SIMULATED PRICE AND SUPPLY CONTROL PROGRAMS FOR THE MICHIGAN NAVY BEAN INDUSTRY

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ABSTRACT

SIMULATED PRICE AND SUPPLY CONTROL PROGRAMS FOR THE MICHIGAN NAVY BEAN INDUSTRY

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Michigan produces over 99 percent of the navy beans grown in the United States. Navy beans are one of the most important agricultural products grown in Michigan and have a wide domestic and export market. Because this crop has had wide yield, price, and income fluctuations in the past, a government price support program has been in effect in the industry for the last 30 years to help reduce the fluctuations in income and to increase producer income.

The objectives of this study are: (1) to estimate the basic supply and demand relationships existent in the Michigan navy bean industry for the period from 1951 - 1967 and (2) to evaluate whether selected price and supply control programs would be desirable to employ in the Michigan navy bean industry, either individually or when combined with a government price support program. Such information might be particularly useful if the government were to

reduce its expenditures for agricultural support programs to any extent.

To fulfill the first objective, an economic model consisting of a navy bean acreage planted equation and a three equation demand structure (domestic demand, exports, and price of small white beans equations) were developed. The first equation was estimated using ordinary least squares and the demand structure was estimated using three stage least squares. A high navy bean planted acreage was found to be associated with a high navy bean price to producers the previous year. In the demand structure, both domestic consumption and exports moved in the opposite direction of the price of navy beans, though both have a low responsiveness to change in navy bean price.

The estimated supply-demand relationships were the basis of a recursive simulation model used to examine different price and supply control programs. The programs examined with the simulation model include: (1) variations in the government price support level, (2) an unsupported market situation, (3) a private price support - storage program, (4) a marketing quota, (5) an acreage control, and (6) a two price system. The program simulations were run for the period 1953 - 1967 and were intended to answer the question: What would have happened during this period had the programs under study actually been in operation?

The results of the variations in the government price support level simulations showed that this program did

increase producer gross income from navy beans over what would have occurred in an unsupported situation. The lower the price support level was set, the less effective the government program and the lower the government expenditures. A private price support - storage program would have been able to decrease price fluctuations in some crop years, but would not have substantially improved producer income from navy beans. A marketing quota and an acreage control would have been able to increase producer gross income from navy beans, but would also have decreased available supplies. Under a two price system, producer gross income from navy beans would have been increased more in the fifteen years if the domestic price had been set at higher levels.

The general conclusions obtained from the examination of the different control programs was that such programs would have increased producer income from navy beans above what it would have been without controls. The government price support program at the actual price support levels was superior in this regard (judging from the price levels considered for the private programs). At some point all the programs ran into constraints that limited their ability to increase producer income or price beyond a certain point.

Not all the programs examined could have been used in the actual industry because of current legal structure and/or organizational deficiencies. The different industry

groups and the public must decide if any of the different programs examined should be tested in the actual market or if they should be studied in further detail.

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CHAPTER I

INTRODUCTION

Michigan produces approximately one third of the dry beans grown in the United States (Table I-1). In 1964, 12,391 farms in Michigan grew dry beans.[1] Dry beans produced in Michigan had a value of $45.7 million in 1967, which was 13.5 percent of the value of all field crops grown in the state that year.[2] In terms of cash receipts from marketings, the dry bean industry was the state's sixth largest agricultural enterprise in 1964.[3]

By far the largest proportion of dry beans grown in Michigan are navy beans (Table I-1). In terms of physical output, generally over 90 percent of dry bean production in Michigan has been navy beans. Michigan now produces over 99 percent of the navy beans grown in the United States. Production within Michigan is concentrated in the "Thumb" region of the state (Figure I-1). Because of the concentration of navy bean production in Michigan and the nature

[1]U.S. Bureau of the Census, 1964 United States Census of Agruculture (Washington, D.C.: Government Printing Office, 1964) Vol. I, part 13, p. 13.

[2]Michigan Department of Agriculture, Michigan Agricultural Statistics (Lansing, 1968).

[3]U.S. Bureau of the Census, 1964 United States Census of Agriculture, pp. 13-18.

TABLE I-1

U.S. AND MICHIGAN PRODUCTION OF DRY BEANS AND NAVY BEANS, 1951-67
(Production in 1000 cwt.)

Crop Year (Sept. 1)	U.S. Production[a]		Michigan Production[b]	
	Dry Beans	Navy Beans	Dry Beans	Navy Beans
1951	15,828	4,072	4,022	3,782
1952	14,917	3,412	3,474	3,202
1953	16,498	3,601	3,750	3,428
1954	16,939	3,158	3,295	3,000
1955	16,672	4,428	4,536	4,343
1956	17,234	5,020	5,389	4,905
1957	15,670	3,358	3,508	3,272
1958	19,287	5,042	5,226	4,949
1959	18,505	6,069	6,413	6,006
1960	17,411	5,845	6,248	5,811
1961	19,672	6,755	7,358	6,714
1962	17,942	6,725	7,392	6,696
1963	19,982	7,599	8,585	7,565
1964	17,375	6,801	7,601	6,771
1965	16,347	5,480	6,175	5,460
1966	19,962	7,289	8,026	7,289
1967	15,472	4,787	5,382	4,787

Sources: [a]U.S. Department of Agriculture, Statistical Reporting Service, Crop Reporting Board, Crop Production (Various Annual Summaries).

[b]Michigan Department of Agriculture, Michigan Agricultural Statistics, (Lansing, Various Issues).

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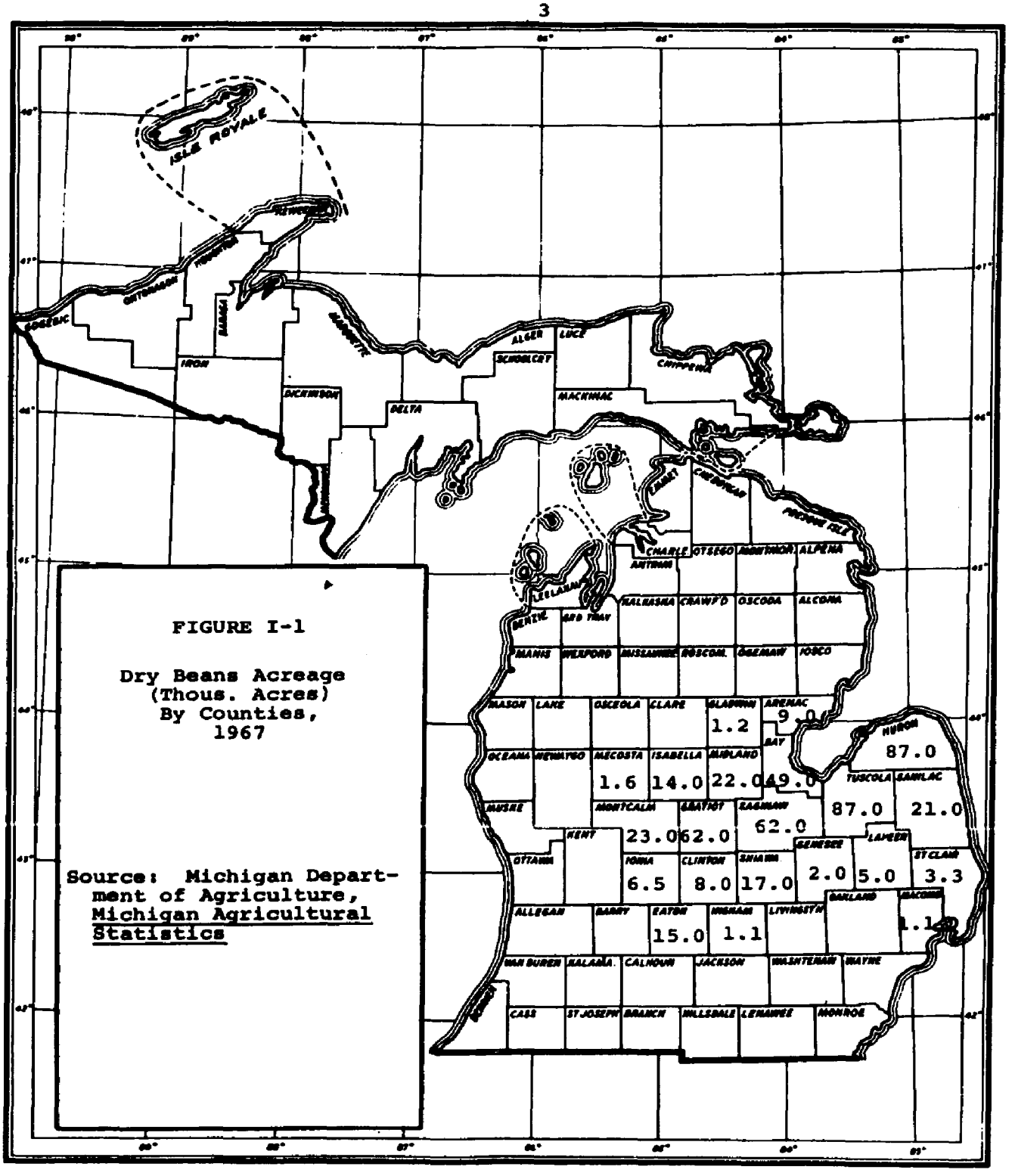

FIGURE I-1

Dry Beans Acreage
(Thous. Acres)
By Counties,
1967

Source: Michigan Department of Agriculture, Michigan Agricultural Statistics

of the navy bean marketing problems, this study will focus on the navy bean industry.

The navy bean industry has exhibited substantial farm price, production, and farm income fluctuations in the past. Weather, yield, and acreage changes for this weather-sensitive crop provide only part of the answer for these fluctuations. The minimal amounts of market information available to some industry participants may be a contributing factor. There appears to be substantial risk and uncertainty for all participants in the dry bean industry because of the lack of market information.

A governmental price support program, which has been in operation in the commodity for approximately thirty years, has helped reduce fluctuations from year to year. This program has resulted in substantial government expenditures in the industry. However, pressures being exerted on the federal government by certain segments of the U.S. society may force reallocation of federal funds away from agricultural programs such as this one. While the price support program probably will not be eliminated, the price support level and associated government expenditures may be reduced. Alternative industry or government programs might be considered by some industry participants as a supplement to or replacement of the current or modified government price support program.

Objectives of the Study

In the last few years, there has been increasing interest in examining various government or industry programs to determine effects of program shifts or adjustments. Until the late 1920's the traditional method of coordination of production and marketing in U.S. agriculture was an open market system with no price or production controls. Under this system wide fluctuations in production and prices have occurred due to vagaries of weather, uncertain price expectations, etc. To alleviate the wide fluctuations and general low level of income to the growers of these commodities, various programs have evolved which modify the market. These include bargaining associations, cooperative marketing organizations, price support programs, marketing orders, and production or marketing control programs. Another program which has been used extensively in Canada and Europe is the marketing board. In 1966 the U.S. National Commission on Food Marketing recommended that Congress should provide the passing of similar enabling legislation for U.S. agricultural industries that wish to create marketing boards.

Many different objectives have been suggested which these supplementary institutions are intended to achieve. The most important of these include: (1) to insure adequate consumer supplies, (2) to improve the absolute level of grower income and the returns to grower resources,

(3) to improve the stability of grower income and (4) to increase the market power of growers.

To fulfill these objectives, various programs have been used. A list of these includes: (1) regulating quantity flow within and between seasons, (2) controlling supply or marketings, (3) regulating quality, (4) advertising and promotion, (5) research, (6) prohibiting unfair trade practices, (7) minimum price guarantees for agricultural commodities and (8) providing market information for commodity participants.

This study tests the hypothesis that certain price and supply control programs other than those now existing in the Michigan navy bean industry could have advantages, either as replacements of or supplements to existing programs, for some interest groups. While it will not be possible to evaluate the effects of each program mentioned above, some major supply and price control measures which can be employed will be studied and their relative degree of success or failure in serving particular interests will be analyzed. The programs which can incorporate one or more of these measures can then be partially evaluated. The programs to be examined are: (1) acreage control, (2) control of quantities marketed, (3) two price system, (4) non-governmental storage program minimum price, and (5) government price support program. The market without supply or demand controls will also be examined. Some of

these have already been tried in the industry while others have not. They are, however, ones which economic theory suggests might produce beneficial results for some industry participants. New enabling legislation would have to be passed before some of these measures could be used in various industry programs.

To measure the advantages and test the validity of the hypothesis for the various programs, several criteria which appear applicable to one or more of the interest groups concerned with industry performance will be used: (1) level of producer income, (2) stability of producer income, (3) stability of price, (4) level of price, (5) amount of government expenditures, and (6) per capita supplies of navy beans. Since changes in some of the criteria can be simultaneously "good" for one group and "bad" in the view of another group, the desirability of the programs is evaluated from several different, potentially competing, viewpoints. It is quite possible that no one measure or program would make everyone better off. However, the quantitative evaluation of these programs should provide each interested group with some reasonable estimates of potential benefits and costs of each program which might be promoted by and adopted in the industry. In summary, the general objectives of this study are:

1) To estimate the basic supply and demand relationships existent in the Michigan navy bean industry in the past 17 years.
2) To evaluate within the above supply and demand context, the expected consequences of alternative methods of regulating or structuring the market for navy beans.

Previous Research

The amount of published economic research related to the navy bean industry is limited. Two studies examined the effects of the government price support program on the navy bean industry. In 1955, Hathaway, doing a study of the Michigan dry bean industry, found that the price support program was an important factor in maintaining incomes for bean producers, in some post-war years.[4] In 1967, Vandenborre, doing a general study of the important dry bean varieties grown in the United States, concluded that the price support program has substantially aided navy bean producers in recent years.[5]

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[4]Dale E. Hathaway, The Effects of the Price Support Program on the Dry Bean Industry in Michigan (Michigan Agricultural Experiment Station Technical Bulletin 250, East Lansing, April 1955), p. 3.

[5]Roger J. Vandenborre, An Econometric Investigation of the Impact of Governmental Support Programs on the Production and Disappearance of Important Varieties of Dry Edible Beans (Giannini Foundation Research Report No. 294, California Agricultural Experiment Station, Berkeley, December 1967), p. 85.

Both of these studies involved estimating econometric models which were then used in running simulations to evaluate the price support program against an unsupported market. However, neither study examined situations other than the government price support program or the unsupported market. Further, neither study differentiated commercial demand into domestic and export segments. With exports taking a large proportion of production in recent years, a model explicitly incorporating exports in it should increase our understanding of the forces operating in the industry.

A third study on the navy bean industry was published by Hayenga in 1968. His emphasis was on describing the structure and related problems of the navy bean marketing system. He found that four shippers handled approximately 95 percent of Michigan bean production.[6] He also found that the industry was concentrated at the canner level.[7] Some of these and other industry participants lack adequate market information which results in increased risk and uncertainty for them. This study will be examining several programs which would necessarily involve structural changes in the industry, and

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[6]Marvin L. Hayenga, Structure and Problems of the Navy Bean Marketing System (Michigan State University Agricultural Economics Report 91, East Lansing, April 1968), p. 9.

[7]Ibid., p. 17.

corresponding changes in the information available to some industry participants.

Outline of the Study

Initially, the historical development of the Michigan navy bean industry programs and organizations will be described. The annual supply and demand relationships which have recently existed in the Michigan navy bean industry will then be modeled. After econometrically estimating the parameters of this model, the implications of the estimates will be discussed. These estimated relationships will then provide an initial basis for the supply and demand structure which will be incorporated into a simulation model. By modifying the estimated relationships to conform with expected behavior under alternative programs, the simulation model can be used to evaluate the impact which particular production or marketing programs would have had during 1953-1967. Consequently, the likely impact of such programs can be evaluated without resort to potentially "expensive" actual implementation within the industry. Using the results of the simulation study, a descriptive analysis of the effects of different programs will then be presented.

CHAPTER II

GENERAL ORGANIZATIONAL SETTING OF THE MICHIGAN NAVY BEAN INDUSTRY

The success of any new industry program is tempered by how compatible it is with existing organizations and programs. More importantly, the actual acceptance and implementation of a new program is dependent on how it is received by different industry participants. Therefore, one should consider where the industry is at present before he will be able to adequately judge any new programs.

Early Development of the Industry[1]

Beans, as a field crop in Michigan, became important enough by 1884 to take a place in that year's state census. By 1900 Michigan was the leading producer of dry beans in the United States. Since that time, Michigan has continued as the largest producer of dry beans in this country. The favorable soil and climatic conditions

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[1]The historical facts in this section are summarized from Wilbur O. Hedrick, Marketing Michigan Beans (Michigan Agricultural Experiment Station Special Bulletin 217, East Lansing, Nov. 1931).

for beans in the "Thumb" region of the state is a major factor leading to this situation.

While Michigan was gaining prominence in the growing of dry beans, production and consumption decisions were based upon a price determined by supply and demand conditions. There was no attempt to establish minimum price guarantees or to control supplies through pooling arrangements by growers.

However, because of poor transportation conditions, the price the grower received was determined by bargaining between him and a local elevator operator. With the limited number of elevators in any one locality, growers were often at a disadvantage in getting a price that broader supply and demand conditions may have warranted. As transportation improved, the market area served by elevators expanded and the options open to the growers increased. Some elevators started providing storage at reduced rates and more credit. Besides buying and selling beans, the elevators also cleaned and graded them.

The actual marketing or selling of the beans to canners and retailers was done by bean shippers. In 1930 there were three or four shippers keeping a regular daily buying market in beans, with twenty or more shippers handling beans at some time during the year. A few of the shippers operated their own elevators while others bought most of their beans from independent elevators.

Some of the independent elevators also sold directly to canners and grocers.[2]

Early Cooperative Movement[3]

Cooperative elevators were established in the Michigan bean industry after World War I. In 1920 these cooperative elevators associated themselves into a central exchange (Michigan Elevator Exchange) which acted as their terminal sales agency.[4] At first these new cooperative marketing organizations added no new features to bean marketing, simply participating in the system like any other elevator. The producer members were issued stock shares in the cooperatives and received patronage dividends.

In 1931 the Federal Farm Board added impetus to cooperative marketing by establishing a pool plan. Under this plan, farmers joined local cooperative associations and pooled their beans. After the marketing season they

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[2]At this time a sizable proportion of navy beans went to the dry market. Although no data is available as to the breakdown today, it is estimated by people in the industry that the dry market now takes about ten percent of production.

