1270	2541	6988
1964	908	906	982	683	1177	5191	2660	3837	7851
1963	1048	811	748	606	1744	5571	3278	5022	8849
1962	893	926	883	630	1650	5691	3076	4726	8767
1961	867	723	823	571	1636	5273	2797	4432	8060
1960	831	645	938	562	1945	5901	2141	4086	7727
1959	642	588	870	461	1774	5148	1925	3699	6833
1958	672	549	724	560	1388	4659	2827	4215	7226
1957	725	510	798	606	1604	4786	1983	3587	6769
1956	641	511	720	604	1284	4252	1993	3277	6245
1955	730	525	686	529	1977	4901	2168	4145	7069

Source: Division of Industry Statistics, National Canners Association.

TABLE 13: Asparagus Frozen Pack in the United States

1955 - 1970

(Thousands of Pounds)

	Asparagus Frozen Pack	Asparagus Frozen Pack by Regions		
		East and South	Midwest	West
	(1000 lbs.)	(1000 lbs.)	(1000 lbs.)	(1000 lbs.)
1970	25925	4229	(a)*	21696
1969	23033	2885	(a)	20148
1968	34355			
1967	32460			
1966	34532			
1965	30866	8881	(a)	21985
1964	31054			
1963	30315			
1962	30810			
1961	42039	9887	756	31395
1960	40026			
1959	32739			
1958	24365			
1957	31201			
1956	37674			
1955	28669			

\* (a) Included in East and South

SOURCE: Compiled by the American Frozen Food Institute, The Almanac of the Canning, Freezing, Preserving Industries



Table 14: Canned Asparagus Carry-over, Pack-Stock-Shipment, Actual Case, U.S. March 1, 1955-1970  
(1000 of actual Cases)

Year	Carry-over March 1 1000 Actual Cases	Pack 1000 Actual Cases	Total Can Supply 1000 Actual Cases	Canners Stocks March 1 1000 Cases	Distributors* Stocks March 1 1000 Cases	Total Stocks March 1 1000 Cases	Canmer Shipments March 1 to March 1
1970	1619	5982	7600	1619	562	2181	6558
1969	1697	6710	8407	1697	647	2344	6782
1968	1386	6811	8197	1386	647	2033	6500
1967	1538	6295	7833	1538	614	2152	6447
1966	1172	7434	8606	1172	627	1799	7068
1965	1687	6988	8676	1687	652	2339	7504
1964	2490	7851	10341	2490	700	3190	8654
1963	1625	8849	10473	1625	705	2330	7983
1962	1522	8767	10289	1522	658	2180	8664
1961	1522	8060	9582	1522	684	2206	8060
1960	1241	7727	8968	1241	695	1936	7446
1959	1623	7074	8697	1623	668	2291	7417
1958	1698	7486	9185	1698	697	2395	7561
1957	1844	6769	8613	1844	734	2578	6915
1956	1803	6245	8048	1803	775	2578	6204
1955	699	7069	7739	669	833	1502	5936

\*Data are either estimates or interpolation.

Source: Consumer and Marketing Service. Compiled mainly from reports of the National Canners Association, the Cannery League of California, the National Kraut Packers Association, and the U.S. Department of Commerce, U.S.D.A.

TABLE 15: U. S. Asparagus Carryover:  
Cold Storage, Canners' Stock, and Distributors' Stock  
March 1, 1950 - 1970 (1000 pounds)

	Total U. S. Asparagus Carryover	Cold Storage	Canners' Stocks	Distributors' Stocks
	(1000 lbs.)	(1000 lbs.)	(1000 lbs.)	(1000 lbs.)
1970	62008.4	10973	37884.6	13150.8
1969	70033.6	15184	39709.8	15139.8
1968	66442.2	18870	32432.4	15139.8
1967	62296.8	11940	35989.2	14367.6
1966	57056.6	14960	27424.8	14671.8
1965	65484.6	10752	39475.8	15256.8
1964	86432.0	11786	58266.0	16380.0
1963	70036.0	15514	38025.0	16497.0
1962	68656.0	17644	35614.8	15397.2
1961	66957.4	15337	35614.8	16005.6
1960	58106.4	12804	29039.4	16263.0
1959	68465.4	14388	37978.2	16099.2
1958	70209.0	14166	39733.2	16309.8
1957	79342.2	19017	43149.6	17175.6
1956	71764.2	11439	42190.2	18135.0
1955	42439.8	7293	15654.6	19492.2
1954	44762.9	9577	24877.7	10308.2
1953	24968.5	5342	13876.7	5749.8
1952	31227.0	6681	17354.9	7191.1
1951	22094.0	4727	12279.1	5087.9
1950	14054.7	3007	7811.1	3236.6

SOURCE: U.S.D.A. Agricultural Statistics.