[3]This section was summarized from Hedrick, Marketing Michigan Beans, and Wilbur O. Hedrick, A Decade of Michigan Cooperative Elevators (Michigan Agricultural Experiment Station Special Bulletin 291, East Lansing, May 1938).

[4]The Michigan Elevator Exchange is one of the four large shippers still operating in the industry.

were to receive a pool price which reflected the benefits of joining the association. Growers also had the option of selling their beans to the pool at the current market price if they so desired. Growers could be advanced some funds on their beans if they delivered all their beans to the pool. The local cooperative associations used the Michigan Elevator Exchange as their sales agency.

However, because of an industry practice requiring payments upon delivery and the consequent high capital requirement, the project failed during the depression. Besides these two factors, the fact that the Farm Board died a political death after three years also contributed to the failure. After the extinction of the Farm Board and the collapse of the overall pool, several of the local pool associations remained active.

The early cooperative movement had several lasting effects on the industry. The first was that local cooperative elevators and the Michigan Elevator Exchange became a permanent fixture in the industry. This has increased the power of growers to some extent within the marketing channel. Second, while the pooling arrangement was a failure, it marked the first attempt of the government and the growers to cooperate in trying to raise farm income for Michigan beans. It probably left growers with the lasting impression that government action was one way to increase their income. A third effect was

that, while not always strong, an interest in cooperative marketing pools has remained in the industry.

Cooperative Elevators Today

There have been cooperative elevators in the Michigan dry bean industry for more than fifty years. Until 1969, the cooperative elevators operated with the Michigan Elevator Exchange as their marketing agency on a voluntary basis: that is, they could market their beans through the Elevator Exchange if they so chose, but were not required to do so. Beginning with the 1969 crop year, the agreement between the Exchange and the local cooperatives was drawn up so that the local participating cooperatives are required to market all their beans through the Exchange. The local cooperative elevators handle approximately 25 percent of the total crop. The Exchange handles approximately 30-35 percent of the crop, picking up the additional amount from non-cooperative elevators.

Cooperative Pooling Today

Since the collapse of the overall pool in the 1930's, there have been continuing attempts by various cooperative marketing associations to organize pools. The latest association, Michigan Bean Growers Marketing Cooperative, was organized in March of 1965. Its major goal was to concentrate a major part of the bean supply in the control of a grower marketing organization. By doing this it was

hoped that growers could increase their market power and influence prices in their direction. This association set a goal of getting 75 percent of navy bean acreage under membership before the pool would become operative. Up to this time, the association has not been able to attract the necessary acreage thought necessary to implement its program.

In 1968, however, the association had a local cooperative elevator operate a smaller pool as a stop gap measure until 75 percent of navy bean acreage could be attracted into the larger pool. The smaller pool legally had no connection with the association and association members were not required to join it. While the small pool did not raise prices, industry people suggest that it might have kept fluctuations within the marketing system at a low level for the year it was in operation. The association was relatively inactive during the 1969 crop year, but it plans a new membership drive for the 1970 crop.

Government Price Support Program

After the demise of the Farm Board, the federal government moved toward price supports for agricultural commodities. However, there was no program intended specifically to support the price of dry beans prior to

World War II.[5] Purchases of dry beans for reliev feeding, school lunches, and other consumption programs did affect market prices, but there were no indications that this was their specific objective.

The first definite support program for dry beans came as a result of World War II. In 1941 a price support program was implemented to expand acreage of white varieties of dry beans.[6] The program was operated through purchases from dealers. The main objective of this program was to increase acreage by stabilizing prices.

After the war, the first support program was terminated. It was replaced by a support program operated through direct non-recourse loan and purchase agreements with growers. This latter type of support is still in operation today. The objectives of this program have been to stabilize the industry and raise producer income while maintaining at least a minimum acreage of beans.[7] This program has helped increase farmer income over what would have resulted under an unsupported market system. It has also increased stability over what it would have been under an unsupported market system.

The magnitude of government takeover of Michigan navy beans and government expenditures for this takeover

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[5]Dale E. Tathaway, The Effects of the Price Support Program on the Dry Bean Industry in Michigan, p. 13.

[6]Ibid., p. 14.

[7]Ibid., p. 15.

shows the dependence of this Michigan industry on the price support program for the period 1951-67. The government has had takeover in 14 of the 17 years (Table II-1). In this 17 year period approximately $87 million has been spent by the government in taking over an average 13.5 percent of Michigan navy bean production. This dependence on the price support program has been persistent even though the support price level was adjusted downward during this time period.

The government takeover of navy beans from this program has partially been disposed of through non-market channels such as the school lunch program and Public Law 480 donations. There has also been some disposal back into normal market channels, both domestic and export, but these statistics are not available. Therefore, the total effect of government actions on the commercial market can not be fully evaluated.

Markets for Navy Beans

The outlets for navy beans have changed during the last thirty years. Thirty years ago a large percentage of the navy beans sold to consumers were in the dry form. Today, it is estimated that 90 percent of navy bean production goes to the domestic consumer in canned form. While navy beans compete with great northern beans in the dry market, great northerns are not effective

TABLE II-1

GOVERNMENT SUPPORT PRICE, TAKEOVER AND EXPENDITURES FOR MICHIGAN NAVY BEANS, 1951-67[a]

	A	B	C
YEAR	Support Price $	Amount Government Takeover 1000 cwt	Government Expenditures[b]
1951	7.94	1130	8,972,200
1952	8.75	260	2,275,000
1953	8.80	377	3,317,600
1954	8.41	0	0
1955	7.43	623	4,628,890
1956	7.38	1747	12,892,860
1957	7.29	31	225,990
1958	7.17	9	64,530
1959	6.43	177	1,138,110
1960	6.46	1838	11,873,480
1961	7.15	1611	11,518,650
1962	7.15	964	6,892,600
1963	7.15	1012	7,235,800
1964	7.15	601	4,297,150
1965	6.90	0	0
1966	6.90	1676	11,564,400
1967	6.90	0	0
Total		12,056	86,897,260

[a]Sources: For years 1951-54 and 1957-67 a personal communication with the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, East Lansing, Michigan. For years 1955-56, U.S. Department of Agriculture, Federal Extension Service, Statistical Summary: Dry Edible Beans and Dry Field Peas, (October, 1964), p. 31.

[b]Government expenditures are equal to the support price per hundred-weight multiplied by takeover per hundred-weight.

competitors in the canned market. This leaves small white beans, grown in California, as the main competitor in the white bean canned market.

Exports add another dimension to the navy bean market. Navy beans have become increasingly dependent on the export market (Table II-2). The United Kingdom is the primary export market where Michigan navy beans compete primarily with Ontario navy beans.

Navy Bean Shippers and Canners

There are two types of marketing firms which handle navy beans between the time they leave the producer and the time they reach the wholesaler or retailer. They are the bean shippers and bean canners.

Producers generally deliver their navy beans to firms commonly called navy bean shippers. These shippers operate grain elevators which provide storage, drying, and transportation loading facilities. The shippers buy beans from producers and then sell them to processors or canners. The canners can be domestic or foreign.

The largest bean shippers are corporate or cooperative elevator chains which control a number of elevators. The four largest are the Michigan Bean Company, the Michigan Elevator Exchange, Frutchey Bean Company, and the Wallace and Morley Company. It is estimated that

TABLE II-2

U.S. EXPORTS OF NAVY BEANS AND NAVY BEAN EXPORTS AS A PERCENTAGE OF U.S. NAVY BEAN PRODUCTION, 1951-1967

(Navy Bean Exports in 1000 cwt.)

Crop Year Starting Sept. 1	Navy Bean Exports[a]	Exports as a % of U.S. Production[b]	Crop Year (Sept. 1)	Navy Bean Exports	Exports as a % of U.S. Production
1951	701	17	1960	640	11
1952	250	7	1961	902	13
1953	716	20	1962	1,704	25
1954	52	2	1963	1,938	26
1955	674	15	1964	1,550	23
1956	1,209	24	1965	1,075	20
1957	8	0	1966	2,044	28
1958	1,029	20	1967	762	16
1959	1,433	24			

Sources: [a]For years 1951-53, Roger J. Vandenborre, An Econometric Investigation of the Impact of Governmental Support Programs on the Production and Disappearance of Important Varieties of Dry Edible Beans (Giannini Foundation Research Report No. 294, California Agricultural Experiment Station, Berkeley, Dec. 1967). For years 1951-67, U.S. Department of Agriculture, Agricultural Statistics (Washington, D. C.: Government Printing Office, Various Issues).

[b]Production statistics taken from: U.S. Department of Agriculture, Crop Production (Various Annual Summaries).

these four shippers handle 90-95 percent of the navy beans produced in Michigan.[8]

Domestically, navy bean canners are the primary buyers of navy beans from these shippers. Canners also are the most important outlet for navy beans destined for consumption in the U.S. There are twelve major navy bean canners which buy dry beans and process them into canned products. Two of these, Stokely Van-Camp, Inc. and Campbell Soup Company reportedly sell nearly one half of the canned beans sold in the United States.[9] The navy bean canners are generally large multi-product companies which have canned navy beans as part of their product line.

The Michigan Bean Commission and the Michigan Bean Shippers Association

The Michigan Bean Commission was legislatively commissioned to begin January 1, 1966.[10] The commission consists of six grower representatives, two shipper-handler representatives, and one bean canner representative, with ex officio members from the Michigan

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[8]This discussion is taken from Marvin L. Hayenga, Structure and Problems of the Navy Bean Marketing System, p. 9.

[9]Ibid., p. 17.

[10]Michigan Department of Agriculture, Bean Commission Law (Pamphlet put out by the Commission, Act No. 114, Public Acts of 1965, Lansing).

Department of Agriculture and the Michigan State University College of Agriculture.

The commission may levy and collect assessment (currently 2 cents per hundredweight) from all participating dry bean growers in Michigan. According to the Bean Commission Law, the Commission may allocate its funds into various bean advertising, research, information or market development activities. The Commission maintains an office in Lansing and has been active in promoting navy bean products and supporting a small amount of research related to navy bean production practices, etc.

A marketing organization that has been in existence in the industry since 1892 is the Michigan Bean Shippers Association.[11] Its main objective is to advance the general interests of those engaged in the growing, handling and processing of Michigan dry edible beans.

The main function of this association is to establish trade rules for industry shippers, to acquire and disseminate pertinent information among its members, and to assist in establishing and maintaining uniform grades for Michigan dry edible beans. The establishing

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[11]Michigan Bean Shippers Association, Constitution and By-Laws of the Michigan Bean Shippers Association, (Publication put out by the Association, Saginaw, 1965).

and maintaining of grades is done in conjunction with the Michigan Department of Agriculture and the United States Department of Agriculture. The Association maintains an office in Saginaw.

Summary

Michigan has been prominent in the growing of beans since the turn of the century. During this time period, local elevator cooperatives, grower marketing pools, and a cooperative elevator exchange were started. Many of the local cooperative elevators and the elevator exchange are still operating. Other supporting market organizations in the industry are the Michigan Bean Commission and the Michigan Bean Shippers Association. The industry has also become highly concentrated at the shipper and canner level.

While all of these have played an important part in the industry, the dominant feature in the industry for the last thirty years has been a government price support program which has set a minimum price in the industry. This has given the industry participants some protection against production and price fluctuations. The producer and market organizations in the industry have become dependent on this program. Thus, the way the industry is now structured can in part be considered a result of this program, and a definite factor affecting the likely acceptance of any new or changed programs in the industry.

CHAPTER III

FORMULATION OF THE ECONOMETRIC MODEL

Annual navy bean production is primarily determined by the acreage planted and subsequent weather during the single growing and harvest season each year. Once production is determined, it plus carryover from the previous year define the U.S. supply for the current year. Since supply is fixed after harvest, demand conditions primarily determine the price at which the current year's supply will be sold.

The primary factors affecting annual navy bean supply and demand will be examined and formulated into a recursive econometric model. The available data and appropriate estimation procedure are subsequently considered.

Supply

Determining the acreage planted to navy beans is the first step in determining production and, consequently, supply of this crop. Navy beans are produced in Michigan as a cash crop; therefore, it is hypothesized growers respond readily to economic factors likely to change their income from navy beans. Navy bean price is an

important element affecting profitability and net income of navy bean producers. Thus, one would expect that navy bean producers respond to a higher expected price by increasing their planted acreage.

The specific way in which growers form their price expectations is probably complex and highly variable among growers. In this study, it is assumed that an 8-month average price (September to April) during the previous marketing season is the primary basis on which growers base their price expectations for next year and their corresponding planting decisions. Since much of the price variability in the industry arises from abandonment of acreage and yield variability, the grower has little more than last year's experience as to what prices might be in the current year, although USDA planting intentions report may plan a minor role.[1]

A second element that can affect grower acreage decisions is the price of competing crops that can be grown on the same land. Corn is the principle competitor of navy beans in Michigan. It is hypothesized that an increase in the average price of corn for the months October to April will lead to a decrease in the acreage planted to navy beans in the current year.

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[1]The announced government support price might also affect acreage planting decisions for some commodities. However, when equations were run making acreage planted a function of the announced support price, no statistically significant relationships were found.

A third variable assumed to be associated with acreage planted is the acreage planted the previous year. It is expected that acreage planted in the current year is positively related to acreage planted in the previous year; that is, if acreage planted was high in the previous year, it will be high in the current year. While this variable is primarily a predictor of acreage planted, several possible causal explanations can help explain this type of producer behavior. Producers could continue to grow the same crops because of habit or specialized know-how. They might also have crop rotations which they want to maintain or investments in specialized machinery which they want to recover.

The following equation represents the important variables assumed to influence planted navy bean acreage:

$$APNB = f(PNB_{t-1}, PC_{t-1}, APNB_{t-1})$$

where: APNB is acreage of navy beans planted in Michigan in thousands of acres.

PNB is average price (September to April) for choice handpicked navy beans in dollars per hundredweight paid to producers in Michigan.[2]

PC is average price (October to April) for corn in dollars per bushel paid to Michigan producers.

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[2] This price is a simple unweighted average of the quotation on the fifteenth of each month; 1951-56, Michigan Bean Company; 1957-67, Michigan Elevator Exchange.

Along with the acreage planted, two other factors affect production of navy beans. One of these is the acreage abandoned or not harvested. Producers might abandon acreage because of a low price for the product. This would show up as a negative relationship between acreage abandoned and price. The simple correlation of these two variables, however, was highly positive. This suggests that acreage abandoned was the cause rather than the effect of a low price. The abandoned acreage is, therefore, assumed to be determined by weather factors which can not be predicted. Consequently, an equation for acreage abandoned was not estimated.

The final factor affecting navy bean production is yield. Attempts were made to construct and estimate a navy bean yield function using acreage planted, expected price, a time variable for improved varieties and cultural practices, and a weather index. The results of the estimation were totally disappointing. Weather is undoubtedly the most important variable influencing yield in any given year, but no adequate weather index is available. Therefore, no yield function is estimated.

Demand

Commercial demand for navy beans consists of domestic and export demand. Since these two demand components are affected by different factors, they are considered separately in this section. The demand for small white

beans, a competing bean, and government demand, created by the price support program, are also discussed.

Domestic Demand

Sales of a commodity are determined by several factors. Typically, as price of the commodity goes up, the quantity sold goes down. Population and consumer income also are factors affecting the sales of a commodity. The quantity sold generally increases as population and consumer income increase.[3] Another determinant which helps to establish the quantity sold is the tastes and preferences of the individuals consuming the commodity. The price of related commodites, both substitutes and complements, make up still another determinant affecting the level of demand for a commodity.

The factors assumed to influence the domestic demand for navy beans at the local elevator level are: 1) the price of navy beans paid to producers, 2) population of the U.S., and 3) price of small white beans. The price paid to producers probably affects the price and profitability at each subsequent level in the marketing process, and the consequent quantity which would be

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[3]Increases in quantity sold brought about by a population increase are generally independent of the absolute, or starting, population level: a two percent rise in population will bring about an approximate two percent rise in sales.

purchased at the elevator level.[4] U.S. population and per capita income trends have been very highly correlated. Thus, U.S. population was used in the demand structure to account for both per capita income and population effects.[5] The price of small white beans was included because small white beans are a competitor of navy beans in certain areas of the country.[6] A lower small white bean price would lead to a shift to using small white beans by canners, and correspondingly less navy bean consumption at the current market price.

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[4]The price used in the demand structure is the same eight-month unweighted average price used in the acreage planted equation. The simple correlation between the 8 and 12-month average prices was .98. However, because of wide price fluctuations during the last four months of the crop year, caused by the selling of the remnants of the current year's production and expectations of the next year's production, the 8-month price gives a more accurate representation of price received for the current year's bean crop.

[5]Both population and income were not used because of the high correlation between the two variables which would result in multicollinearity. Multicollinearity results in less efficient estimators.

[6]Great northern beans, a larger type of white beans, were included in Hathaway's economic model; Dale E. Hathaway, The Effects of the Price Support Program on the Dry Bean Industry in Michigan. However, when included in the economic model of this study, no significant relationship between great northern and navy beans was found. A possible explanation for great northern and navy beans not being related to any significant extent at this point in time is that great northern beans compete almost exclusively in the dry bean retail trade, which now is very small, while navy beans are used mainly in canned bean products which are now the primary intermediate uses of dry beans in the United States.

A fourth variable included in the domestic demand equation was a dummy variable. This variable is zero for the years 1951-57 and one for the years 1958-67. It was included after observation of the data showed a large increase in domestic demand after 1957. While no apparent reason for this phenomena has been forthcoming, two possible explanations are offered. One, there could have been a change in the way data was reported, or two, there could have been a change in taste occurring for the commodity, although this seems highly unlikely in such a short time period. The effect of this variable is to allow a shift in the constant term in the domestic demand equation after 1957.

The following equation represents the variables assumed to influence domestic demand for navy beans.

DDNB = f (PNB, PSW, USPOP, DUMMY)

where: DDNB is domestic demand for navy beans in 1000 cwt., 12-month (September 1 - August 31).

PNB is average price (September to April) for choice handpicked navy beans in dollars per hundredweight paid to producers in Michigan.

PSW is 8-month average price for small white beans received by growers in dollars per cwt. (September 1 - April 31).

USPOP is average U.S. population (millions of people) during the year.

DUMMY is a variable which is zero for years 1951-57 and one for years 1958-67.

Demand for Exports

A large proportion of United States navy bean exports go to the United Kingdom. The other regular exporter of navy beans to the United Kingdom is Canada. Almost all of Canada's exports go to this market. Since the commodity being exported by these two countries is the same, exports from both countries are added together in the export equation. For this study, United States navy bean exports are assumed to be determined within the model while Canadian exports are assumed to be primarily determined by forces other than the variables included in the export demand equation.

The demand for exports should be influenced by determinants similar to those influencing domestic demand. The price of navy beans paid to Michigan farmers is the price assumed to influence the quantity demanded. However, a difference between domestic and export demand becomes apparent when the determinants influencing the level of demand in the export equation are considered. Since the United Kingdom is the primary market for both United States and Canadian exports, United Kingdom population is assumed to influence the level of demand for navy beans. Because this variable has been closely correlated with time, its estimated coefficient will probably pick up influence of other variables also

related to time but not included in the equation. Therefore, the clear interpretation of this coefficient may be difficult.

The equation to be estimated for exports is:

$$EXNB = f\ (PNB, UKPOP)$$

where: PNB was previously defined.

EXNB are United States exports (USEX) and Canadian exports (CANEX) for the crop year in 1000 (U.S.) cwt. EXNB equals USEX plus CANEX.

UKPOP is average United Kingdom population (millions of people) during the year.

Price of Small White Beans

The price of small whites should be influenced by the quantity of small white beans available. Other factors influencing price are demand shifters such as the price of competitive beans and population or income.[7]

The factors that are assumed to influence the price of small white beans are: (1) the production of small white beans, (2) the price of navy beans, and (3) United States population.

The equation to be estimated is:

$$PSW = f\ (PRSW, PNB, USPOP)$$

where: PSW, PNB and USPOP were previously defined.

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[7]Small white beans compete with navy beans for use in canned products like pork and beans.

PRSW is production of small white beans in 1000 cwt.

Government Role in Navy Beans

The demand structure for navy beans is not complete without considering the role of the government price support program. The government operates a price support program under which it sets a minimum price and theoretically takes sufficient quantity off the market to insure that the market price does not fall below the support price.[8] Whether a price support operation will be effective in any given year depends on the total supply of the commodity available in that year and the willingness of enough producers to allow the government to take ownership of the beans if the market price does not exceed or is not expected to exceed the support price.

A simplified example may make the operation of this program clearer. In this example, a linear demand curve is assumed (ABD in Figure 1). Supply is also fixed after the crop is harvested for a particular crop year.

If the net government support price is P_1: as shown in the diagram, the demand curve facing the

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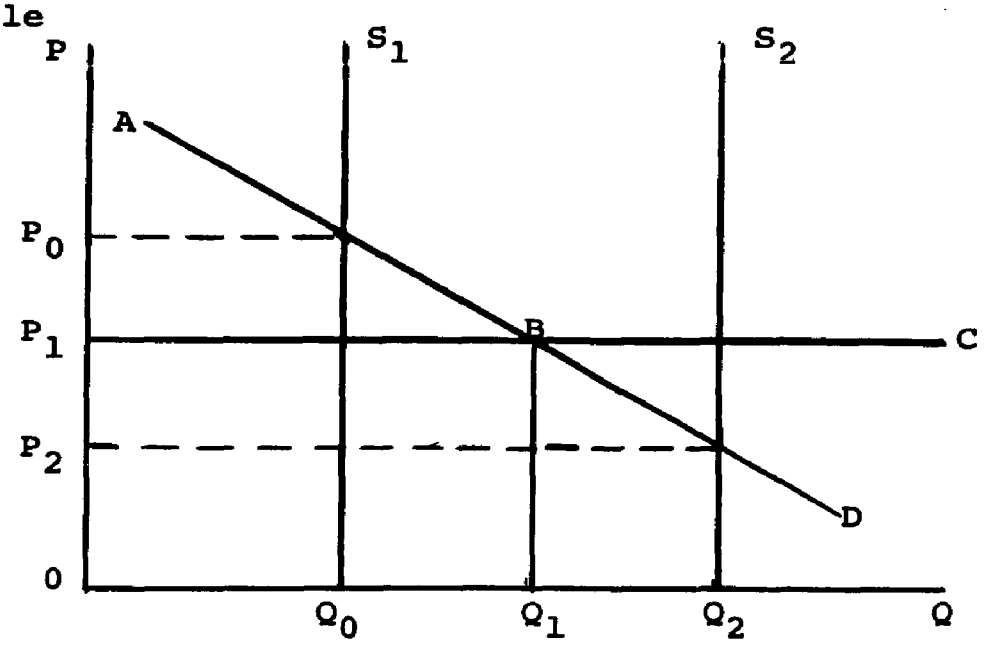
[8]The quoted support price is a gross price. To obtain a price equivalent to the market price or net price received by growers, a handling charge of approximately $.95 must be subtracted from the given support price.

producer is ABC as compared to ABD without the price support. The demand curve is completely elastic for quantities greater than Q_1. If supply for a given year is greater than Q_1, the price does not fall below P_1, the price support level, because the government purchases the quantity needed to maintain the market price at P_1. For example, if supply for a given year is Q_2, without a price support program, the market price would be P_2 and the entire quantity Q_2 would go into the commercial market. However, with the price support program, the government purchases a quantity necessary to maintain price at the support level. In the case of supply Q_2, quantity $Q_2 - Q_1$ is bought by the government, while quantity Q_1 is sold in the commercial

FIGURE III-1

Operation of Government Price Support Program

Example



market. If supply is less than Q_1, the price support is not effective for that time period and no government takeover occurs. For example, if supply after harvest is Q_0, market price is P_0, which is above the support level of P_1. Therefore, the entire quantity goes into the commercial market.

In actual practice, the market price sometimes falls a small amount below the support price because of the way the government mechanism works. In large crop years, if market price approaches the net support price, producers can put all or part of their production under loan to the government. They receive the net support price. If the market price goes above the support price, they can sell their beans in the commercial market and repay the loan to the government. If the market price does not rise above the support level by a certain date (set by the CCC each year), the producer can let the government take over the quantity of beans under laon, as payment for the loan. Uncertainty as to what market price will do may cause enough producers to retain ownership so that the market price may fall below the support price due to insufficient takeover in some years.

Given supply, commercial demand, and the price support level for navy beans, the amount of government takeover in any given year can be determined. The price support program, by setting a floor or market price,

creates an elastic demand for the product at this price and government takeover is a residual amount. Therefore, an equation for government takeover need not be estimated.[9] Two identities complete the demand structure. The first identity fixes the supply at the beginning of a crop year; the second identity in effect subtracts the government price support pruchases from total supply to give total commercial consumption, thus closing the demand structure.

The identities are:

SUPNB = PRNB + BINV

SUPNB = DDNB + USEX + GDNB

where: DDNB and USEX were previously defined.

PRNB = production of navy beans in U.S. in 1000 cwt.

BINV = beginning inventory (September 1) for navy beans in 1000 cwt.

SUPNB = U.S. supply of navy beans in 1000 cwt.

GDNB = government navy bean takeover in 1000 cwt.

Model Estimation Procedure

Any model development involves certain arbitrary judgments as to variables chosen and estimation procedures

[9]The estimation of the demand structure is done under the assumption that government disposal of navy beans has not entered back into the commercial market. This probably leads to an underestimation of domestic commercial disappearance since some of the government takeover has gotten back into the commercial market in some short crop years.

used. Data limitations and cost of estimation are prime considerations in these judgments. Only recently have navy bean data been separated from all dry bean data. Because of this, only the years 1951-67 are used in the estimation procedure. The use of two different estimation procedures were used due to the differing structures of the supply and demand relationships within the industry. The behavioral model can be summarized into the following stochastic model.

Supply Structure:

$$APNB^* = A_0 + A_1 PNB_{t-1} + A_2\ PC_{t-1} + A_3 APNB_{t-1} + V^{**}$$

Demand Structure:

$$DDNB^* = B_{10} + B_{11}\ PNB^* + B_{12}\ PSW^*\ B_{13}\ USPOP + B_{14}\ Dummy + U_1^{**}$$

$$EXNB^* = B_{20} + B_{21}\ PNB^* + B_{22}\ UKPOP + U_2^{**}$$

$$PSW^* = B_{30} + B_{31}\ PNB^* + B_{32}\ USPOP + B_{33}\ PRSW + U_3^{**}$$

$$SUPNB - GDNB = DDNB^* + EXNB^* - CANEX$$

*Endogenous variables

**V and U are the disturbance terms for the equations.

The acreage planted equation has only one endogenous variable. Ordinary least squares was used to estimate it. A linear functional relationship between variables was also used. Ordinary least squares gives the best, linear, unbiased, consistent estimated coefficients of the equation under the following assumptions: 1) disturbance terms have a zero mean, 2) variance is equal over all

observations (homoscedasticity), 3) there is zero correlation between disturbance terms for any length of time between them, and 4) all variables other than the dependent variable are predetermined.[10]

As shown in the stochastic presentation, the demand structure consists of three equations and an identity. There are four endogenous variables in the structure. In reality, the values of these endogenous variables are determined simultaneously (within the same period of time). It has been shown that ordinary least squares estimation of the demand structure would result in biased estimates of the parameters.[11] If the equations in the structure are just-identified or over-identified, the equations can be estimated using simultaneous estimation procedures. Since the equations in the demand structure are identified or over-identified according to the rank and order conditions, they were estimated using three stage least squares (3SLS). Three stage least squares gives consistent and asymptotically efficient estimates when it is assumed that the demand structure exhibits the following properties: 1) the disturbance terms have a

[10]A simultaneous estimation procedure could also have been used with the results being the same as the ordinary least squares results. Since ordinary least squares estimation procedure is the least expensive, it was used.

[11]J. Johnston, Econometric Methods (New York: McGraw-Hill Book Company, 1963), p. 233.

zero mean, 2) the variance of disturbance terms is constant over all time periods, 3) the disturbance terms are independent over all time periods, and 4) the exogenous variables are nonstochastic.

CHAPTER IV

ESTIMATED SUPPLY AND DEMAND RELATIONSHIPS IN THE MICHIGAN NAVY BEAN INDUSTRY, 1951-67

The economic forces at work in the Michigan navy bean market during 1951-67 can provide insight into why the market has behaved as it has, and be useful in interpreting future market behavior. The statistical estimates of the navy bean industry supply and demand model provide a picture of the major influences on market behavior. In analyzing individual equations, an evaluation of important results obtained and their implications are given. Some shortcomings and weaknesses of the results are also considered and some implications for specific industry programs are suggested.

Estimated Results

The results of the ordinary least squares estimation of acreage planted and the 3SLS estimation of the demand structure are given in Table IV-1. The variables shown in this table were defined in Chapter III. The procedure used to calculate the R^2 (the percentage variation in the normalized endogenous variable explained by

TABLE IV-1

ESTIMATES OF STRUCTURAL EQUATIONS IN THE MODEL

Equation	Normalized Endogenous Variable		Coefficients[a] (standard errors of coefficients) and explanatory variables[b]	R^2 (Durb.-Wat. Stat.)
1	APNB	=	$317.5776 + 0.5112APNB_{t-1} + 20.4132PNB_{t-1}$ (114.8333) (0.1307) (7.1419)	
			$-181.0371PC_{t-1}$ (51.3822)	.89 (1.71)
2	DDNB	=	$-548.0385 - 80.1858NB + 13.6156PSW$ (4098.8389) (822.9839) (468.6216)	
			$+24.5519USPOP + 696.2777DUMMY$ (28.0938) (1358.3249)	.75 (2.48)
3	EXNB	=	$-15332.2373 - 63.7641PNB + 323.5717UKPOP$ (4268.6814) (159.1106) (77.3603)	.55 (2.41)
4	PSW	=	$-2.3352 + 0.7357PNB - 0.0034PRSW$ (3.5183) (0.2190) (0.0011)	
			$+0.0514USPOP$ (0.0199)	.88 (2.58)

[a]Not all the coefficients are significant to four decimal places.

[b]Definitions of variables are given in Chapter III.

the other variables in the equation) for each equation in the demand structure is the same procedure that is used in the ordinary least squares estimation method, which was used for the acreage equation. Consequently these values are not strictly valid when 3SLS is the estimation procedure. However, they do give an approximate measure of the fit of the arbitrarily designated dependent variable to the other variables in the equation.

Durbin-Watson statistics, used to test for serial correlation of residuals, are also presented for each equation, but again these in the demand structure are not strictly valid for a simultaneous system of equations. They can, however, provide a quasi-index of serial correlation. If the demand structure was a system of independent equations, all the Durbin-Watson statistics are within the acceptable range.

While it is difficult to evaluate the performance of a model with any single criterion, there are several criteria that can give a fairly reliable indication of the model's performance. These criteria include: (1) the variation in the normalized endogenous variable explained by the other variables in the equation--R^2, (2) the statistical significance of the model's coefficients, and (3) the sign and magnitude of the model coefficients when compared to the economist's expectations (based on real world and theoretical considerations).

Using the first criterion, the model has fairly good results. The R^2 value for the acreage planted equation was .89. The R^2 values in the simultaneously estimated demand structure ranged from a low of .55 to a high of .88. Export demand was the endogenous variable least well explained by its equation. This result could have been anticipated from the formulation of the equations. When an equation estimates the exports of two countries, the likelihood of omitting important "local" variables affecting exports is greater.

The second criterion, the significance of the coefficients, can be evaluated by calculating the ratio of the coefficient to its standard error (both shown in the table). While some variables may not be statistically significant when compared to an arbitrarily chosen significance level, they may be included to make the model compatible with its further uses. This criterion does, however, provide a guide to the retention or rejection of variables not otherwise crucial in the remainder of this study. The above criteria and the conformity of the statistical results with those expected on the basis of our theoretical understanding of market behavior are discussed in detail in what follows.[1]

[1]The analysis of estimated results of the demand structure with more than one jointly dependent variable in each equation needs clarification. This analysis can be done on the equations as they were presented in Chapter III. It can also be done by making each jointly dependent variable a function of only exogenous variables (reduced

Navy Bean Acreage Planted[2]

The explanatory value of the variables expected to be related to acreage planted decisions of farmers was quite high. The calculated R^2 for equation one was estimated at .89.

The signs of the coefficients are reasonable, although the magnitudes may be less than some economists might expect. An increase in navy bean price in the preceding year has been associated with an increase in planted navy bean acreage. An increase in last year's navy bean price by one dollar has typically resulted in a 20,413 acre increase in the current year's acreage planted; that is, a one percent change in the previous year's navy bean price has been associated with a .28 percent change in acreage planted in the current year in the same direction.[3] These results indicate the acreage planted is relatively unresponsive to different price levels. In a similar earlier study, Vandenborre found an elasticity of dry bean acreage planted with respect to last year's dry bean price of .39.[4]

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form equations). The analysis will be done on the equations as they were presented in this Chapter III; that is, only direct effects will be considered.

[2]In the calculations in the descriptions all other explanatory variables are held constant when the first derivative is taken.

[3]The calculation of elasticities in this study are done at the mean for the variables used.

[4]Roger J. Vandenborre, An Econometric Investigation

Corn, as a competitive cash crop, would be expected to infringe on navy bean acreage if corn became relatively more profitable, or vice versa. A ten cent drop in last year's corn price increased the current year's planted acreage of navy beans by 18,103 acres. The elasticity of acreage planted with respect to corn price the previous year was estimated at -.44. Vandenborre estimated this elasticity at -.34.[5] This result indicates that growers have substituted the planting of corn for navy beans, if the relative price position the previous year warrants such a move.

The acreage planted the previous year has been positively related to acreage planted in the current year. This would seem to indicate that growers' decisions are influenced by their previous decisions or by the continuing influence of the same factors which prompted their decision last year. If a grower planted a large acreage the previous year, he will plant a large acreage in the current year.

The implication of the estimated parameters is that wide price fluctuations in the industry will only lead to small percentage responses in acreage planted.

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of the Impact of Governmental Support Programs on the Production and Disappearance of Important Varieties of Dry Edible Beans, p. 33.

[5] Ibid.

The size of the constant term is quite large, representing over half the acreage planted in any of the years. This could be a result of the government price support program causing a stable expected price, which could have led to a fairly large "base acreage" in the time period under study.

Navy Bean Domestic Demand

The percentage of variation in domestic demand (R^2) explained by the equation was 75 percent in equation two. Signs of the coefficients were consistent with expectations. Navy bean price has been inversely related to domestic sales of navy beans; that is, as price of navy beans moved in one direction, domestic sales moved in the opposite direction. The price elasticity of demand with respect to navy bean price has been -.14. Retail price generally is quite stable, perhaps because beans only contribute a small proportion of the total cost of the retail canned beans. This may be part of the cause of the inelastic demand situation at the elevator level.

Domestic demand and the price of small white beans move in the same direction. A one dollar increase in the small white bean price has been associated with a 13,615 hundredweight increase in domestic consumption of navy beans. The cross-elasticity of demand has been .03. Thus, the small white bean price has very little influence

on the domestic demand for navy beans. Since small white bean production is so small in proportion to total navy bean production, this result was to be expected.

United States population changes have had a positive effect on domestic demand. A one million increase in population has been associated with a 24,551 hundredweight increase in domestic demand. In percentage terms, a one percent change in U.S. population has been associated with a 1.14 percent change in domestic demand. Over the estimated period, domestic demand was growing at a rate slightly larger than population was growing. Since there is a high correlation between population, income and time, the population variable could have picked up some of the effects of income increases or other variables related to time.

The dummy variable has a coefficient of 696, which means the constant term is increased by that many 1000 hundredweight after 1957. This was the result expected of this variable after observation of the raw data. However, no clear-cut explanation of this observed phenomena has been found.

In summary, the domestic demand for navy beans is quite inelastic with demand growing only slightly faster than population. This, coupled with the low influence of small white bean price on navy bean domestic demand, suggest that substantial increases in price would result from small decreases in supply.

Navy Bean Export Demand

Approximately 55 percent of the variation in U.S. and Canadian exports was explained by the other variables in the equations. The signs of the coefficients are consistent with expectations. Exports have typically expanded when price decreased. The price elasticity of export demand has been -.36, which makes it approximately two and one-half times as elastic as domestic demand. It was hypothesized that exports are more price elastic than domestic demand. However, even though this has been observed, the fact that export demand was inelastic (price elasticity less than an absolute value of -1) is somewhat surprising, although the elasticity for two countries (as in this equation) would be less elastic than one country. The competitiveness of international markets and the general availability of substitute products usually make export demand price elastic (price elasticity greater than an absolute value of -1). However, since this particular export market involves only a few countries (United Kingdom and a few other western European countries), an inelastic export demand might be expected. The export market stimulates more countries into the market at low prices. If the price support level had not been as high in the past, other importing countries might have been prompted to enter the market at lower prices, creating a more elastic export demand curve.