Table 16 Asparagus Packs by Style, Actual Case, U.S., 1955-1970 (Thousand of Actual Cases)

Year	Green Asparagus Packs by Style				White Asparagus Packs by Style			
	Spears*	Cut	Cut & Tips Rem'd	Total	Spears*	Cut	Cut & Tips Rem'd	Total**
1970	2607	2958	149	5714	168	74	25	267
1969	3007	5908	187	6102	335	157	115	607
1968	3266	2569	193	6028	426	180	177	783
1967	2869	2927	215	6010	301	91	112	504
1966	2815	2747	255	5817	1101	433	279	1822
1965	2618	2868	232	5718	834	232	204	1270
1964	2380	2612	198	5191	1650	427	582	2660
1963	2829	2460	282	5571	1625	928	725	3278
1962	2676	2754	261	5691	1411	1134	531	3076
1961	2547	2442	284	5273	1535	690	561	2787
1960	2817	2528	240	5586	1134	455	551	2141
1959	2355	2350	202	4907	1206	324	396	1926
1958	1952	2187	261	4400	1408	755	665	2827
1957	2218	2283	286	4787	1249	151	583	1983
1956	2010	2008	234	4252	1407	140	446	1993
1955	2475	2064	363	4902	1576	165	426	2168

\*Includes salad points

\*\* All white asparagus packed in California

Source: Divisions of Statistics, National Canner Association

TABLE 17: U. S. Disposable Personal Income:  
 Total Current, Total Real, Current per Capita  
 and Consumer Price Index (1957 - 59 = 100), 1950 - 70  
 (dollars)

	Total Current ----- (B \$)	Total Real (1957 - 59 = 100) ----- (B \$)	Current per Capita ----- \$	Real per Capita (1957 - 59 = 100) ----- \$	Consumer Price Index ----- (1957 - 59 = 100)	U. S. Population ----- (millions)
1970 <sup>20</sup>	687.8	516.4	3334	2503.0	133.2	204.8
1969	634.2	504.9	3108	2474.5	125.6	202.6
1968	591.0	494.6	2939	2459.4	119.5	200.6
1967	546.3	475.0	2744	2386.1	115.0	198.6
1966	511.9	457.0	2599	2320.5	112.0	196.9
1965	473.2	434.1	2432	2231.2	109.0	194.6
1964	438.1	406.8	2268	2105.8	107.7	192.1
1963	404.6	381.0	2125	2000.9	106.2	189.4
1962	384.6	366.3	2060	1961.9	105.0	186.7
1961	364.7	349.0	1985	1899.5	104.5	183.8
1960	351.8	341.6	1936	1879.6	103.0	180.7
1959	337.3	332.6	1904	1877.7	101.4	177.8
1958	317.9	314.4	1827	1808.1	101.1	174.9
1957	308.8	316.7	1804	1851.3	97.5	172.0
1956	292.9	311.6	1742	1853.2	94.0	168.9
1955	274.4	293.8	1661	1778.4	93.4	165.9
1954	256.9	274.5	1566	1673.1	93.6	163.0
1953	252.5	270.9	1568	1682.4	93.2	160.2
1952	238.7	258.0	1512	1634.6	92.5	157.6
1951	227.5	251.4	1465	1618.8	90.5	154.9
1950	206.9	246.9	1369	1633.6	83.8	152.3

SOURCE: Economic Indicators.

Table 18: Per Capita Consumption of Asparagus and Its Four Years Moving Average, U.S., 1938-70 (lbs.)

Year	Fresh* Asparagus	Canned** Asparagus	Frozen** Asparagus	4-Year Moving Average		
				Fresh Asparagus	Canned Asparagus	Frozen Asparagus
1938	1.1	.5	.05	1.35	.58	.04
1939	1.3	.6	.03	1.40	.62	.04
1940	1.5	.6	.05	1.37	.62	.05
1941	1.5	.6	.05	1.30	.62	.06
1942	1.3	.7	.04	1.20	.57	.08
1943	1.2	.6	.06	1.15	.65	.11
1944	1.2	.6	.11	1.12	.65	.12
1945	1.1	.4	.14	1.05	.68	.13
1946	1.1	1.0	.13	1.00	.72	.13
1947	1.1	.6	.11	.95	.65	.12
1948	.9	.7	.14	.89	.68	.13
1949	.9	.6	.13	.85	.68	.13
1950	.9	.7	.12	.82	.72	.14
1951	.8	.7	.13	.78	.75	.15
1952	.8	.7	.15	.75	.75	.16
1953	.8	.8	.16	.72	.78	.16
1954	.7	.8	.17	.72	.78	.16
1955	.7	.7	.16	.75	.78	.16
1956	.7	.8	.17	.75	.80	.17
1957	.8	.8	.16	.75	.78	.15
1958	.8	.8	.15	.70	.78	.15
1959	.7	.8	.19	.65	.78	.18
1960	.7	.7	.21	.62	.75	.18
1961	.6	.8	.16	.57	.75	.17
1962	.6	.8	.18	.57	.72	.16
1963	.6	.7	.16	.52	.72	.16
1964	.5	.7	.17	.47	.72	.16
1965	.6	.8	.15	.48	.72	.16
1966	.4	.7	.16	.42	.70	.16
1967	.4	.7	.17	.45	.72	.19
1968	.5	.7	.16			
1969	.4	.7	.15			
1970	.5	.9	.28			