There has been a positive relationship between navy bean exports and the United Kingdom's population, which is consistent with expectations. However, the magnitude of the coefficient is extremely large, which suggests that this variable has picked up the influence of other variables omitted from the equation, but associated with time (U.K. population size also has been highly correlated with time). Therefore, by itself, the U.K. population coefficient does not fully explain the growth in navy bean exports over the estimated time period. Part of the magnitude of this variable might be the influence of export market development activities which have increased in recent years but which cannot be adequately quantified.

Small White Bean Price

The percentage of variation in small white bean price (R^2) explained by the equation was 88 percent. The signs of the coefficients are consistent with expectations. There has been a negative relationship between small white bean production and price. An increase in small white bean production of 100,000 hundredweight has been associated with a decrease of $.34 in small white bean price. The price flexibility of demand was -.23; that is, a one percent change in production was associated with a .23 percent change in price.

Small white bean price and navy bean price were positively related in this equation. A dollar increase in navy bean price has been associated with a $.73 increase in small white bean price. Since navy beans are usually shipped to small white bean production areas, one would expect that small white bean price would be strongly related to navy bean price. In percentage terms, a one percent change in navy bean price has been associated with a .52 percent increase in small white bean price. A large percentage of the variation in small white bean price is explained by variation in navy bean price.

U.S. population has also been positively related to the price of small white beans. A million person increase in population has been associated with an increase of $.05 in small white bean price.

Data Required for More Detailed Analysis

The price used in the model was an unweighted 8-month average. If sales volume at each price could be obtained, an improved weighted average price could be used in the demand structure, probably resulting in improved R^2 and significance of the variables.

The magnitude of the coefficient for U.K population probably reflected the effect of some ommitted variables in the export equation. A closer study of the export market, if and when data become available, might

show the need for more than one export equation and the addition of a market development activity variable to the existing equation. Improved data and additional equations would help reduce part of the present unexplained variation in exports.

A more accurate breakdown of where production goes would also help improve the estimated results. Some of the unexplained fluctuations in domestic and export sales could then be explained, thus, improving the R^2 and significance of the variables.

Summary and Conclusions

The model and the estimated results seem reasonable when evaluated in the context of signs of coefficients and the correlation coefficients. However, the significance and magnitudes of some variables suggest that further improvements in the model could be made when data becomes available.

In terms of usefulness, the estimated model provides a quantitative picture of recent demand and supply relationships in the navy bean industry. This information can be useful to persons contemplating public policy changes in the industry. Further, these equations can be used for prediction purposes. Given the acreage planted the previous year, the price of navy beans and of corn for the previous year, an estimated acreage

planted for the current year can be obtained. Using estimates of production, an estimated price, domestic demand, and export demand can be obtained. These estimates can help different industry participants plan their market activity for the current year. Finally, further research needed in the industry and the data needed to carry out the research are pointed out.

CHAPTER V

EVALUATION OF PRICE AND SUPPLY CONTROL PROGRAMS

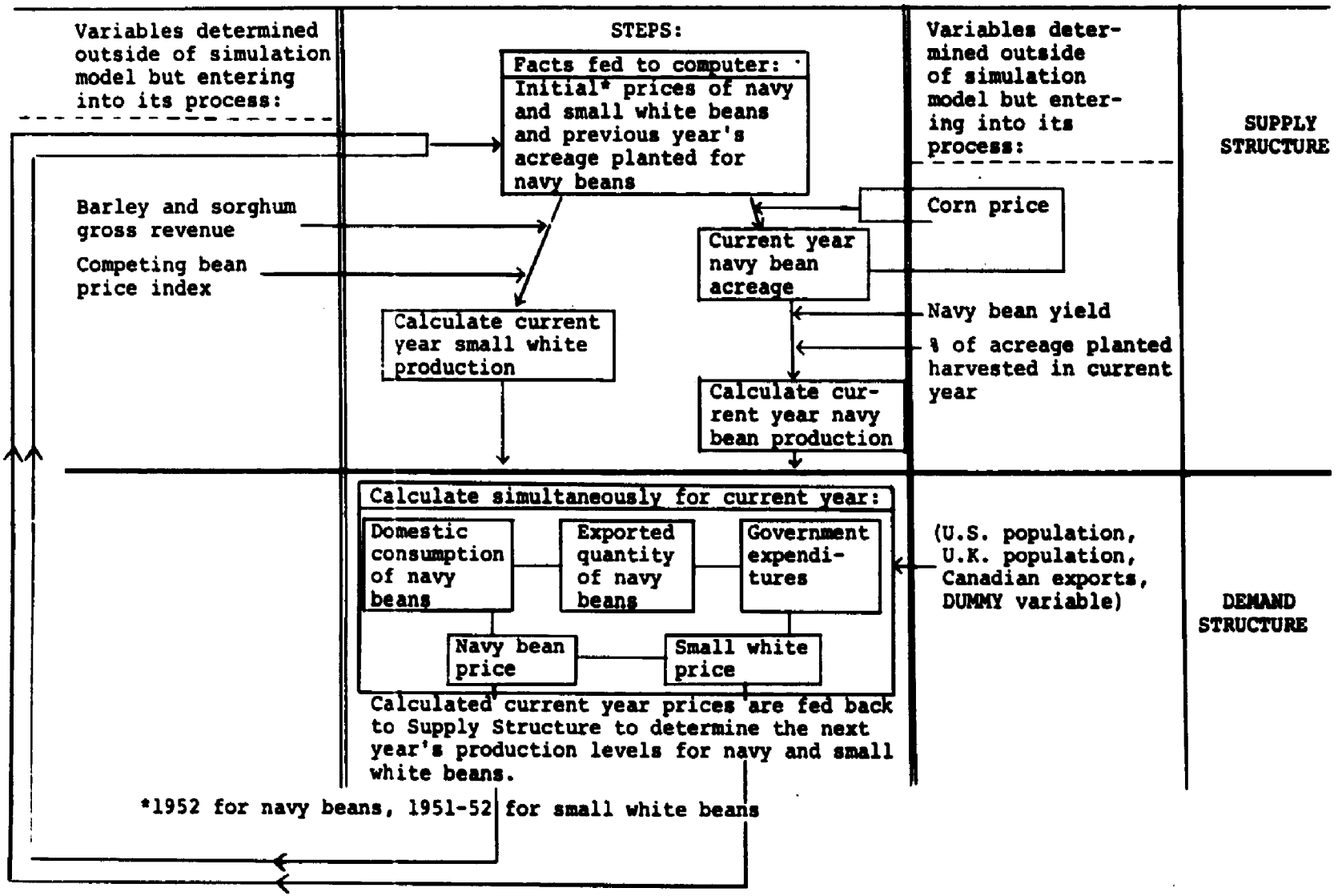
The previously estimated equations were used in developing a simulation model which simulates the supply-demand behavior in the navy bean industry. This dynamic computer model provides a means of experimentally evaluating alternative price and supply control programs which might be instituted in the industry without exposing the industry to the actual consequences of each program. Basically, the simulation model can be used to answer the question: What would have resulted in the navy bean industry if the government or private control programs under study had been in operation during the period 1953-67? This answer should also provide some insight into the likely relative future benefits of these programs if they would be implemented in the industry.

Basic Dynamic Framework

The design of the simulation model was based on an information-feedback loop involving the price and production of navy and small white beans (See Figure V-1). The previous year's navy bean price was fed into the navy

FIGURE V-1

INFORMATION-FEEDBACK DESIGN USED IN THE SIMULATION MODEL



bean acreage planted equation. Using the actual previous year's corn price, the planted acreage was predicted. This estimate was multiplied times the actual proportion of dry bean harvested in Michigan and actual navy bean yield for that year to obtain navy bean production.

For small white beans, the small white price of the previous two years was used, along with the previous year's barley and sorghum gross revenue and competing bean prices, to determine the production of small white beans. These two production figures were then put into the simultaneous demand structure. Along with the actual values for the variables determined outside the model (U.S. and U.K. population and Canadian exports), these variables were used to determine price of navy beans, price of small white beans, and domestic consumption, exports, and government purchases of navy beans. The generated prices were then fed back into the production equations to start the process again for the next year.

Each year all the variables were stored, printed out, and used in subsequent analysis and evaluation. For example, these variables were used to calculate producer gross income from navy beans and domestic per capita consumption of navy beans, two measures of program performance which might be considered important by some industry members. The value of each of the generated

variables for evaluation purposes varies for different industry groups. All industry groups would be interested in the price of the product since it affects everyone's welfare. Farm input suppliers would be interested in acreage planted because this would probably be closely related to the volume of purchased inputs. Canners would be interested in domestic consumption since this is a measure of their aggregate volume. Shippers would be interested in the production level, which determines their volume of business. Consumers would be interested in per capita consumption and the price level at the elevator level, which might affect their retail prices somewhat. The gross income from navy beans relative to the number of acres planted would be of most interest to producers.

However, the reader must be cautioned in examining this income figure. It is only for gross income from navy beans and not the navy bean producers' total gross income. The study is too limited to examine the implications of all possible switches in cropping mix. What can be said is that if producers' gross income from navy beans rises on fewer acres, one would expect that the navy bean producers' net income from beans and total gross income would also rise. So, navy bean producers' total gross income for different

industry programs should not be compared without considering the associated navy bean acreage under each program.

The equation used for estimating small white bean production was taken from a previous study.[1] The influence of the price of small white beans the previous two years, an index of competing bean prices, and average gross income of barley and sorghum per acre to California producers were consistent with expectations and significantly different from zero.[2]

The estimated results for this equation along with its correlation coefficient, standard errors, and Durbin Watson statistic are:

$$PRSW = 2{,}739.6010 - \underset{(157.0015)}{729.3139} \log GIBS_{t-1}$$

$$+ \underset{(106.1815)}{647.6832} \log PSW_{t-1}$$

$$+ 119.0698 \log PSW_{t-2} - 406.6399 \log CBPI_{t-1}$$

$$R^2 = .86 \qquad \text{D-W statistic} = 2.31$$

where PRSW and PSW were previously defined. GIBS is average gross income of barley and sorghum to California producers. CBPI is average price of competing beans (to small white beans) per cwt. paid to producers.

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[1]Roger J. Vandenborre, An Econometric Investigation of the Impact of Governmental Support Programs on the Production and Disappearance of Important Varieties of Dry Edible Beans, p. 30.

[2]Small white beans are grown exclusively in California.

The five behavioral equations used in the simulation model are shown below:

$$APNB^* = 317.5776 + 0.5112APNB_{t-1} + 20.4132\ PNB_{t-1} - 181.0371\ PC_{t-1}$$

$$PRSW^* = 2{,}739.6010 - 729.3139 \log GIBS_{t-1} + 647.6832 \log PSW_{t-1} + 119.0698 \log PSW_{t-2} - 406.6399 \log CBPI_{t-1}$$

$$DDNB^* = -548.0395 - 80.1858PNB^* + 13.6156\ PSW^* + 24.5519\ USPOP + 696.2777DUMMY$$

$$USEX^* = -15{,}332.2373 - 63.7641\ PNB^* + 323.5717\ UKPOP - 1.0\ CANEX$$

$$PSW^* = -2.3352 + 0.7357PNB^* - 0.0034\ PRSW + 0.0514\ USPOP$$

*Endogenous variables

The behavioral structure of the simulation model was these equations except where specific modifications seemed desirable to improve the realism of the simulated results.

By simulating industry behavior during 1953-1967, actual data could be used for the variables assumed to be determined outside the economic model. To start each simulation run, the actual 1952 navy bean price and planted acreage were used. The actual 1951 and 1952 small white bean prices were also used. In succeeding

years of each simulation run, the simulated navy bean price, planted acreage, and small white bean prices from the previous year were used.

Validation of the Model

After the simulation model was built, it was tested to see if it functioned realistically; that is, did it duplicate reality with any degree of accuracy? To test this, the actual government price support program that operated in the navy bean industry and the small white bean industry from 1953-1967 was inserted into the basic simulation model. In this simulation, it was assumed that government takeover was not placed back into the commercial market. This assumption was made because a breakdown of government commercial sales and donations of navy bean takeover was not available. Since it appeared that most of the government disposal was via donation, this assumption appeared fairly realistic.

In the first runs of the simulation model, the estimated equations in the demand structure were used with no restrictions on the top portion of the demand curve. The results of these early runs showed that in the years when there was no government takeover of navy beans, the simulated navy bean price was substantially above the actual price observed in those years. From studying the actual price and supply values, it was

observed that the average navy bean price for a year went above $8.50 in only one year from 1953 to 1967, even though supply was small in several years. This suggested that demand was less inelastic at higher price levels. At higher price levels, there are probably other goods that consumers substitute for navy beans.

To make the top portion of the navy bean demand structure conform more closely to past behavior, the estimated linear demand structure was modified for navy bean prices greater than $8.50. For supply less than 800,000 hundredweight, a maximum price of $10.50 was set. Between $8.50 and $10.50, the following equation was used:

$$PNB = 10.9 - 0.0005\ SUPNB.$$

This flatter demand structure better fit the few observations available in the upper portion of the demand curve.

With the addition of the government price support program and the above modification in the demand structure, the model was then run to simulate what actually occurred from 1953 to 1967 in the navy bean industry. The annual values for some selected performance variables from this run are presented in Table V-1. They include navy bean acreage planted, producer gross income

TABLE V-1

ACTUAL AND SIMULATED RESULTS OF THE NAVY BEAN GOVERNMENT PRICE SUPPORT PROGRAM, 1953-1967[a]

YEAR	Navy Bean Domestic Consumption 1000 cwt.		Navy Bean Exports 1000 cwt.		Navy Bean Government Takeover 1000 cwt.		Government Expenditures for Navy Bean Takeover (Million $)	
	Actual	Simulated	Actual	Simulated	Actual	Simulated	Actual	Simulated
1953	2508	2884	716	153	377	592	3.3	5.2
1954	3106	2836	52	0	0	0	0.0	0.0
1955	3131	3120	674	702	623	403	4.6	2.9
1956	2064	3191	1209	711	1747	1132	12.9	8.4
1957	3319	3055	8	220	31	0	.2	0.0
1958	4004	4072	1029	1063	9	254	.1	1.8
1959	4459	4181	1433	1086	177	1047	1.1	6.7
1960	3367	4265	640	1109	1838	712	11.9	4.6
1961	4242	4250	902	1295	1611	1322	11.5	9.4
1962	4054	4325	1704	1222	967	1515	6.9	10.8
1963	4649	4375	1938	1527	1012	2000	7.2	14.3
1964	4640	4455	1550	1348	601	637	4.2	4.6
1965	4405	4364	1075	332	0	0	0.0	0.0
1966	3567	4590	2044	1416	1676	1070	11.6	7.4
1967	4025	4466	762	388	0	0	0.0	0.0
Average Difference	303		362		414		2.7	

[a]The sources for the actual data are given in Appendix B.

TABLE V-1 (continued)

YEAR	Navy Bean Planted Acreage (1000 A)		Navy Bean Production 1000 cwt.		Small White Production 1000 cwt.		Navy Bean Price $/cwt.		Small white Price $/cwt.		Producer gross income from navy beans (million $)	
	Actual	Simulated	Actual	Simulated	Actual	Simulated	Actual	Simulated	Actual	Simulated	Actual	Simulated
1953	350	371	3601	3629	560	576	7.83	7.85	9.81	9.73	28.2	28.5
1954	441	417	3158	2836	731	678	9.37	9.48	10.97	10.72	29.7	26.9
1955	489	476	4428	4225	884	752	6.48	6.48	8.26	8.40	28.7	27.4
1956	477	490	6020	5034	771	717	6.17	6.43	7.71	8.64	31.0	32.4
1957	482	483	3358	3275	759	657	7.62	9.26	9.05	11.09	25.6	30.3
1958	514	559	5042	5388	800	846	6.44	6.22	9.23	8.36	32.5	33.5
1959	511	538	6069	6314	943	669	5.46	5.48	7.48	8.57	33.1	34.6
1960	497	521	5845	6086	618	618	5.46	5.51	8.46	8.92	31.9	33.5
1961	508	520	6755	6867	438	430	6.00	6.20	10.78	10.33	40.5	42.6
1962	516	545	6725	7062	542	506	6.07	6.20	9.02	10.12	40.8	43.8
1963	519	543	7599	7903	607	575	6.15	6.20	9.36	9.99	46.7	49.0
1964	556	529	6801	6440	514	576	6.61	6.20	10.95	10.14	45.0	39.9
1965	600	517	5480	4696	578	435	8.35	8.55	12.35	12.50	45.8	40.2
1966	577	560	7289	7075	670	576	6.01	5.95	9.12	10.21	43.8	42.1
1967	493	500	4787	4854	470	458	8.35	8.50	12.95	13.27	40.0	41.2
Average Difference	24		244		58		.23		.70		2.4	

from navy beans, government expenditures on navy bean takeover, government takeover of navy beans, navy bean domestic consumption, navy bean exports, and government takeover of small white beans.[3] The comparable actual results are also given in the same table.

Comparison of the actual results and simulated results indicated that the simulation model performed fairly well in simulating values for the selected variables. The average values for these comparisons performed better than the year to year results (the average values are shown in Table V-2). This was to be expected because the few variables in each estimated equation did not completely explain the variation of the dependent variables. The largest difference arose in the allocation of supply between domestic and export markets with domestic consumption higher and exports lower than what actually occurred.

After duplicating the actual situation, the next step in validating the model was extending the estimated relationships beyond observed price levels so other programs potentially involving these price levels could be evaluated. The extension of the model in the unobserved price range was accomplished by simulating an unsupported market. The first simulations of this situation

[3]While the government price support program was in effect for small white beans from 1953-1967, almost no government takeover occurred. The simulation had no small white bean government takeover.

were based on the assumption that the estimated relationships between variables were valid over the entire navy bean price range. However, this assumption may be questioned because there were no price observations below the government price support level. But, the unsupported market and some of the other simulated programs might touch these lower price levels. Consequently, the validity of this assumption was carefully examined for both the demand and acreage response equations during the unsupported market simulation.

To improve the realism of the unsupported market simulation, it was assumed that navy bean price would not fall below $2.00 per hundredweight. As price falls, new demands for navy beans would probably show up. For example, there is a price where navy beans could be used as livestock feed. There also can be a speculative storage demand where beans would be bought and stored at a low price in the hope that price would go up in the future and they could then sell at a profit. The $2.00 floor was chosen because it was consistent with observations of the lower limits of average navy bean prices prior to introduction of the government price support program.

The acreage planted equation was assumed to have the same slope below the price support level that it had above that price level for all the simulations. An

analysis of costs and returns for navy beans showed that navy bean price would have had to average approximately $4.57 per hundredweight to be at a breakeven profit level with corn for a large number of producers.[4] Producers expect navy bean price fluctuations and further, have specialized technical knowledge and equipment. They also are influenced by fairly fixed crop rotations and habit. Thus, one might reasonably expect that producers would continue to grow some beans even though price might fall to very low levels in one year (so long as the average price received over a longer period of time still made them competitive with

[4] In a study of cost and returns to cash crops (Larry J. Connor, Costs and Returns for Major Cash Crops in Southern Michigan: Michigan State University Agricultural Economics Report No. 87, East Lansing, Nov. 1967; pp. 8 & 16), it was estimated the cash cost for growing field beans was approximately $14 less than for growing corn on the loam-clay soil found in the "Thumb." From 1953-1967, average price of corn in Michigan was $1.14 per bushel and the yield was 56.8 bushels per acre. This gives an average gross income of $64.75 per acre. To obtain an income figure comparable with navy bean gross income, the $14 additional cash cost per acre for corn was subtracted from this gross income figure. The value obtained was $50.75. Given that the average navy bean yield was 11.1 hundredweight per acre for 1953-1967, an average navy bean price of $4.57 would have been the breakeven point between corn and navy beans. The data to compute the average values was taken from: U.S. Department of Agriculture, Agricultural Prices (Washington, D.C.: Government Printing Office, various issues) for corn prices; Michigan Department of Agriculture, Michigan Agricultural Statistics (various issues) for corn yield; and personal communication with U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, East Lansing, Michigan for navy bean yield.

alternative crops). If the average navy bean price for the 15 year period were to fall to $4.57 for any of the simulations, a re-examination of the acreage equation should be made. However, it was felt that a slope similar to that obtained in recent years was a reasonable approximation of the actual average response which producers would have had to lower price level in this study.

Based on the comparisons of the actual and simulated results of the actual situation, it appeared that the simulation model came reasonably close to duplicating likely industry behavior. The modifications made to the estimated linear equations appeared to be reasonable approximations of industry behavior under low price situations which have not been observed recently. Consequently, it was decided that the simulation model could be used to realistically test price and supply control programs which might be considered for the industry.[5]

Program Testing and Evaluation

The different programs to be examined included: (1) variations in the government price support levels,

[5]The simulation program used in the study is stored in the Department of Agricultural Economics, Michigan State University, East Lansing.

including an unsupported market situation, (2) private (non-governmental) price support-storage program, (3) marketing quota or control, (4) acreage control, and (5) a two price system.[6] These programs are not the only ones that might have relevance for the navy bean industry. However, they are programs which have been considered or utilized in other commodity situations plagued by highly variable production and price levels.

Variation of the Government Price Support Level

One factor normally considered by policy-makers when they are discussing a price support program is government expenditures. With the decreasing relative importance of agriculture in the total economy, it has become harder to get large amounts of government expenditures for a price support program and higher price support levels. At the same time other groups in the country are placing demands for increased government expenditures in the urban areas of the country. Demands are also being placed for government expenditures to fight pollution wherever it is found. Part of the funds now going to agriculture may be shifted into other

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[6]With the exception of the variation in the government price support levels, the programs were not used for small white beans in the simulations. Small white bean price and supply were not controlled or supported. In the variation of the government price support levels, the small white support price was reduced the same percentage as the navy bean support price.

programs. This could mean a reduction in price support levels or elimination of some price support programs. If this were to occur, what would be the likely consequences for the navy bean industry? These simulations were designed to give some insight into such a situation by answering the question: What would have happened in the navy bean industry from 1953 to 1967 if the yearly price support level had been reduced for navy beans? By showing what impact the program would have had in the past, consequences in the future can also be inferred if the general pattern of industry behavior and exogenous variable variation continues in the future. Further, the basic model structure could subsequently be used to test new or different programs under expected future conditions.

Six different 15 year simulation runs were made (Table V-2). In each run the actual price support levels for navy and small white beans for each of the 15 years were adjusted downward by a predetermined percentage. For example, in the first simulation, the actual annual price support level in each of the 15 years was reduced by 10 percent. The last simulation shown is the unsupported situation (no government price support program).

With a 10 percent reduction in the yearly price support level, average navy bean planted acreage and corresponding production levels would have decreased

TABLE V-2

AVERAGE ANNUAL RESULTS FOR ACTUAL, SIMULATED ACTUAL, AND SIMULATED REDUCED NAVY BEAN PRICE SUPPORT LEVELS, 1953-67

Government Price Support Level in Effect for the 15 Year Period (Average Support Price in $/cwt.)[b]	AVERAGE YEARLY				
	Navy Bean Planted Acreage	Production of Navy Beans	Production of Small White Beans	Domestic Consumption of Navy Beans	Navy Bean Exports
	1000 A.	1000 cwt.	1000 cwt.	1000 cwt.	1000 cwt.
Actual[a] ($7.24)	497.0	5409.0	652.6	3666.3	1038.6
Simulated Results:					
Actual Support Level (ASL) ($7.24)	499.5	5391.1	584.8	3856.4	829.8
90% of ASL ($6.52)	480.0	5176.4	559.7	3888.9	822.7
80% of ASL ($5.79)	468.1	5046.2	543.6	3899.1	842.1
70% of ASL ($5.07)	460.7	4965.4	531.6	3894.1	853.7
60% of ASL ($4.34)	463.4	4890.7	518.6	3890.2	846.1
50% of ASL ($3.62)	448.1	4844.0	506.2	3882.4	832.6
Unsupported Market ($0.00)	446.2	4819.7	496.8	3959.7	860.0

[a]The sources of the actual data are given in Appendix B.

[b]This is the quoted support price. To get a price equivalent to the market price, handling charges (assumed to be 95 cents in this study) must be subtracted.

TABLE V-2 (Continued)

Government Price Support Level in Effect for the 15 Year Period (Average Gross Price in $/cwt.)	Average Yearly					Average Weighted Price to Producers from Navy Beans[d]
	Producer Gross Income from Navy Beans	Government Takeover of Navy Beans	Government Expenditures for Navy Beans	Government Takeover of Small White Beans	Domestic Per Capita Consumption of Navy Beans[c]	
	Million $	1000 cwt.	Million $	1000 cwt.	lbs.	$/cwt.
Actual ($7.24)	36.1	704.2	5.0	0.0	2.07	6.67
Simulated Results:						
Actual Support Level (ASL) ($7.24)	36.0	705.1	5.0	0.0	2.18	6.68
90% of ASL ($6.52)	31.7	464.8	3.0	0.0	2.19	6.12
80% of ASL ($5.79)	29.3	305.0	1.7	0.0	2.20	5.80
70% of ASL ($5.07)	27.6	217.6	1.1	0.0	2.20	5.55
60% of ASL ($4.34	25.7	161.1	.7	0.0	2.20	5.26
50% of ASL ($3.62)	24.4	129.0	.4	0.0	2.19	5.03
Unsupported Market ($0.00)	23.1	0.0	0.0	0.0	2.21	4.79

[c]Average yearly domestic per capita consumption of navy beans equals total navy bean domestic consumption for the 15 year period divided by the average U.S. population for the same period divided by 15.

[d]Navy bean average price equals total producer gross income from navy beans for the 15 year period divided by the total navy bean production for the same period.

slightly. Average yearly producer gross income from navy beans would have dropped more than 10 percent due to the inelastic demand curve for navy beans. Government expenditures would have dropped 40 percent because of decreased government takeover resulting from the reduced price support level.[7] Average yearly domestic consumption would have increased slightly because of the lower price in some years. The weighted average navy bean price received by the producer would have dropped $.56.

With further reductions in the support level, the movement of the selected variables would, in most cases, have been farther in the same direction. As the support price level was dropped, less navy bean acreage was planted, resulting in less production. Average annual producer gross income from navy beans and average price per unit sold would have fallen as the price support level was dropped, with the lowest producer gross income from navy beans and lowest average price coming in the simulation where the price support program was eliminated. Domestic consumption would have also been highest when the government program was eliminated. If the navy bean price support in each year had been 50 percent lower in each of the 15 years,

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[7]No government small white bean takeover would have occurred under any of the price support levels tested.

government expenditures would have averaged only $400,000.[8] Without a price support program, government expenditure would have been zero.

Private Price Support-Storage Program

If a government price support program can be successful in increasing average annual producer gross income from navy beans, the possibility exists that a private program could also have the same effect if a government program were not available. A private industry price maintenance and storage program might be a potential substitute for a government program in the future. Some measure of its effects should be of value to industry decision-makers.

The private price support-storage program, in the simulation model, was similar to the government program. The storage agency would have purchased a large enough quantity in large crop years so that the market price would not have fallen below the stated support price. It would have been different in that the quantity taken over by the storage agency would have been put back into the market when supply and demand conditions allowed the minimum price to be maintained. Under the government

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[8]Government expenditures include the cost of beans and not administrative costs. Therefore, total government costs would be greater than this. To the extent that some commercial sales took place, expenditures would be reduced correspondingly.

program, an attempt was made to dispose of the stored quantity in non-market channels. However, the biggest difference would have been that the private agency would not have had any outside funds to pay for the beans taken over by it.

In order to pay the producers for the amount taken over, the private agency would have had to borrow money. The agency would have had to pay assumed interest charges of 6 percent per year. The agency would also have had to pay storage charges of $.72 per hundredweight per year. After the agency sold its stored beans, it would have had to pay back the money borrowed and redistributed any extra funds back to producers. If the minimum price was set too high, the private agency would not have been able to sell all the beans it took over. Its alternatives would have been to either lower the price support level or make producers pay for the costs of the program; which, in effect, lowers the support price received by producers.

What minimum price level could the agency have maintained over the period? To answer this question, ten simulations were run, each with a different minimum price. The minimum price levels were selected over the relevant price range for navy beans. The important variables of interest are the annual ending storage, the 15 year ending storage and the agency financial

position. The producer gross income from navy beans is misleading if the agency was not able to sell all the beans it had taken over. Part of it was money borrowed by the agency to pay the producer for the beans that had been taken over. A more meaningful gross income figure can be obtained by adjusting the average annual gross income producers would have received for their navy beans by one-fifteenth of the ending agency financial position. It is not claimed that the higher mimimum price levels could have been maintained. They are shown to give the reader some insight into the inventory buildup and increasing debt position of the agency at higher minimum price level resulting from the inability of the agency to sell its beans.

The higher the minimum price was set for the 15 year period, the more years storage would have taken place (Table V-3). At a $2.50 minimum, storage would have occurred in 5 of the 15 years with average annual ending inventory of 114,600 hundredweight. At a $7.00 minimum, storage would have occurred in 14 out of the 15 years, with an average annual inventory of 5,028,900 hundredweight. Average annual ending inventory would have increased the higher the minimum price was set. The average price per hundredweight received by farmers, a measure of profitability, would not have been increased substantially over the unsupported situation (see

TABLE V-3

SIMULATED RESULTS FOR TEN MINIMUM PRICE SUPPORT LEVELS OPERATED BY A PRIVATE STORAGE AGENCY, 1953-1967

Minimum Support Price for the 15 Year Period	Average Yearly								Number of Years Navy Beans Stored	Navy Beans Stored at end of the 15 Years	Financial Position of Storage Agency at end of 15 years[c]	Average Weighted Price to Producers from Navy Beans
	Navy Bean Planted Acreage	Navy Bean Production	Small White Production	Domestic Consumption of Navy Beans	Navy Bean Exports	Producer Gross Income From Navy Beans	Domestic Per capita Consumption of Navy Beans[b]	Ending Agency Storage				
	1000 A.	1000 cwt.	1000 cwt.	1000 cwt.	1000 cwt.	Million $	lbs.	1000 cwt.		1000 cwt.	Million $	$
$2.50	443.6	4787.2	500.7	3[illegible].4	858.7	23.8 (23.8)	2.22	114.6	5	0	4.3	5.03
$3.00	445.8	4804.8	507.2	3[illegible].7	875.0	24.5 (24.7)	2.22	152.3	5	0	3.6	5.14
$3.50	441.9	4771.5	505.1	3894.9	876.7	23.8 (23.7)	2.20	294.3	8	0	-.6	4.97
$4.00	448.7	4850.0	516.4	3925.2	924.8	25.3 (25.3)	2.21	562.8	9	0	0.1	5.22
$4.50	450.2	4863.1	519.9	3922.7	940.4	25.9 (25.0)	2.21	898.8	10	0	-12.9	5.14
$5.00	460.8	4982.6	534.8	3938.0	1044.6	27.6 (26.1)	2.22	1399.3	10	0	-22.7	5.23
$5.50	472.3	5109.9	550.4	3922.4	1044.8	29.9 (26.6)	2.21	2078.0	12	2139.0	-50.1	5.20
$6.00	486.4	5270.9	569.3	3892.5	1034.7	33.7 (27.5)	2.20	3149.2	12	5205.0	-92.9	5.21
$6.50	494.0	5352.5	579.7	3869.0	1027.4	35.6 (27.8)	2.18	3544.9	14	6910.0	-117.0	5.18
$7.00	510.3	5532.8	599.3	3835.2	1006.8	39.5 (27.4)	2.16	5028.9	14	10466.0	-182.1	4.95

[a]The value in parentheses is the gross income from navy beans received by producers after adjusting for the financial position of the storage agency at the end of the period.

[b]Average yearly domestic per capita consumption of navy beans equals total domestic consumption of navy beans for the period divided by the average U.S. population for the same 15 year period divided by 15.

[c]Financial position of the storage agency is equal to the income received from selling of stored beans minus debt for unpaid borrowed capital, unpaid interest, and unpaid storage charges.

[d]Average weighted price paid to producers from navy beans equals total producer gross income from navy beans (adjusted for ending agency financial position) for the 15 year period divided by the total navy bean production for the same period.

Table V-2 for unsupported situation) for any of the minimum price levels.

A problem would have occurred for any minimum price above $5.00 because of the increased storage at high minimum prices. At minimum prices above this level, there would have been storage occurring in most of the 15 years, with some beans still being stored at the end of the period. When a portion of the current year's production would have been stored in most of the 15 year period, very few stored beans would have been sold. This means that very little money would have flowed back into the storage agency and it would not have been able to pay its interest charges, storage costs or capital debt. It would have had to borrow additional money to meet these expenses and also administrative costs, if the minimum price level was to be maintained.

The breakeven point in terms of the agency being able to sell all its beans and cover storage and interest charges would have been at a minimum price of $4.00.[9] Above a $5.00 minimum, the agency would not have been able to sell all its takeover by the end of the 15 years.

[9]The $4.00 minimum's ending financial position would have been better than the $3.50 minimum's financial position because with a higher minimum price in some large crop years, more beans would have been stored. When the beans were sold in following years the agency had more beans to sell at a higher price (in the elastic portion of the demand structure), but not enough of a quantity to have put price back on to the inelastic portion of the demand structure.

The higher the minimum price level went above a $5.00 minimum, the larger the storage would have been at the end of the 15 years.

Compared to the actual government price support program, the private price support-storage program would have been substantially lower in producer gross income and average price from navy beans. However, the program would have offered a benefit of less price variation within each season by establishing certainty as to the minimum price possible. The program would have offered more price and income stability but not substantial increases in either price or income compared to the government program.

Marketing Quota or Control

If one wishes to increase producer gross income and reduce price stability, another program exists which could have maintained a minimum price in the industry. The program would have involved controlling the amount of beans marketed so that the market price would not have gone below the minimum price level. This could have been accomplished by issuing marketing certificates for the beans that could be marketed, based on a quota for each producer. If a producer did not receive a certificate for a certain portion of his production, he could not have marketed that portion of his production. When supply and demand conditions warranted, the producer

would have been given certificates which would have allowed the marketing of some stored production. A program of this type would have required an industry or government agency that had a monopoly on the selling of beans.

Under this type of program, the market price would have been paid only for the production allowed to be marketed. The producer would have retained ownership of the rest, and would have paid commercial storage rates in this simulation. He would have retained ownership and received no payment for the unmarketed production in some years. In simulating his production behavior, it was assumed that he reacted to this situation as if he had received a lower price and sold his total supply. He then planned his next year's production taking this price (as a proxy for the effect of the unmarketed production) into account.

To estimate the results of this program in the navy bean industry, ten 15 year simulations were run at different relevant minimum price levels (Table V-4). The main difference between this program and the private price support-storage program was in planted acreage. Under the private price support-minimum price program, the producer would have received at least the minimum price for all his production and, therefore, would have made acreage decisions based upon the market price.

Under the marketing quota, the producer would have only received the minimum price for the marketed portion of production. Given the assumption stated in the last paragraph, he, therefore, planned next year's production (in some years) with a price lower than the minimum stated level. This accounted for the lower acreage planted.

Production would generally have been less for the 15 years if the minimum price for the period was increased. With a higher minimum price level, the producer would have been able to market a smaller quantity of beans. Therefore, he would have produced fewer beans. For example, if the minimum price level was set at $4.00 for the 15 years, average annual production would have been 4,720,000 hundredweight, while at a $6.00 minimum, average annual production would have been 4,599,000 hundredweight. Because of the reduced production, the higher price level could have been maintained with less storage than occurred under the private price support-storage program. At the same time, the increase in price would have more than offset the decrease in production, thereby, increasing producer gross income from navy beans. In fact, at a $7.00 minimum price, the marketing quota would have given an average yearly producer gross income from the navy beans he sold of $34.2 million,

TABLE V-4

SIMULATED RESULTS FOR TEN MARKETING QUOTA LEVELS FOR THE PERIOD 1953-1967

Navy Bean Price Maintained by Use of the Marketing Quota	Average Yearly								Unmarketed Navy Beans at end of 15 year period	Number of years marketing Quota Operated	Average Weighted Price to Producers from Navy Beans[b]
	Navy Bean Planted Acreage	Navy Bean Production	Small White Production	Domestic Consumption of Navy Beans	Navy Bean Exports	Producer Gross Income from Navy Beans	Domestic per capita Consumption of Navy Beans[a]	Unmarketed Navy Beans at end of crop year			
	1000 A.	1000 cwt.	1000 cwt.	1000 cwt.	1000 cwt.	Million $	lbs.	1000 cwt.	1000 cwt.		$
$2.50	440.4	4752.0	503.1	3918.9	833.1	24.2	2.21	121.3	0	5	5.05
$3.00	440.4	4752.5	512.8	3910.1	842.4	25.2	2.21	141.6	0	5	5.24
$3.50	439.0	4746.3	523.3	3904.4	841.8	26.2	2.20	200.1	0	6	5.46
$4.00	437.0	4720.3	538.2	3887.5	832.8	27.5	2.19	251.7	0	7	5.77
$4.50	436.6	4705.7	552.1	3872.9	832.7	28.8	2.19	286.0	0	7	6.06
$5.00	436.2	4691.8	564.0	3855.8	836.0	29.9	2.17	330.7	0	8	6.31
$5.50	432.9	4650.5	577.9	3834.7	815.8	31.1	2.16	406.1	0	8	6.61
$6.00	428.3	4599.6	591.4	3820.2	779.4	32.1	2.16	488.3	0	8	6.91
$6.50	428.5	4600.5	604.5	3801.4	799.1	33.5	2.15	584.6	0	9	7.21
$7.00	424.0	4555.8	614.7	3774.5	781.2	34.2	2.13	666.5	0	10	7.41

[a]Average yearly domestic per capita consumption of navy beans equals total domestic consumption of navy beans for the 15 year period divided by the average U.S. population for the same period divided by 15.