\*Commercial farm weight

\*\*Processed weight

Source: Vegetable Situation, TVS-174, October 1969.

TABLE 19: Production for Processing of Competing Vegetables

1000 Pounds, U. S., 1955 - 1970  
(Thousand Pounds)

	U. S. Sweet Corn Farm Production for Processing	U. S. Snap Bean Farm Production for Processing	U. S. Green Peas Farm Production for Processing
	1000 lbs.	1000 lbs.	1000 lbs.
1970	3742100	1139300	952500
1969	4218700	1136900	1048800
1968	4958600	1253400	1164800
1967	4203800	1273580	1181100
1966	3924800	1043840	1018200
1965	3227200	1081360	1203820
1964	2961400	939760	<b>965400</b>
1963	3358280	948860	1033120
1962	3598500	901580	1053280
1961	3452540	957100	1021020
1960	2781920	813940	890780
1959	3164340	731720	946400
1958	2659800	730000	971620
1957	3049000	722620	1115360
1956	3420000	677260	1090720

Source: U.S.D.A. Agricultural Statistics.

TABLE 20: U. S. Processed Pack of Competing Vegetables,  
1000 lbs., 1955 - 1970 (Thousand Pounds)

	U. S. Pack of Sweet Corn			U. S. Pack of Snap Bean			U. S. Pack of Green Peas		
	Processed Pack	Canned Pack	Frozen Pack	Processed Pack	Canned Pack	Frozen Pack	Processed Pack	Canned Pack	Frozen Pack
1970	1396669.0	1099683.0	296986	1340220.8	1113184.8	227036	1016029.8	671509.8	344520
1969	1518837.8	1155655.8	363182	1316116.4	1110470.4	205546	1117784.4	750461.4	367323
1968	1798012.2	1387105.2	410907	1444696.8	1213102.8	231594	1277157.4	647805.4	429352
1967	1512944.2	1152871.2	360073	1500777.2	1244248.2	256529	1306238.8	881992.8	424246
1966	1409691.0	1065285.0	344406	1195379.4	948542.4	246837	1120790.4	745430.4	375360
1965	1177836.4	915314.4	262522	1275715.8	1067671.8	208044	1322778.0	879489.0	443289
1964	1066296.4	878693.4	187603	1073206.6	874200.6	199006	1039984.0	703053.0	336931
1963	1213060.8	1033156.8	179904	1060143.8	881407.8	178736	1130743.2	785959.2	344784
1962	1250738.6	1070409.6	180329	1052454.4	862664.4	189790	1146021.0	789165.0	356856
1961	1261267.8	1080307.8	180960	1030433.2	939814.2	363619	1104205.6	758136.6	346069
1960	967278.4	825458.4	141820	935492.6	775803.6	159689	967134.6	671907.6	295227
1959	1095713.8	964828.8	130885	872054.6	723036.6	149018	1037585.6	732630.6	304955
1958	894053.6	772644.6	121409	910305.0	754299.0	156006	1095153.0	843219.0	251934
1957	1026463.0	899847.0	126616	861289.0	746928.0	134361	1262009.0	966186.0	295823
1956	1156826.0	1018251.0	138575	822381.2	684637.2	137744	1194619.8	834958.8	359661

Source: U.S.D.A. Agricultural Statistics.