[b]Average weighted price paid to producers from navy beans equals total producer gross income from navy beans for the 15 year period divided by the total navy bean production for the same period.

which was only $1.8 million less than what happened under the actual government price support program.

At higher minimum price levels for the period, average yearly domestic consumption and exports would have decreased over what would have occurred under the private price support-storage program with the same minimum price level. On the other hand, average storage would have been less because of the reduced production. In none of the simulations would there have been storage remaining at the end of the 15 year period with this program.

From viewing the results of the marketing quota simulations, some people might suggest that price could have been raised considerably higher than the highest experimented level of $7.00. While the model might suggest this, at higher prices other areas of the country might start to grow beans. There probably also would be substitutions of other beans or other food products for navy beans that would not have taken place at lower prices, especially over a prolonged period like 15 years. Therefore, there are constraints that would keep navy bean prices from reaching very high levels over an extended period of time.

Acreage Control Program

Under the programs considered up to this point, the main emphasis has been on the controlling of price

by controlling navy bean market supply within different years. Alternatively, the major production input, land, needed to produce navy beans might be controlled. Tobacco is just one example of where the land input is restricted.

An acreage restriction could be the prime control device in operating such a program for navy beans. Nine acreage maximums were arbitrarily set to test this program. The model was run nine times for the 15 year period. Each run was made with a different maximum in effect. The results are given in Table V-5.

If the acreage maximum had been set at 300,000 acres per year, that amount would have been planted each year. Average annual gross income from navy beans would have been $29.2 million. However, production and, therefore, domestic consumption and exports would have been drastically reduced. If the acreage maximum had been set higher, average yearly production, producer gross income from navy beans and consumption would have increased until the 400,000 acre limit was reached.[10] Beyond this point, average yearly producer gross income

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[10]The possibility exists that by use of more fertilizer, improved seeds, etc., part of the effect of the acreage control could have been reduced through increased yields. If this had occurred, the decrease in production at the different control levels would not have been as great as the simulations suggest.

TABLE V-5

SIMULATED RESULTS FOR NINE SELECTED ACREAGE CONTROL LEVELS FOR THE PERIOD 1953-1967

Size of the acreage planted restriction for the 15 year period (per year)	Average Yearly							Average Weighted Price to Producers from Navy Beans[b]	Years Acreage Restriction Level was Reached
	Navy Bean Planted Acreage	Navy Bean Production	Small White Production	Domestic Consumption of Navy Beans	Navy Bean Exports	Producer Gross Income from Navy Beans	Domestic Per Capita Consumption of Navy Beans[a]		
	1000A.	1000 cwt.	1000 cwt.	1000 cwt.	1000 cwt.	Million $	lbs.	$	
300,000 Acres	300.0	3166.0	684.3	3133.4	32.7	29.2	1.77	9.23	15
325,000 Acres	325.0	3429.8	671.6	3367.9	97.4	30.7	1.88	8.94	15
350,000 Acres	346.3	3692.6	660.5	3509.9	221.6	32.2	1.96	8.71	14
375,000 Acres	367.8	3933.5	643.2	3594.2	388.6	32.9	2.00	8.37	13
400,000 Acres	389.3	4170.0	629.4	3667.4	544.3	33.7	2.05	8.07	13
425,000 Acres	407.7	4386.8	591.1	3754.4	676.1	31.3	2.10	7.14	12
450,000 Acres	422.5	4556.8	545.4	3859.6	742.7	27.5	2.16	6.04	10
475,000 Acres	433.6	4679.2	527.1	3920.2	805.8	26.6	2.19	5.69	5
500,000 Acres	438.9	4734.2	516.5	3922.0	859.3	25.9	2.19	5.47	5

[a]Average yearly domestic per capita consumption of navy beans equals total domestic consumption of navy beans for the 15 year period divided by the average U.S. population for the same period divided by 15.

[b]Average weighted price paid to producers from navy beans equals total producer gross income from navy beans for the 15 year period divided by the total navy bean production for the same period.

from navy beans would have fallen in the 15 year period while the acreage maximum was reached less often. If a 500,000 acre maximum had been in operation, it would have been effective in only one-third of the years.

The results of these simulations suggest that if acreage planted had been restricted too much, producer gross income from navy beans would have been reduced because the elastic portion of the demand curve was reached and quantity demanded declined relatively faster than price increases at extremely high prices (although the net income from navy beans could be higher). If acreage had not been restricted enough, producer gross income from navy beans also would have decreased because the inelastic portion of the demand curve was reached and price decreased relatively faster than quantity increased. Thus, the intermediate restriction zone seems to be where the highest producer gross income from navy beans would have been.

This program was the only one examined that did not entirely base planting decisions on the competitive position between crops when the planting decision was made. Consequently, the question of what happens to total producer gross income arises. In some years, producers would not have been able to raise as many beans as the competitive situation suggested they wanted to grow. The model was not designed to explicitly

handle this question. When comparing this program to the other programs, the reader should remember that producers would have had an opportunity to plant some of the acreage diverted from navy beans in other crops. Therefore, the producers' gross income from navy beans is not necessarily equivalent to the navy bean producers' gross income.

Two Price System (Price Discrimination)

Another type of supply management program can control the quantity of navy beans going into different markets.[11] The idea behind this type program is to get a higher price for the commodity in the market that is less responsive to price changes. By reducing the quantity supplied in the market which is less responsive to price changes, and increasing supply in the other market, producer gross income can be increased. This form of price discrimination can take place if the total market for the commodity can be legally and effectively divided into submarkets which exhibit different responsiveness to price. Price discrimination is used quite frequently in both agricultural and non-agricultural products. The selling of milk for fluid uses at a higher

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[11]A discussion of price discrinimation is given in Richard H. Leftwich, The Price System and Resource Allocation (New York: Holt, Rinehart and Winston, 1966), pp. 197-200.

price than milk for manufactured uses is an example of price discrimination in agriculture.

The proposed separation of markets under this program in the navy bean industry would have been between domestic and export markets. A higher price would have been charged in the domestic market because domestic consumption is less responsive to price changes than are exports. Therefore, a higher price could be charged in the domestic market with a corresponding small decrease in consumption. The quantity of beans not sold in the restricted domestic market at the higher price would have been sold in the export market where it would have less effect on the world price.

To maintain a separation of the domestic and export markets, governmental action would have been required. The tariff on dry beans has averaged out to approximately $1.50 above the export or world price.[12] If the difference had become greater than this, imports would have driven the domestic price down. If a larger difference in price had been desired, either a larger tarriff or a quota restriction on imports into the United States would have been needed.

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[12]U.S. Tariff Commission, Tariff Schedules of the United States Annotated (1969) (T. C. Publication 272, Washington D.C.: Government Printing Office, 1968), p. 41.

In the first simulation of a two price system, no restrictions were placed on production. Instead, the simultaneous demand structure was adjusted so that the domestic price would have been $1.50 above the export price. This price setup is compatible with the existing U.S. tariff structure on dry beans. Under this two price system, domestic marketings would have been controlled so that domestic price would have stayed $1.50 above the export or world price. Acreage planted decisions were assumed to be based on the average of the two prices, weighted by the quantity sold in both markets.

The results of the simulation were quite similar to the unsupported market simulation (Tables V-2 and V-6). Average yearly producer gross income from navy beans would have risen only $200,000 during the 15 years over what it would have been with the unsupported market situation. Domestic consumption and exports would have been virtually unchanged. Since neither domestic consumption nor exports are very responsive to changes in price, these results were not surprising. The reason for this was that production was so large in five of the fifteen years that the $1.50 difference between domestic and export prices could not have been maintained, with both prices reaching the $2.00 minimum set by the model.

TABLE V-6

RESULTS OF THE TWO PRICE SYSTEM SIMULATIONS FOR THE PERIOD 1953-1967

Type of Two Price System	Average Yearly							Commercial Inventory at end of 15 years	Average Weighted Price to Producers from Navy Beans[b]
	Navy Beans Acreage Planted	Navy Bean Production	Small White Production	Domestic Consumption of Navy Beans	Navy Bean Exports	Producer Gross Income from Navy Beans	Domestic per capita Consumption of Navy Beans[a]		
	1000 A.	1000 cwt.	1000 cwt.	1000 cwt.	1000 cwt.	Million $	lbs.	1000 cwt.	$
$5.50 domestic minimum	459.9	4961.2	562.1	3922.8	1038.3	27.3	2.19	0	5.50
$5.75 domestic minimum	460.1	4976.4	567.1	3911.8	1064.6	27.1	2.19	0	5.45
$6.00 domestic minimum	464.5	5015.5	575.5	3900.1	1115.3	27.8	2.18	0	5.55
$6.25 domestic minimum	468.3	5057.2	584.3	3887.6	1169.6	28.6	2.17	0	5.66
$6.50 domestic minimum	472.1	5099.8	593.7	3884.4	1215.4	28.9	2.17	0	5.79
$6.75 domestic minimum	476.0	5141.6	602.8	3869.5	1226.8	29.8	2.16	679	5.90
$7.00 domestic minimum	480.0	5181.9	611.9	3856.3	1233.2	30.6	2.15	1387	6.02
$7.25 domestic minimum	483.3	5223.0	620.8	3840.9	1242.7	31.5	2.15	2092	6.13
$7.50 domestic minimum	486.9	5262.4	629.5	3828.9	1252.2	32.3	2.14	2721	6.26
$7.75 domestic minimum	490.0	5297.9	636.5	3816.5	1253.9	33.1	2.13	3418	
$1.50 price difference (no minimum)	447.4	4825.8	504.6	3959.3	866.2	23.3	2.21	0	4.83

[a]Average yearly domestic per capita consumption of navy beans equals total domestic consumption of navy beans for the 15 year period divided by the average U.S. population for the same period divided by 15.

[b]Average weighted price paid to producers from navy beans equals total producer gross income from navy beans for the 15 year period divided by the total navy bean production for the same period.

In a second simulation of a two price system, the model was set up with a minimum domestic price for the fifteen year period. Domestic navy bean producers would have been restricted so that beans could not have been bought for domestic consumption from producers for less than the minimum level in any of the 15 years. The remaining supply of navy beans was marketed in the export market, with price allowed to fall to the $2.00 minimum set by the model. This two price system would have caused a difference greater than $1.50 in price between the export and domestic markets. It was assumed that a quota or higher tariff would have been put into operation to restrict imports into the U.S. domestic market.

Ten fifteen year simulations, each with a different minimum domestic price, were run (Table V-6). These results show that the two price system would have increased producer gross income from navy beans. However, it would also have caused domestic consumption to be reduced and exports to be expanded over what they would have been without controls. Producer gross income from navy beans would have increased more if the minimum domestic price had been set at a higher level. An increase in navy bean acreage planted also would have occurred.

However, there is a problem associated with this two price simulation. It was assumed some private individuals or groups would store beans at the $2.00 minimum in the hope they would have been able to sell them in the export market when prices went up. At minimum domestic prices above $6.50, these speculators would not have been able to sell their beans. Therefore, it is doubtful that very much of this type storage would have taken place at domestic prices above $6.50. What probably would have happened was producers would have had to take a reduced price in the domestic market or store the beans themselves.

Summary

Attention has been focused, in this section, on simulating several price and supply control programs. The simulations were designed to give estimates of how these programs would have performed in the navy bean industry from 1953 to 1967. The variables generated and examined included navy bean planted acreage, production, domestic consumption, exports, government takeover, and producer gross income from navy beans.

The first program examined was the lowering of the government price support level. The larger the reduction, the less government takeover and expenditures would have occurred. Producer gross income from navy beans and the average producer price would have been

progressively less as the government price support level was reduced. However, even a reduction to 50 percent of the actual price support level for 1953-67 would have kept the average producers' price received above the price they would have received in an unsupported market.

A private price support-storage program, similar to the government program, was then examined. This program would not have raised average price received by producers above $5.23 for any of the minimum price levels tested. The breakeven point (that is, having no agency storage or debt at the end of the 15 years) would have been at a minimum support price of $4.00.

Third, a marketing quota or control was examined. This program would have been able to increase the producer gross income from navy beans and the average producer price. The amount of the increase was dependent on the degree of marketing restrictions. As marketings were restricted, less domestic consumption and exports would have taken place.

An acreage control was the fourth program tested. The acreage control would have reduced production of navy beans more, the greater the restriction for the 15 year period. The highest average price obtained in the simulations was where acreage was restricted to only 300,000 acres per year. However, the largest average

annual producer gross income from navy beans would have been obtained at a maximum acreage planted restriction of 400,000 acres per year over the entire 15 year period.

The last program simulated was a two price system. In one simulation, the domestic price was set to be a maximum of $1.50 above the export or world price. This simulation produced an average price and producer gross income from navy beans similar to the unsupported market simulation. In the other two price simulations, a minimum domestic price was set, with export price allowed to fall below the domestic minimum. These simulations showed a larger producer gross income from navy beans and also a larger average price as the domestic minimum was raised. Above a price of $6.50 for the domestic minimum, not all of the 15 years' production could have been sold by the end of the period. This might have caused problems in maintaining the domestic minimum at these high levels.

Comparison of producer gross income from navy beans and the acreage planted together, give an indication of what total navy bean producer gross income would have been under each program. In their best performance, the acreage control and the marketing quota would have given a higher level of producer gross income from navy beans when compared with other private programs. This would have been accomplished with less

planted acreage. These two programs' average annual producer gross income from navy beans would also have come within several million dollars of the actual average annual producer gross income from navy beans. They would have accomplished this with less planted acreage. If this diverted acreage had been planted to other crops, these programs would have been in the same or in a slightly higher range in terms of average annual total producer gross income, when compared to the actual government price support program.

A final qualification of the simulation results needs to be mentioned. It is possible that the response of exports to lower prices might have been greater than the export demand curve indicated. If this had been the case, the results just examined would have been slightly different. Average price would not have fallen to the bottom of the price range as often. There most likely would have been a small upward shift in average price because of increased navy bean exports for all programs at lower price levels. However, the private minimum price-storage program and the two price system probably would have improved their position relative to the other programs. These two programs were constrained by not being able to sell beans at low prices, thus, accumulating large inventories. If more beans could have been exported at lower prices, these

two programs might have performed better than the current simulation results suggest.

The summary of the simulation results would not be complete without discussing the relevance of the results for the industry in the future. Can they be used to predict the future? What can be said is that if the trend of variables used in the model but determined outside it (corn price, Canadian exports, population) continue to move in the same way they have in the past, the relative results obtained from the different programs in the future most likely would be quite similar. For example, one could reasonably expect a private price support-storage program would bring some stability by evening out supply from year to year. However, it probably would not increase price or income to any large extent over what it would be with an unsupported market.

However, there are some indications that the variables determined outside the system are changing or will change differently from how they moved in the past. Feed grain prices have been moving downward. If this continues, more planted navy bean acreage will most likely occur at each expected price level. This might make an acreage control look relatively more attractive in the future than it looked for 1953-1967. In the export market, Canada is now operating a two

price system with a lower export price compared to their domestic price. Canadian exports may increase and place pressure on our export market. This change might make a two price system for the U.S. navy bean industry look better relative to how it looked for 1953-1967, particularly if export market development continues and leads to a more elastic export demand curve.

CHAPTER VI

IMPLICATIONS FOR DIFFERENT INDUSTRY GROUPS

To a large extent this study has been approached from the producer viewpoint. This has been particularly true in building and applying the models. The main reason for this emphasis has been that the data available for the industry has been kept primarily by public agencies which have concentrated on recording economic activity at the farm or producer level. A simulation model constructed using this type of data generates values that are primarily concerned with the effects at the producer level. This level of activity certainly affects and reflects related behavior farther along in the marketing process. To build a model that directly takes into account the behavior of other groups involved in the navy bean production-consumption system, more information and data concerning these activities will first have to become available to the researcher.

However, some implications of the price and supply control programs for most industry participants can be examined through this simulation model. The navy bean industry can be divided into many different groups with

many different concerns. A partial listing of the groups that would be affected by the use of the programs are: (1) producers, (2) consumers, (3) taxpayers, (4) farm input group, (5) shippers, and (6) processors. The industry's outlook on its economic well-being is discussed within the context of these different industry groups. Since many individuals find themselves in more than one of these groups, they may have several, possibly conflicting, views of any one program.

Producers

It is assumed that producers' primary goal is a high level of economic well-being. The price, gross income, and acreage planted to navy beans are partial ways of measuring this well-being. It is also assumed that producers have a high regard for individual freedom of action. A recent study of Michigan farmers found that they do not want their actions restricted.[1]

Past attempts to raise producer income in agriculture have caused problems because most proposals have conflicted with producers' individual freedom of action. This problem still exists with the control programs

[1]Dale E. Hathaway, et al. Michigan Farmers in the Mid Sixties (Michigan State University Agricultural Experiment Station Research Report 54, East Lansing, 1965), p. 63.

examined in this study. The evaluation of the programs from the producers' viewpoint can be looked at as a conflict between a desire for high price and income and a desire for individual freedom of action. The private price and supply control programs would replace the individual's freedom of action with the more restrictive group freedom of action.

One fact that stands out from the producer viewpoint is that the government price support program has been quite successful in attaining the goal of higher average navy bean price and year to year price stability, when compared to the unsupported situation. At the same time very little of the producers' freedom of action has been sacrificed, since the government support program has been merely another marketing option available to farmers. However, if price support levels had been dropped as little as 10 percent, some of the other programs might have provided higher average price and gross income from navy beans. The acreage control program might have given equally high producer gross income if the acreage diverted from navy beans could have been planted to other crops.

The non-government programs would have involved more restriction on producer freedom of action than the government price support program. However, if no government price support program existed, the producers might have found that one or more of the other programs offered

enough increase in average price and gross income from navy beans to balance off the decrease in their individual freedom of action. Running a government price support program without restriction on acreage or supply probably is feasible only for minor crops, except where very low support levels are involved. Governmental price support programs for major crops (corn, wheat and cotton) usually have restrictions on producers' actions. Without some type of supply restriction, the money the government has spent in the past on major crop programs rapidly reached politically dangerous levels. To make the major crop price support programs work effectively, but at lower costs, supply or acreage restrictions are now used.

Increased average price and gross income from navy beans over what would have resulted with an unsupported market could have been achieved with an acreage control, marketing control or quota, or two price system. All three of these programs would have involved a loss of some producer freedom of action: one in the size of the navy bean enterprise, and the other two in when, how much, and where beans could be marketed. Under a private price support program there would have been gains over an unsupported situation, but less than other programs would have provided. However, the producers' freedom of action would have been affected less than

under the other non-governmental programs. If exports had increased more at lower prices than the navy bean export demand equation suggests, the performance of the private storage program would have been improved.

Because of conflicting producer goals, no clear cut program preference can be deduced from the simulation runs. The results do give producers information on what might have happened if the different programs had been used in the navy bean industry from 1953 to 1967. This information provides a basis from which the producers, acting individually and as a group, can better decide the tradeoffs from different courses of action they might consider in the future.

Even though no data is available on the distribution of producers by size, it is obvious that in any program based on production, the benefits are directly proportional to the size of each farmer's production. Therefore, larger producers with higher production receive more of the benefits. Since the income benefits of a program may be capitalized into the value of the land where navy beans can be grown, the benefits of the program have accrued and usually benefit the original landowner most. New producers, who pay a higher price for the land because of the program, are dependent on the program continuing. Ending of a program could be financially disastrous for producers who have purchased land at program-inflated prices. This potential drop

in current income and land values could give added impetus for finding different programs to substitute for or supplement a reduced government price support program.

Consumers and Taxpayers

It is difficult to separate the consumer and the taxpayer. Most individuals belong to both groups, but a higher proportion of a low income person's expenditures go for food, less for taxes; thus, low income consumers are more concerned with food prices than taxes. Nevertheless, there are conflicts between the values individuals hold as consumers and the values they hold as taxpayers. Consumers as a group value having a high quality and sufficient quantity of food available to them at the lowest possible price. Taxpayers as a group have supported policies that help provide a more equitable distribution of income between different sectors of the economy. However, the attainment of equitable distribution or the desire to attain it is not completely dominant. Taxpayers do place a restraint on the amount of government expenditure that can go for this purpose. They want some equality, but they want it obtained at the lowest possible expense.

The navy bean policy conflict can be illustrated by comparing the simulated results of the actual

government price support program for navy beans from 1953 to 1967 and the simulated results of the unsupported market. Using the simulation, we find that average annual producer income from navy beans at the actual price support level was $36.1 million (Table V-1). This was obtained with the help of an average yearly expenditure of $5.0 million by the government for price supports. According to the simulation results, without the price support program, average yearly producer income from navy beans would have been $23.1 million, but with no expenditures by the government.

With these income figures as a basis, the income transfer that resulted from the government price support program can be partially examined. The average yearly increase in gross income going to navy bean producers because of the program was $13.0 million ($886 per farm).[2] Taxpayers paid $5.0 million ($341 per farm) of this total in the form of expenditures for government takeover. Consumers paid the remaining $8.0 million ($545 per farm) in the form of higher prices.[3] What the price

[2]The per farm figure is obtained by dividing the gross income figure by 14,665. This figure is the average number of Michigan dry bean farms as reported in 1954, 1958 and 1964: U.S. Bureau of the Census, 1964 United States Census of Agriculture, p. 13.

[3]Dr. C. Bedford, Department of Food Science, Michigan State University estimates a one pound can of prepared beans has approximately four ounces of C.H.P. dry beans in it. Therefore, a $1.00 increase in the price paid to producers will increase the price of a one pound can of prepared beans $.0025 (other things constant). Since the difference between the actual

support program did was place part of the income transfer burden on the taxpayer and part of it on the consumer. An alternative to this program could have been a direct payment of the $13.0 million to producers without use of a price support program. Under this type of program, the taxpayer would have carried the entire burden of income transfer. Another alternative could have been the use of non-government price and supply control programs like those that are examined in this study. This would have shifted the entire burden of income transfer to the consumer. If consumers used navy beans in the same proportion that they paid taxes, the burden would have been the same for all individuals. However, beans are consumed in large quantities by low income individuals who pay proportionately less taxes. In terms of these low income consumers, the non-governmental programs would be the least desirable. These low income consumers might be for either a program of government support of preferably no support at all in order to keep bean prices low.

The consumers and taxpayers can not view the programs to be used in the navy bean industry in isolation.

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average weighted price and the unsupported market's average weighted price was $1.88 (see Table V-2), the government price support program increased the price of beans an average of $.0047 for a one pound can over what it would have been with an unsupported market.

The programs must be considered as part of an overall farm and welfare program or policy. Therefore, no clear consensus as to how the different navy bean programs might fit into the overall policy can be predicted. The implementation of any of the non-governmental programs would mostly like come from a compromise between overall government farm and welfare policy. The simulations can be helpful in giving each group information which consumers and taxpayers can use in deciding which program(s) is most desirable or acceptable to them.

Farm Input Group

It seems reasonable to assume that the farm input industry serving the navy bean industry wishes to maximize its profit. The input group is interested in having a large and, if possible, a growing demand for the products and services it sells. This demand will remain large if acreage goes up and producers receive a high price and income for the products they produce. If producers receive higher prices and income and use more purchased inputs to accommodate a growing demand for their products, the farm input industry's interests would not be in conflict with the interests of producers.

However, the price and supply control programs attempt to increase the price and income producers receive by regulating and restricting supply rather than by demand expansion programs. The acreage control and

marketing control or quota would have reduced the navy bean acreage over the period under study. Looking at this one fact alone, the input group might oppose implementation of these programs.

A broader view on the problem might change the situation. Even if acreage of one commodity is reduced, this does not necessarily mean that the demand for purchased inputs by producers is also reduced. The acreage taken out of production of one commodity probably will end up in the production of another commodity. Further, the navy bean income per acre may increase, leading to increased demand for inputs. The picture is further confused when the simulation without controls is examined. If no control had been used, price and income received by producers would have been lower. In response to this, producers would have planted fewer acres to navy beans. In these last two cases, the farm input group might be either neutral or for price and supply control, depending on their restrictive nature and the expected transfer effect to other commodities.

The preceding discussion shows that the use of price and supply control programs have effects on the producer input group as well as other participants in the industry. Depending on the programs used and the level at which they are used, the demand for the

products and services supplied by the farm input group could either increase or decrease. The study does not provide sufficient information to determine the exact tradeoffs between acreage planted and producer gross income as they affect the demand for purchased inputs. To provide this information accurately, studies on a multi-commodity basis would have to be made.

Shippers

Like the farm input group, the shippers are assumed to be guided by the goal of profit maximization. If the shippers operate with a certain margin of profit per unit of beans handled, total profit is dependent on the total number of units handled. Shippers, therefore, are interested in handling a large volume of beans in order to insure a large profit. The larger the volume handled, the lower the profit margin on each unit handled has to be in order to obtain the same total profit. Shippers probably are interested in programs that increase the volume of beans they handle. They are also interested in having a certain minimum quantity available for shipping each year.

The government price support program resulted in an average yearly production of 5,409,000 hundredweight. The simulation without controls resulted in an average yearly production of 4,819,700 hundredweight. The

government program has had the effect of increasing the number of beans that the shippers handled over what they would have handled without the program. If the other price and supply control programs had been substituted for the government price support program, production of navy beans would have fallen below what it was with the government program in operation (with the exception of the private price support-storage program at very high minimum price levels).

The price stability provided by some of the control programs probably would be considered a positive factor by most shippers. The price support programs, the marketing control or quota, and the two price system restrict the price movement so that shippers could purchase beans for resale with some assurance that price would not fall below a certain price. The storage feature of the marketing control or quota and the price support program also should be considered a positive factor by the shippers. Stored supplies insure supplies for export in short crop years, which makes it easier to develop and hold export markets. The programs that require storage of beans would also help the shippers' business through increased use of their elevator facilities.

Consequently, shippers would receive some benefits from the use of the private price and supply

control programs. However, private control programs imply control over trading, so some possible duplication of salesmen in various competing shippers' offices might be eliminated. Also, the volume that shippers would handle would probably decrease with the use of any of the private price and supply control programs over what it would be with a government price support program that is maintained at price support levels equivalent with past ones. The handling and storage of government takeover has been done by licensed elevators. Since almost all elevators are licensed, and producers have the option to take beans bound for government storage to any licensed elevator, reduction in volume stored would be spread proportionately over all elevators.

One final comment on the effect of the private price and supply control programs on the shippers is needed. One of the two largest shippers is a cooperative run on a non-profit basis by producers. Since it is run for the benefit of producers and not for a profit like the corporate shippers in the industry, its view of the programs may be close to that taken by the producers.

Processors

Processors' profit, as it concerns navy beans, is dependent on the volume of beans it processes and

sells. Generally, the more beans the processors handle, the greater their profit will be. Navy beans are only one of many products handled by most processors (primarily bean canners). The data generated by the simulations, consequently, does not give a clear picture of the effects of the programs on the profit or operation of the processors in the area of navy beans. The simulations with the two control programs and the two price system suggest that domestic consumption of navy beans would decrease slightly if these programs are implemented. However, this does not indicate what would happen to total processors' profit, since consumers may increase consumption of another product within their product line.

A more stable price and supply would help canners in their planning, processing, promotion, and merchandising practices. All the supply and price control programs offer more of this stability than would an unsupported market.

Required Institutional Setting

The use of the private price and supply control programs would all have required producer group action and the loss of some individual freedom of action. The group action could involve regulating market supply, setting minimum prices, storing beans, and controlling acreage planted. These activities would require an

appropriate institutional setting. Let us examine some institutional forms that could provide the legal and economic framework necessary for successful operation of the programs.

In theory, all the programs could have operated in the navy bean industry under existing cooperative legislation. However, cooperative programs which have tried to regulate price and supply have had very little success in increasing producer income. Many producers have tried to get the benefits from these cooperative programs without joining the cooperative and paying the associated costs. The name most commonly used for this is the "free rider" problem. The chief weakness of these cooperative programs has been in the lack of power to compel all producers or handlers to act in the manner required to make a certain control program work.

The marketing order, an option open to many U.S. commodity groups, has used compulsory powers. It was authorized by the Agricultural Marketing Agreement Act of 1937. Under marketing order legislation, an industry group may operate certain supply and price control programs if it is accepted by a two-thirds majority of producers.[4] However, marketing orders are not authorized

[4]The two-thirds majority can be by number of producers or by quantity produced. For some citrus crops the required majority is higher than two-thirds.

for navy beans at this time. A marketing order may be issued only for certain products, chiefly milk and some fresh fruits and vegetables. Marketing orders for a commodity may have one or more of the provisions discussed below. Before a particular order is issued, it must be voted on by the producers in the area covered by the order. Once an order is issued by the Secretary of Agriculture, it is mandatory that all handlers affected by the order comply with the provisions. Marketing orders for some fruits and vegetables must also be approved by the handlers of the product. A committee recommended by the industry and appointed by the Secretary of Agriculture makes recommendations of courses of action to take. This committee can be made up of both producers and handlers.[5]

Market orders for milk generally have required handlers to pay for milk on the basis of their use of the milk, with different prices for each use. Milk marketing orders specify minimum prices for each use class. Orders that have been issued for other allowed commodities have not involved price control directly. Instead, limitations have been placed on shipments, the kinds of containers used have been regulated, and

[5]U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Compilation of Statutes Relating to Soil Conservation et al. (Agricultural Handbook No. 242, January 1, 1963), pp. 275-91

research and development have promoted. Prices have been raised mainly through limitations on shipments or allocation between markets. Powers given under the order can be used to limit: (1) the total amount of a crop that may be sold, (2) the grade, size or quality of the product that may be sold, (3) the amount that may be sold in any time period, and (4) the amount that may be sold in any market.

The effect of the marketing order as a price and income raising tool has been open to question because orders directly regulate the handler and not the producer. This has meant no direct controls of production. Marketing orders' major contribution has been short run stability in the markets where the marketing order applies.

The marketing board, an institution that has some features similar to the marketing order, has been used to help improve the results flowing from various agricultural products in the United Kingdom, Canada, and Australia. A Guelph bulletin defines it as: "A producer-controlled compulsory, horizontal organization sanctioned by government...to perform specific marketing operations...in the interest of the producer of the commodity concerned."[6] The marketing board can

[6]Department of Agricultural Economics, University of Guelph, A Comparative Study of Agricultural Marketing Legislation in Canada, Australia, United Kingdom and the United States (Department Publication No. A. E./64-65/11, Buelph, Ontario, Nov. 1964), pp. 3 & 4.

directly regulate the producer if it so desires. Use of this power must be approved by producers. This gives this institution the power to affect price for a commodity either through use of the power or threat of its use.

The main difference between the U.S. marketing order and the U.K. style marketing board is the potentially greater power and producer control inherent in the marketing board. The marketing board is run by a board composed of producers, who are elected by and directly responsible to the producers. This gives the wide powers of administration to the producers. The marketing order committee can only make recommendations to the Secretary of Agriculture. The Secretary is the only one who can make modifications in the order and he is not directly responsible to the producers. With an order the producers do not have the powers of administration.

In conclusion, there has been no institution legally available in the navy bean industry that could have effectively used or can now use the non-governmental price and supply control programs examined in this study.[7]

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[7]Cooperatives are not considered capable of using the programs because of the "free rider" problem associated with them because they do not have a mandatory compliance provision.

However, there are institutions that can use one or more of the programs considered, but they are not now legally available. These are the marketing order and the marketing board.[8] The marketing order affects individual freedom of action less than the marketing board. It probably would be less effective in using some of the control programs than the marketing board.

For the marketing order to be made available extension of the Marketing Agreement Act to include navy beans as one of the applicable commodities would be required. In the case of the marketing board entirely new enabling legislation giving powers not previously given to producers would have to be passed. The "Mondale Bill," which has been in committee in the U.S. Senate for the past several years, would extend the marketing order to all agricultural commodities. The bill would also provide for the use of producer marketing quotas. This would make the marketing order have more powers similar to the U.K. style marketing board.

The simulation results suggest the private programs could improve producer gross income from navy

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[8]A discussion of the use of a marketing board in the Ontario Navy bean industry is given in Appendix A.

beans in the future if the government price support level is reduced. However, this would require the passing of legislation making the existence of a marketing order, a marketing board, or some other similar institution possible in the navy bean industry.

CHAPTER VII

SUMMARY

Michigan produces over 99 percent of the navy beans grown in the United States. Navy beans are one of the most important agricultural products grown in Michigan and have a wide domestic and export market. In the domestic market, they are primarily purchased by canners and processed into canned beans in tomato sauce, bean soups, etc. The exports go chiefly to the United Kingdom where they compete with navy beans from Ontario. Because navy beans have had wide yield, price, and income fluctuations in the past, a government price support program has been in effect in the industry for the last 30 years to help reduce the fluctuations in income and to increase producer income. This government program has involved a large expenditure of government funds for purchasing part of the production in large crop years to support the price of navy beans. The industry has relied heavily on this government program during these years.

Government expenditures on agricultural programs may be cut in the future. If this should occur, the

industry may have to operate with a reduced government price support level or no government support program at all. This study is designed to look at the effects of variations in the government price support level and of some non-governmental price and supply control programs that could be used individually or in combination with the current support program. More specifically, the objectives of the study are: (1) to estimate the basic supply and demand relationships existent in the Michigan navy bean industry for the period from 1953-67, and (2) to evaluate whether selected price and supply control programs would be desirable to employ in the Michigan navy bean industry.

To examine various price and supply control programs one must first examine the supply and demand relationships that exist in the navy bean industry. It is within this context that these programs would have to operate if they were implemented. The first step in the study was to examine the industry's historical and present position in terms of marketing organizations and programs. The second was to design and estimate an economic model of the industry using price and supply data for the years 1951-67. The economic model was composed of a recursive supply and demand structure. The supply structure included a navy bean acreage planted equation, which, when combined with actual yield,

predicted the production for a particular year. The acreage planted equation was estimated by ordinary least squares. A large navy bean planted acreage was usually associated with a large acreage planted to navy beans the previous year, a high navy bean producer price during the previous year, and a low price of corn received by producers the previous year.

The demand structure included three equations: domestic demand, export demand, and the price of small white beans (a competitor of navy beans). Three stage least squares was the estimation procedure used for these three equations. Both domestic consumption and exports moved in the opposite direction of the price of navy beans. They were both price inelastic, with price elasticity of domestic demand being -.14 and price elasticity of export demand being -.36. Domestic consumption was found to move in the same direction as U.S. population, and exports in the same direction as U.K. population. The price of small white beans was found to move in the same direction as the price of navy beans with a $1.00 change in navy bean price associated with a $.74 change in small white bean price.

The estimated supply-demand relationships are the basis of a recursive simulation model. The basic information-feedback loop used was price and quantity data for navy beans and small white beans. The question

to be answered by using the model was: What would the effects of using a certain control device have been on the navy bean industry for the period from 1953 to 1967? The model was first validated by using a government price support program in the model and seeing if it could duplicate what actually happened in the industry in that fifteen year period. Actual values for the variables determined outside the economic model and actual government price support levels were used in the validation. The yearly values for variables examined for this validation included price of navy beans, production of navy beans, production of small white beans, navy bean producer income, government expenditures for navy bean takeover, government takeover of navy beans, and government takeover of small white beans. Before the validation was completed, the top portion of the demand curve was modified to make the simulated results conform more closely with the actual results.