TABLE-21: Carryover of Cometing vegetables, 1000 pounds, U. S., 1955 - 1970 (Thousand Pounds)

	U. S. Sweet Corn					U. S. Snap Beans					U. S. Green Peas					
	Carryover (Aug 1)	Cold Storage (Aug 1)	Carriers' Stocks (Aug 1)	Distributors' Stocks (Aug 1)	Carryover (July 1)	Cold Storage (July 1)	Carriers' Stocks (Jul.1)	Distributors' Stocks (July 1)	Carryover	Cold Storage	Carriers' Stocks	Distributors' Stocks	Carryover	Cold Storage	Carriers' Stocks	Distributors' Stocks
	1000 lbs.	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs	1000 lbs
1970	410690.8	120411	207615.4	90464.4	349295.4	62495	213759.0	73931.4	339109.0	136698	136666.6	65543.4	339109.0	136698	136666.6	65543.4
1969	430308.6	110103	224780.4	95495.2	426712.6	90127	259997.4	76588.2	387868.2	147912	173334.4	67321.8	387868.2	147912	173334.4	67321.8
1968	246983.2	67711	93735.2	82835.0	377612.4	78654	225933.4	73125.0	329863.2	124341	136924.2	69498.0	329863.2	124341	136924.2	69498.0
1967	145742.0	10059	27669.4	71814.6	209389.8	46234	96688.8	64467.0	247504.4	100529	79723.8	67251.6	247504.4	100529	79723.8	67251.6
1966	123173.6	30035	26109.6	63999.0	257381.2	40627	151023.6	65730.6	301066.8	113526	120814.2	66066.6	301066.8	113526	120814.2	66066.6
1965	164195.4	21439	65395.4	74178.0	200712.0	52112	87567.0	60723.0	225921.8	97926	65694.8	52361.0	225921.8	97926	65694.8	52361.0
1964	302395.6	33547	150169.0	80599.6	235310.4	50778	122709.6	61822.8	271836.4	100694	101485.8	65708.6	271836.4	100694	101485.8	65708.6
1963	325276.2	53490	183994.2	90792.0	236623.4	44803	130852.8	61167.6	246354.0	93934	71908.2	75511.8	246354.0	93934	71908.2	75511.8
1962	265507.2	49806	135422.0	79279.2	278367.4	62011	153644.4	62712.0	219402.4	86350	69123.6	63928.8	219402.4	86350	69123.6	63928.8
1961	190312.2	22498	49537.8	71276.4	192018.0	38397	96127.2	57493.8	213982.8	74589	68351.4	71042.4	213982.8	74589	68351.4	71042.4
1960	167399.6	15155	63772.6	80262.0	182932.2	27135	94770.0	61027.2	302162.0	77756	150368.4	74037.6	302162.0	77756	150368.4	74037.6
1959	153277.4	21444	62314.2	69219.2	242502.0	35295	142997.4	64209.6	393614.2	84513	225810.0	83491.2	393614.2	84513	225810.0	83491.2
1958	226152.0	25432	112112.0	78358.0	214857.4	24592	127506.6	62758.8	409999.2	116953	195783.0	85363.2	409999.2	116953	195783.0	85363.2
1957	233481.8	24520	121738.8	77103.0	199543.4	29753	110167.2	59023.2	282489.2	118268	91283.4	72937.8	282489.2	118268	91283.4	72937.8
1956	144855.4	19661	50216.4	77688.0	209698.2	25587	118989.0	65122.2	171273.2	49289	48157.2	73827.0	171273.2	49289	48157.2	73827.0

Source: U.S.D.A. Agricultural Statistics.



Table 22. Export Canned Asparagus Prepared or Preserved in Airtight Containers to Other Countries, Quantity and Value, Pounds and Dollars, U.S., 1950-1970 (Pounds, Dollars)

	Net Quantity (lb.)	Value (\$)
1970	7486235	2420987
1969	11475289	3438716
1968	15682562	4472801
1967	18944085	5410935
1966	28956181	9221786
1965	46442560	12482384
1964	61744512	15571300
1963	62246438	15100408
1962	64107005	14077052
1961	44362954	10339593
1960	51175247	9786803
1959	30239868	5785090
1958	48187454	9302751
1957	37957954	6841789
1956	32704748	6179254
1955	25305227	5411025
1954	16638676	3313768
1953	16010166	2759644
1952	9454834	2458868
1951	10877332	2780161
1950	7916245	2066400

Source: U.S. Department of Commerce. Foreign Trade 410.

Table 23. Canned Asparagus Leading Export Market, 1000 cases 2 1/4 No. 303 Cans (24 lbs.). Figure Rounded, U.S., 1952-1970 (Thousand Cases)

Country of Destination	Year	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	1959	Average 1957-61	Average 1952-56
Total		479	614	669	1318	1366	2715	2718	2673	2184	1848	1500	1991	1793	827
Belgium-Lux.		78	54	42	115	61	166	196	118	77	98	84	97	87	70
West Germany		83	177	207	471	687	1472	1533	1641	1214	995	733	1165	975	260
Netherlands		14	31	24	99	38	104	144	116	103	93	48	117	88	50
Sweden		89	79	73	112	112	170	145	132	122	98	113	161	118	59
Switzerland		32	49	51	81	103	210	213	212	249	174	148	135	165	130
United Kingdom		28	28	59	102	57	115	120	104	75	53	67	16	44	12
Other Europe		84	126	129	177	174	192	163	147	87	71	(a)	(a)	(a)	(a)
Canada		11	5	12	13	26	23	32	21	35	74	68	47	57	31
Latin American Rep.		20	21	21	61	34	70	51	68	85	69	65	78	74	90
Other		40	44	51	87	74	193	121	114	137	123	174	174	185	130

(a) Included in other countries.