After the model was validated, the following price or supply control systems were simulated: (1) variations in the government price support level, (2) an unsupported market situation (no price or supply control), (3) private support-storage program, (4) a marketing quota, (5) an acreage control, and (6) a two price system.

In the simulation of these situations or programs, the actual values for the variables determined outside the economic model during the fifteen years were used. The variables examined for effects were the variables generated within the model. These included navy bean acreage planted, navy bean production, navy bean producer income, etc. Various runs of the model with each device in it were made. Each run had the controlled variable set at a different level. For example, the private minimum price level was set at 10 different levels and a fifteen year run of the model was made for each minimum price level.

The use of the computer to evaluate economic questions, as this study has done, allows a fairly quick and easy manipulation of a complex system of variables. It provides valuable information to interested individuals and decision makers who have an interest in the navy bean industry, without the costs of actual implementation of undesirable programs. However, the reader should remember that the results are simulated and are presented only to help improve both the actions that might be taken in the industry and the understanding of the current industry behavior.

The first limitation of the computer simulation is that it is only as good as the equations that are its basis. These equations perform relatively well

when they are used over the range of values encountered for the variables in the actual operation of the industry. At variable levels not often reached, the relationships between variables as expressed in the estimated equations may no longer be relevant ones. If a certain portion of the variable's range has not been observed in recent years, as in the case of the low price range in navy beans, assumptions as to the behavior of the variables must be made.

The second limitation concerns the programs examined and the levels at which the controllable variables are set at before the simulations are run. The results are dependent on the programs chosen for examination. It may be, however, that the best program from the total industry viewpoint and subindustry viewpoint was not included. The most important shortcoming in this area may be the researcher's creativity or ability to find feasible alternatives to simulate. The results probably would also be different if a different time period had been used. Further, the equations may not be valid under all programs. For example, greater uncertainty may change parameters in the supply equations. However, the basic model remains available to test other alternatives that may look promising.

The simulation technique is not used to give the course of action that would maximize or minimize as in linear programming. Each group within the industry has goals it pursues, but different industry goals may conflict; that is, what one group wants maximized another might want minimized. If there is to be optimization or any close approximation thereof, it must be done in some type of collective action procedure where competing industry groups or government policy makers examine the tradeoffs involved in using one or more of the programs. The final course of action most likely will not be exactly what any one industry group wants, but will be some compromise between the attainment of competing industry goals.

The results of varying the government price support level show that when government price support levels were lowered a given percentage in each of the fifteen years and the model run under this condition, the effects on producer navy bean gross income, government takeover of navy beans and government expenditures for this takeover were significant. The more the minimum price support level was reduced, the less gross income the producer would have received for his navy bean production. At the same time, government takeover and expenditures would have become less. If government price support levels had been only 50 percent of what

they actually were for the fifteen year period, government yearly average expenditure would have been only $400,000 as compared to the $5.0 million ($341 per farm) that actually occurred. Average yearly producer income from navy beans would have been $24.4 million as compared to $36.1 million.

Two conclusions can be drawn from these simulations. First, the government price support program has been effective in maintaining producer price above what it would have been without a price support program. Second, it would have taken only a slight reduction in the government price support levels to have significantly diminished the income producers would have received and the expenditures of the government.

The private price support program examined was similar in operation to the government one with two exceptions. One, the private operation would have had to put all takeover back on the market when price allowed; and, two, the private program would have to be paid for entirely by producers. The results of the simulations show that the minimum price could have been set at a price of $4.00 and not have had any storage or debt remaining at the end of the 15 year period. The price could have been set at $5.00 without any ending storage. However, the agency would still have been in debt because of accumulated interest and storage charges. A

$5.00 minimum would not have increased average price paid to producers over the $4.00 level after adjusting for the ending agency debt.

In order to see the effect of controlling supply by limiting the amount producers could market and thus maintaining price at some target level, a marketing control was added to the model. Production would not have been directly controlled. Instead, producers would have been allowed to market only a certain maximum amount of their crop. Any remaining portion would not have been allowed to be marketed until doing so would not have lowered market price below the minimum level. It was assumed that producers would take the unmarketed portion of the previous year into account when making the current year's planting decision, and thus reduce acreage planted in the current year. Under this program producer gross income from navy beans and average price would have increased at higher minimum target price levels. Because of the decreasing amount of the crop allowed to be marketed when the minimum target price level was set at high levels, acreage planted and production would have decreased as the target price level was set higher.

Controlling the acreage planted was also tested. The effect of this acreage control was to decrease acreage planted, production, and to increase producer

income from navy beans. The simulation results show that if acreage planted had been limited to 400,000 acres a year, average yearly gross income from navy beans would have been $33.7 million. If the limit had been either higher or lower, producer gross income from navy beans would have gone down.

The final program tested was a two price system. One variation simulated was a price set-up in which the domestic price would have been kept $1.50 above the export or world price. The results of this simulation were similar to the unsupported market simulation. In another two price simulation, domestic price was set at some level and the export price was allowed to fluctuate freely within the model framework. With this system producer gross income from navy beans and average price would have been increased more in the fifteen years if the domestic price had been set at higher levels. However, that part of production kept off the domestic market to maintain domestic price would have had to be sold in the export market. At very high domestic prices, not all of the production alloted to the export market could have been sold in the export market under the assumed demand conditions at those low export prices.

The general conclusion obtained from the examination of the different control programs is that they would

have increased producer income from navy beans above what it would have been without controls. The government price support program at the actual price support levels was superior in this regard (at least at the price levels considered for the private programs). The effectiveness of the other control programs was dependent on their ability to limit production. Those that did not have this ability were not as successful at raising gross income from navy beans or average price. At some point all the programs ran into constraints that limited their ability to raise income or price beyond a certain point. Each program also would have side effects on different groups in the industry that must be considered by those using or giving the power to use the programs.

The question as to whether or not non-governmental control programs will be used depends on the priorities and concerns of the public. Government expenditures to low income groups go to those that can organize in such a way as to make their problem a national political issue. In the past, agriculture was able to do this because it had a large percentage of the low income people in the country. The government price support program came out of this type of setting, increasing income to those farmers who produced significant amounts. In the past 20 or 30 years, however,

agriculture has lost many of its poor to the other areas of the economy. The concern of the country for low income people, to a large extent, has turned away from agriculture toward other areas, particularly the urban ghettos. If agriculture is to continue to receive public help, it may have to be in the form of law changes that would permit the operation of non-governmental control programs similar to those examined in this study. If that happens, this study may provide some useful information which can assist in the evaluation of alternative programs. In the interim, the econometric model can be used for predictive and planning purposes. It can give estimates of the next year's planted acreage. It can also be used to estimate navy bean price, domestic consumption and government takeover in the current year.

Some final comments on needed research areas may prove useful to those who may examine the navy bean industry in the future. Several areas of research can be suggested:

1. A more complete study of the export market is needed when data becomes available in order to better determine what exports will be at different prices. Each country which imports beans should be studied and the factors influencing demand should be established.

2. A study of where and how the government disposes of its takeover and the effects this disposal has on the price and demand for navy beans could be of value to both those people working in the industry and those doing further research on likely consequences of industry policy change, assuming the government program continues.
3. Examination of the domestic supply and demand situation in Canada might be useful to both Canada and the United States. Since the two countries are the chief producers of the navy beans grown in the world, an examination of both U.S., Canadian, and world markets must take the policies and supply of both countries into account. The effects of a market-sharing duopoly operating under different marketing policies might be simulated by combining a Canadian model with the model used in this study, and could provide some meaningful insight into the effects of the recently instituted Canadian two-price plan, and the best competing policy for the United States.
4. An analysis of the opinions of producers and other industry groups on the different price and supply control programs may be needed

before any such programs would be feasible in the industry. A study of this type might show what educational or extension programs need to be undertaken to show the positive benefits and costs that could be associated with each program.

5. A more detailed analysis of each program could be done. This could include examination of the needed administration each program would require and the administrative costs. The exact legal and organizational changes needed before implementation could also be examined more closely.

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APPENDICES

APPENDIX A

THE ONTARIO NAVY BEAN INDUSTRY[1]

In examining an industry and how it might be changed to better fulfill its ends in a changing environment, the organization of similar industries can provide information for comparisons and directions in which to move the industry's structure. The Ontario navy bean industry is examined with this purpose in mind, and also to provide background about the organizational setting of the major U.S. competitor in the export market.

There are several similarities between the Michigan and Ontario navy bean industries. Both produce almost all the navy beans produced in their respective countries. Second, production is concentrated in a small area within the state or province. In Ontario, six southwestern counties produce virtually all the navy beans in the province, as does the "Thumb" region in Michigan. Third, production in both state and province

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[1]The information on the Ontario bean industry was obtained through personal interview with Mr. Charles E. Broadwell, Manager-Marketing Agent for the Ontario Bean Producers' Marketing Board, July 1969.

is in small acreages, with the planting per grower averaging around 50 acres in the United States and 30 acres in Canada. Total production in both places has also trended upward in recent years (Tables I-1 and A-1).

The breakdown of sales between domestic and export markets also are similar. Both countries are becoming more dependent on the export market (Tables I-2 and II-2). The United Kingdom is the primary market for both countries with Canada having a tariff preference which gives it a 6% price advantage on its competitors.[2]

However, there are also several differences between the two industries, particularly, in how their institutions are set up. A Bean Producers' Marketing Board voted into existence by producers under the Farm Products Marketing Act has covered navy and yellow eye beans in Ontario since 1944.[3] Until 1968 the main function of this Board was to have a negotiation committee of producers and dealers (shippers). This committee decided: (1) when payment for beans delivered

[2]This tariff preference will be reduced to 4 percent by January 1, 1971.

[3]Under this Act, a local marketing board must have a plan approved by the Farm Products Marketing Board. The Farm Products Marketing Board has the right to establish, amend, and revoke plans of local boards for control and regulation of the marketing of farm products.

TABLE A-1

ONTARIO PRODUCTION AND EXPORTS OF NAVY BEANS, 1958-67

YEAR	PRODUCTION 1000 cwt.	EXPORTS 1000 cwt	EXPORTS AS A % OF PRODUCTION
1958	679	34	5.0
1959	633	58	9.1
1960	620	33	5.3
1961	744	127	17.0
1962	838	200	23.8
1963	863	218	25.2
1964	1117	397	35.5
1965	1182	597	48.9
1966	1396	669	47.8
1967	821	300	36.5

Source: Personal communication with the Ontario Bean Producers' Marketing Board; London, Ontario, May 2, 1969.

to a dealer was to be made; (2) how disputes as to grade, moisture content, or conditions of beans were to be settled; and (3) what the maximum charge by any dealer for grading and picking was to be. In time, the agreements between the producers and dealers were standardized by contracts. In 1952, the producers started a cooperative (owned by the Board) to market their own beans.[4] Promotional efforts for beans was another activity carried out by the Board.

Starting with the 1968 crop year, the Marketing Board started operation under a new marketing plan. This plan's main feature is that all pea and yellow eye beans grown in Ontario must be marketed by or through the Board.

In actual practice, after harvest starts, producers deliver beans to the elevators of their choice, at which time the elevator operator, as agent of the Board, pays the producers an initial payment (decided in advance by the Board.)[5] The Board then pays to the dealer the money paid out by him on behalf of the Board. Producers may store beans if they desire, but there is

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[4]The cooperative and the Board have since been separated. The cooperative is now treated like any other dealer by the Board.

[5]There are now 23 dealers operating in navy beans in Ontario.

no advantage for a producer to store beans past a specified date (March 16 in the first year of operation).

Once delivered to the dealer, the beans are owned by the Board, which now sets the minimum prices at which the beans can be sold. In its first year of operation, the Board has operated under a two price system (under the old marketing plan, only the market price existed). It sells beans in the domestic market at a higher price than it does on the export market, the domestic market being protected by an approximate $1.50 per cwt. tariff.[6] This means the domestic price can be up to a $1.50 higher than the export price.

Before the beginning of the marketing year, the Board negotiates with the dealers to determine what charges will be paid to the dealer for handling of the Board's beans. When the dealer sells the beans, he pays the Board the price set by the Board minus the agreed upon handling charges. The Board can change the price it sets during the market year if it is necessary to meet competition.

To make the initial payment to the grower, when his beans are delivered to an elevator, the Board borrows from a bank. As the Board sells the beans, it pays off

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[6]The domestic price was adjusted in Western Canada to account for freight rate differences between the United States and Canada. The United States freight rate being below the Canadian rate.

the loan and forms a pool with the rest of the money. As money accumulates in this pool, it is paid out to the growers, based on the quantity of beans they delivered to the Board. After the entire crop has been sold, all the money in the pool should have been paid out to the growers.[7] The growers are charged six cents per cwt. to cover the administrative costs of the Board.

The Board has the right to restrict the quantity of beans that a grower can market, but this provision was not used in the first year of operation. There are no plans for this power to be used in the near future.

Another provision of the new marketing plan calls for an advisory committee composed of a chairman and eight members. Three of the members are appointed by the dealers, four are growers appointed by the Board and three are appointed by the Ontario Food Processor's Association. The Chairman is appointed by the Farm Products Marketing Board. The function of this committee is to advise and make recommendations to the Board, the dealers, or the Ontario Food Processers'

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[7]During its first year, the Board operated under an agreement with the dealers that required that no more than 5 percent of the 1968 crop would be remaining in storage at the end of the crop year. If this agreement continues, the board will not be able to carry production over from a large crop year. This type of agreement is not required by the Board's marketing plan.

Association with respect to the promotion of greater efficiency in production and marketing, and prevention and correction of irregularities in marketing of beans.

APPENDIX B

DATA USED IN STUDY BUT NOT PRESENTED IN THE TEXT

Year	1 PC[a]	2 PSW[a]	3 PRSW[a]	4 PSSW[b]	5 PERCN[c]	6 Dummy[a]
1951	1.71	8.04	736	7.89	96	0
1952	1.44	8.74	540	8.30	94	0
1953	1.38	9.81	560	8.35	97	0
1954	1.37	10.97	731	7.81	84	0
1955	1.12	8.26	884	6.76	97	0
1956	1.19	7.71	771	6.71	97	0
1957	1.07	9.05	759	6.92	92	0
1958	1.06	9.23	800	6.80	98	1
1959	1.01	7.48	943	6.06	93	1
1960	.97	8.46	618	6.09	99	1
1961	.91	10.78	438	7.21	98	1
1962	.99	9.02	542	7.33	99	1
1963	1.06	9.36	607	7.33	98	1
1964	1.09	10.95	514	7.33	97	1
1965	1.08	12.35	578	7.52	95	1
1966	1.24	9.12	670	7.52	99	1
1967	.98	12.95	473	7.52	91	1

[a]Variable and units defined in Chapters III and V.

[b]Government price support level for small white beans in dollars per cwt.

[c]Percentage of Michigan dry bean planted acreage that was harvested.

Sources:

Col. 1: U.S. Department of Agriculture, Agricultural Prices, Various Issues.

Col. 2,3, and 4: U.S. Department of Agriculture and California Department of Agriculture, Dry Beans: California Market Summary (Federal-State Market News Service, Sacramento, Annual Issues).

Col. 5: Michigan Department of Agriculture, Michigan Agricultural Statistics (Lansing, Various Issues).

TABLE B-1 (Continued)

Year	7 PNB[a]	8 USPOP[a]	9 UKPOP[a]	10 BINV[a]	11 Yield[d]	12 AHNB[e]
1951	6.51	155	50	400	1075	352
1952	7.43	158	51	144	1065	301
1953	7.83	160	51	490	1010	339
1954	9.39	163	51	74	810	370
1955	6.48	166	51	50	920	472
1956	6.17	169	51	150	1065	461
1957	7.62	172	52	244	740	442
1958	6.44	175	52	25	985	502
1959	5.46	178	52	30	1265	475
1960	5.46	181	53	363	1185	490
1961	6.00	184	53	160	1350	497
1962	6.07	187	53	32	1315	509
1963	6.15	189	54	338	1480	511
1964	6.61	192	54	139	1250	541
1965	8.35	195	55	384	960	569
1966	6.01	197	55	499	1280	569
1967	8.35	199	55	415	1070	447

[d]Yield of navy beans in Michigan in pounds per acre.

[e]Michigan harvested navy bean acreage. Obtained by dividing Michigan production of navy beans by Michigan yield of navy beans.

Sources:

Col. 7: Records kept by Department of Agricultural Economics, Michigan State University.

Col. 8: Council of Economic Advisers, Economic Report of the President (Washington, D.C.: Government Printing Office, 1969), p. 251.

Col. 9: United Nations, Statistical Yearbook (New York, Various Issues).

Col. 10: Personal communication with the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Oilseeds and Special Crops Division, Washington, D.C.

Col. 11: Personal Communication with the Michigan Crop Reporting Service, Lansing, Michigan.

TABLE B-1 (Continued)

Year	13 APNB[f]	14 GIBS[a]	15 CBPI[a]	16 CANEX[a]	17 DDNB[g]
1951	365	49.03	10.98	16	2497
1952	319	48.50	11.44	156	2556
1953	350	47.32	11.15	516	2924
1954	441	48.42	10.72	150	3130
1955	489	43.49	9.90	55	3032
1956	477	45.84	10.17	49	1970
1957	482	42.99	10.75	82	3538
1958	514	43.65	11.10	34	3999
1959	511	44.28	11.73	58	4126
1960	497	50.09	16.05	33	3570
1961	508	55.69	13.84	127	4370
1962	516	58.73	10.87	200	3751
1963	519	57.23	11.12	218	4848
1964	556	65.58	12.52	397	4405
1965	600	62.85	13.41	579	4290
1966	577	66.14	20.60	669	3653
1967	493	62.44	17.91	300	4066

[f]Navy bean planted acreage in thousand acres. Obtained by dividing percentage of Michigan dry bean planted acreage that was harvested (Col. 5) into Michigan navy bean acreage harvested (Col. 12).

[g]Domestic demand of navy beans obtained by adding U.S. production plus beginning inventory and then subtracting U.S. exports and government takeover.

Sources:

Col. 14: U.S. Department of Agriculture, Agricultural Statistics, Annual Issues.

Col. 15: Roger J. Vandenborre, An Econometric Investigation of the Impact of Governmental Support Programs on the Production and Disappearance of Important Varieties of Dry Edible Beans.

Col. 16: Years 1951-57, U.S. Department of Agriculture, Foreign Agriculture Service, World Agricultural Production and Trade(Various Issues): Years 1958-67, Personal communication with Ontario Bean Producers Marketing Board, London, Ontario.