Source: United States Department of Agriculture, Foreign Agricultural Service, Fruit and Vegetable Division, Commodity Analysis Branch.

Table 24: Relationship of the variables to the all sale Asparagus price ( $P_f$ ) received by Michigan Farmers

$X_{40}$

Vari-ables	Regression Coefficients	Standard Errors of Coefficients	T-test	F-test	Signi-ficance
$\alpha_0$	-166.3653	27.9222	-5.9582	35.4999	<0.0005
$X_2$	0.1686	0.0228	7.3965	54.7084	<0.0005
$X_{36}$	- 0.00023	0.000049	-4.5522	20.7225	0.001
$X_8$	39.0343	8.43002	4.6304	21.4405	0.001
$R^2 =$	.9746				
$R =$	.9872				
$\bar{R}^2 =$	.9676				
$\bar{R} =$	.9837				

Standard error of estimate = 12.23206347

Table 25: Relationship of the variables to the all sale Asparagus price ( $P_f$ ) received by Michigan Farmers

$X_{40}$

Vari-ables	Regression Coefficients	Standard Error of Coefficients	T-test	F-test	Significance
$\alpha_0$	-298.7665	156.0963	-1.9140	3.6634	0.085
$X_2$	0.18006	0.0266	6.7614	45.7166	<0.0005
$X_{36}$	- 0.000219	0.0000508	-4.3268	18.7209	0.001
$X_8$	44.2768	10.47429	4.2272	17.8692	0.002
$X_1$	0.02355	0.027306	0.8624	0.7438	0.409
$R^2 =$	.9763				
$R =$	.9881				
$\bar{R}^2 =$	.9669				
$\bar{R} =$	.9833				

Standard error of estimate = 12.37704043

Table 26: Relationship of the variables to the all sale Asparagus price ( $P_p$ ) received by Michigan Farmers

$X_{40}$

Variables	Regression Coefficients	Standard Errors of Coefficients	T-test	F-test	Significance
$X_0$	-284.7728	86.7399	- 3.2831	10.7785	0.013
$X_2$	0.1835	0.01494	12.2795	150.7869	<0.0005
$X_{24}$	0.00017	0.0000229	7.2988	53.2721	<0.0005
$X_{36}$	0.00029	0.000022	-13.1680	173.3956	<0.0005
$X_7$	- 0.0000012	0.00000018	- 6.4654	41.8013	<0.0005
$X_8$	22.9651	5.016279	4.5781	20.9591	0.003
$X_6$	- 19.77707	13.12437	- 1.5069	2.2707	0.176
$X_1$	0.06383	0.01398	4.5644	20.8336	0.003

$R^2 = .9975$

$R = .9987$

$\bar{R}^2 = .9949$

$\bar{R}^2 = .9949$

$\bar{R} = .9975$

Standard error of estimate = 4.84666263

Table 27: Relationship of the variables to the all sale Asparagus price ( $P_f$ ) received by Michigan Farmers

Vari-ables	Regression Coefficients	Standard Errors of Coefficients	T-test	F-test	Signi-ficance
$X_{40}$					
$\alpha_0$	-371.8137	69.66015	-5.3375	28.4893	0.001
$X_2$	0.1991	0.0115	17.1914	295.5452	<0.0005
$X_{24}$	0.00016	0.000024	6.6370	44.0499	<0.0005
$X_{36}$	- 0.000295	0.000024	-12.2604	150.3169	<0.0005
$X_7$	- 0.0000011	0.00000019	- 5.8425	34.1352	<0.0005
$X_8$	24.11877	5.33674	4.5194	20.4248	0.002
$X_1$	0.06903	0.01458	4.7322	22.3939	0.001
$R^2$	= .9966				
$R$	= .9983				
$\bar{R}^2$	= .9941				
$\bar{R}$	= .9971				

Standard error of estimate = 5.217409

Table 28: Relationship of the variables to the all sale Asparagus price ( $P_f$ ) received by Michigan Farmers

$X_{40}$

Vari-ables	Regression Coefficients	Standard Errors of Coefficients	T-test	F-test	Signi-ficance
$\alpha_0$	-330.5417	63.3266	-5.2196	27.2446	<0.0005
$X_2$	0.1672	0.0368	4.5360	20.5753	0.001
$X_{41}$	95.3379	37.6167	2.5345	6.4234	0.026
$R^2$	= .9351				
$R$	= .9670				
$\bar{R}^2$	= .9242				
$\bar{R}$	= .9614				

Standard error of estimate 18.71900543

Table 29: Relationship of the variables to the Michigan fresh Asparagus prices at farm level

$X_{41}$

Variables	Regression Coefficients	Standard Errors of Coefficients	T-test	F-test	Significance
$\alpha_0$	-3231.7978	411.8636	-7.8468	61.5718	<0.0005
$X_2$	0.5626	0.0476	11.8107	139.4937	<0.0005
$X_7$	-0.0000046	0.00000069	-6.7082	44.9996	0.001
$X_6$	379.6505	53.371962	7.1133	50.5990	<0.0005
$X_{11}$	0.00313	0.000405	7.7273	59.7113	<0.0005
$X_{14}$	0.31902	0.05349	5.9636	35.5641	0.001
$X_8$	61.8677	9.5322	6.4904	42.1252	0.001
$X_{25}$	-0.000126	0.000031	-4.0494	16.3973	0.007
$X_{19}$	-0.00179	0.000404	-4.4319	19.6416	0.004
$R^2 =$	.9918				
$R =$	.9959				
$\bar{R}^2 =$	.9808				
$\bar{R} =$	.9903				

Standard error of estimate = 9.36450418

Table 30: Relationship of the variables to the Michigan fresh Asparagus prices at farm level

$X_{41}$

Vari-ables	Regression Coefficients	Standard Errors of Coefficients	T-test	F-test	Signi-ficance
$\alpha_0$	-321.9242	66.5823	-4.8350	23.3771	0.001
$X_2$	0.1251	0.0404	3.0981	9.5981	0.010
$X_{41}$	122.4361	40.2215	3.0440	9.2662	0.011
$X_{39}$	14.1984	19.2915	0.7360	0.5417	0.477
$R^2$ =	.9333				
$R$ =	.9661				
$\bar{R}^2$ =	.9152				
$\bar{R}$ =	.9566				

Standard error of estimate 19.66616082



Table 31: Relationship of the variables to the Michigan fresh Asparagus prices at farm level

$X_{41}$

Vari-ables	Regression Coefficients	Standard Errors of Coefficients	T-test	F-test	Signi-ficance
$X_0$	-277.8444	87.2716	-3.1837	10.1358	0.009
$X_2$	0.1429	0.0407	3.5103	12.3219	0.005
$X_5$	-0.000045	-0.0000609	-0.7457	0.5561	0.471
$X_{41}$	123.1595	40.0124	3.0780	9.4743	0.011

$R^2 = .9334$

$R = .9661$

$\bar{R}^2 = .9153$

$\bar{R} = .9567$

Standard error of estimate 19.65389284

Table 32: Relationship of the variables to the Michigan processing Asparagus prices at farm level ( $P_p$ )

Variables	Regression Coefficients	Standard Error of Coefficients	T-test	F-test	Significance
$X_{42}$					
$\alpha_0$	-174.0357	32.5464	-5.3473	28.5937	<0.0005
$X_2$	0.1709	0.0265	6.4356	41.4171	<0.0005
$X_{36}$	-0.00025	0.000057	-4.3831	19.2113	0.001
$X_8$	40.4188	9.8261	4.1134	16.9200	0.002
$R^2 =$	.9671				
$R =$	.9834				
$\bar{R}^2 =$	.9582				
$\bar{R} =$	.9789				

Standard error of estimate = 14.25784301

Table 33: Relationship of the variables to the Michigan processing Asparagus prices at farm level ( $P_p$ )

$X_{42}$

Variables	Regression Coefficients	Standard Error of Coefficients	T-test	F-test	Significance
$\alpha_0$	1122.2644	97.07314	11.5610	133.6572	<0.0005
$X_{24}$	0.00017	0.000019	9.0822	82.4868	<0.0005
$X_{36}$	0.000368	0.000026	-14.0088	196.2475	<0.0005
$X_{14}$	-0.13766	0.01745	-7.8846	62.1668	<0.0005
$X_6$	-149.8698	20.05397	-7.4733	55.8505	<0.0005
$X_{11}$	-0.00037	0.000104	-3.5461	12.5749	0.008
$X_4$	0.000053	0.000020	2.5743	6.6271	0.033
$R^2 =$	.9962				
$R =$	.9981				
$\bar{R}^2 =$	.9934				
$\bar{R} =$	.9967				

Standard error of estimates = 5.67942845

Table 34: Relationship of the variables to the Michigan processing Asparagus prices at farm level ( $P_p$ )

$X_{42}$

Vari-ables	Regression Coefficients	Standard Error of Coefficients	T-test	F-test	Signi-ficance
$\alpha_0$	917.8038	232.2529	3.9517	15.6161	0.004
$X_2$	0.0561	0.0342	1.6405	2.6913	0.140
$X_{24}$	0.000187	0.000027	6.8181	46.4859	<0.0005
$X_{36}$	-0.00036	0.000037	-9.7962	95.9650	<0.0005
$X_7$	-0.00000052	0.00000028	-1.8676	3.4880	0.099
$X_{14}$	-0.124478	0.036189	-3.4396	11.8312	0.009
$X_6$	-139.50971	32.30457	-4.3186	18.6501	0.003
$R^2 = .9928$					
$R = .9964$					
$\bar{R}^2 = .9875$					
$\bar{R}^2 = .9937$					

Standard error of estimate = 7.80822113

Table 35: Relationship of the variables to the Michigan processing Asparagus prices at farm level ( $P_p$ )

$X_{42}$

Variables	Regression Coefficients	Standard Error of Coefficients	T-test	F-test	Significance
$\alpha_0$	-342.4865	73.1466	-4.6814	21.9155	0.001
$X_2$	0.1716	0.0426	4.0305	16.2453	0.002
$X_{41}$	94.9143	43.4999	2.1845	4.7718	0.049
$R^2$	= .9176				
$R$	= .9579				
$\bar{R}^2$	= .9038				
$\bar{R}$	= .9507				

Standard error of estimate = 21.62172193

Table 36: Relationship of the variables to the Michigan processing Asparagus prices at farm level (P<sub>p</sub>)

X<sub>43</sub>

Variables	Regression Coefficients	Standard Error of Coefficients	T-test	F-test	Significance
$\alpha_0$	-1.374238	0.6416	-2.1418	4.5874	0.058
X <sub>2</sub>	0.00167	0.0005	3.2685	10.6831	0.008
X <sub>8</sub>	0.6723	0.2432	2.7645	7.6427	0.020
X <sub>24</sub>	-0.0000016	0.0000009	-1.5941	2.5412	0.142
X <sub>16</sub>	-0.000256	0.00024	-1.0694	1.1436	0.310

$$R^2 = .9207$$

$$R = .9595$$

$$\bar{R}^2 = .8890$$

$$\bar{R} = .9429$$

Standard error of estimate = 0.26572043

Table 37: Relationship of the variables to the canned green Asparagus price, f.o.b. factory Midwest fancy cut And tips no. 303 ( $P_c$ )

$X_{43}$

Variables	Regression Coefficient	Standard Error of Coefficients	T-test	F-test	Significance
$\alpha_0$	-0.9755	0.5996	-1.6268	2.6464	0.130
$X_2$	0.0019	0.0005	3.7632	14.1615	0.003
$X_8$	0.3901	0.1807	2.1585	4.6591	0.052

$$R^2 = .8974$$

$$R = .9473$$

$$\bar{R}^2 = .8803$$

$$\bar{R} = .9382$$

Standard error of estimate = 0.27599993

Table 38: Relationship of the variables to the canned green Asparagus price, f.o.b. factory Midwest fancy cut And tips no. 303 (P<sub>c</sub>)

X<sub>43</sub>

Vari-ables	Regression Coefficients	Standard Errors of Coefficients	T-test	F-test	Signifi-cance
$\alpha_0$	11.9397	2.1708	5.5001	30.2514	< 0.0005
X <sub>14</sub>	-0.0020	0.00028	-7.4597	55.6472	< 0.0005
X <sub>5</sub>	0.0000013	0.0000005	2.3241	5.4013	0.042
X <sub>6</sub>	-1.64766	0.344766	-4.7791	22.8394	0.001
X <sub>41</sub>	0.45299	0.305505	1.4828	2.1986	0.169

$$R^2 = .9640$$

$$R = .9818$$

$$\bar{R}^2 = .9496$$

$$\bar{R} = .9745$$

Standard Error of estimate = 0.17911



Table 39: Relationship of the variables to the canned green Asparagus price, f.o.b. factory Midwest fancy cut And tips no. 303 (P<sub>c</sub>)

X<sub>43</sub>

Vari-ables	Regression Coefficients	Standard Error of Coefficients	T-test	F-test	Signi-ficance
$\alpha_0$	14.7429	1.1235	13.1219	172.1837	<0.0005
X <sub>14</sub>	-0.00235	0.00020	-11.3491	128.8028	<0.0005
X <sub>5</sub>	0.00000124	0.00000058	2.1536	4.6378	0.054
X <sub>6</sub>	-1.8984	0.31638	-6.0003	36.0031	<0.0005
R <sup>2</sup> =	.9561				
R =	.9778				
$\bar{R}^2$ =	.9441				
$\bar{R}$ =	.9716				

Standard error of estimate = 0.188617

Table 40: Relationship of the variables to the canned green Asparagus price, f.o.b. factory Midwest fancy cut And tins no. 303 (P<sub>c</sub>)

X<sub>43</sub>

Vari-ables	Regression Coefficients	Standard Error of Coefficients	T-test	F-test	Signi-ficance
$\alpha_0$	16.52829	0.8656	19.0933	364.5548	<0.0005
X <sub>14</sub>	0.00241	0.00023	-10.2888	105.8587	<0.0005
X <sub>6</sub>	-2.0835	0.34759	-5.9939	35.9265	<0.0005

$$R^2 = .9375$$

$$R = .9683$$

$$\bar{R}^2 = .9271$$

$$\bar{R} = .9629$$

Standard error of estimate 0.215317

Table 41: Relationship of the variables to the canned green Asparagus price, f.o.b. factory Midwest fancy cut And tips no. 303 ( $P_c$ )

$X_{43}$

Vari-ables	Regression Coefficients	Standard Error of Coefficients	T-test	F-test	Signi-ficance
0	7.6259	1.7278	4.4135	19.4794	0.001
$X_{14}$	-0.00104	0.00032	-3.2197	10.3664	0.008
$X_{45}$	0.01091	0.00201	5.4205	29.3819	0.0005
$X_{41}$	0.8095	0.4769	-1.6973	2.28808	0.118
$R^2 =$	.9546				
$R =$	.9770				
$\bar{R}^2 =$	.9422				
$\bar{R} =$	.9707				

Standard error of estimate = .1917717

Table 42: Relationship of the variables to the canned green Asparagus price, f.o.b. factory Midwest fancy cut And tips no. 303 ( $P_c$ )

X43

Variables	Regression Coefficients	Standard Errors of Coefficients	T-test	F-test	Significance
$\alpha_0$	5.9888	1.5418	3.8843	15.0875	0.002
$X_{14}$	-0.00103	0.00034	-2.9742	8.8461	0.012
$X_{45}$	0.00816	0.0012	6.3428	40.2316	0.0005
$R^2 = .9427$					
$R = .9709$					
$\bar{R}^2 = .9331$					
$\bar{R} = .9660$					

Standard error of estimate = 0.20625328

Table 43: Relationship of the one-variable to the Michigan fresh asparagus prices at farm level.

$X_{41}$ Variable	Regression Coefficients	Standard error of Coefficients	T-test	F-test	Significance
$\alpha_0$	-154.8697	67.1726	-3.0104	10.1248	0.015
$X_2$	0.2406	0.0262	3.5332	12.3519	0.005
$R^2$	= .8665				
$R$	= .8986				
$\bar{R}^2$	= .8563				
$\bar{R}$	= .8953				
Standard error of estimate 25.59382972					

## Bibliography

- United States Department of Agriculture. Crop Reporting Board  
Agricultural Marketing Service. Washington, D.C.: Government  
Printing Office.
- \_\_\_\_\_. Agricultural Statistics. Washington, D.C.: Government  
Printing Office.
- \_\_\_\_\_. Consumer and Marketing Service. Compiled mainly from  
reports of the National Canners Association, The Canner League  
of California, The National Kraut Packers Association, and  
the U.S. Department of Commerce. Washington, D.C.: Government  
Printing Office.
- \_\_\_\_\_. Vegetable Situation. TVS-174, October, 1969. Washington,  
D.C.: Government Printing Office.
- \_\_\_\_\_. Foreign Agriculture Service. "Canned Asparagus Leading  
Export Market," Fruit and Vegetable Division, Commodity Analysis  
Branch. Washington, D.C.: Government Printing Office.
- United States Department of Commerce. Census of Agriculture, 1964  
and 1969. Bureau of the Census. Washington, D.C.: Government  
Printing Office.
- \_\_\_\_\_. United States Census. Bureau of the Census. Washington,  
D.C.: Government Printing Office.
- \_\_\_\_\_. Foreign Trade 410. Bureau of International Commerce.  
Washington, D.C.: Government Printing Office.
- Economic Indicators. U.S. Government Printing Office.  
Washington, D.C.
- The Almanac of the Canning, Freezing, Preserving Industries.  
Edward E. Judge & Son. Westminster, Maryland, 1962, 1966  
and 1970.
- National Canners Association. Asparagus Pack by Style, 1955-1970.  
Division of Statistics. Washington, D.C.: Government Printing  
Office.