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dissertation entitled

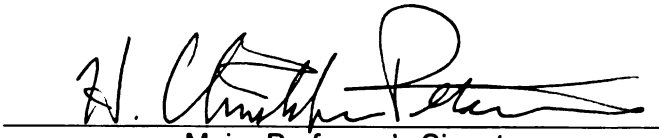
Integrating Econometric Analysis with Scenario Analysis for Forecasting in a Rapidly Changing Environment: Case Study of the U.S. Dry Bean Industry

presented by

Meeta Punjabi

has been accepted towards fulfillment
of the requirements for the

Ph.D degree in Agricultural Economics



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3/11/05

Date

Integrating Econometric Analysis with Scenario Analysis for Forecasting in a Rapidly Changing Environment: Case Study of the U.S. Dry Bean Industry

By

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A DISSERTATION

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

DOCTOR OF PHILOSOPHY

DEPARTMENT OF AGRICULTURAL ECONOMICS

2005

An Abstract of a Dissertation

Integrating Econometric Analysis with Scenario Analysis for Forecasting in a Rapidly Changing Environment: Case Study of the U.S. Dry Bean Industry

By

Meeta Punjabi

The U.S. agricultural economy is in the midst of rapid and significant structural transformations. These changes have implications for all participants in the agriculture and food industry. The issue of changes assumes importance because of its implications for decision-making. While it is very challenging to plan in a rapidly changing environment, the most pressing issues arise in such circumstances. In the recent agricultural economics literature, there is concern regarding the analytical capacity of the traditional economic models in analyzing these changes and understanding their implications for the future of the industry. The main contention is that in times of rapid changes, a traditional analytical approach based on historical data is not likely to be useful in *ex ante* assessment of the imminent changes. This study attempts to address these concerns by integrating econometric analysis with scenario analysis, a widely recognized approach in the strategic management literature for planning in a rapidly changing environment. The combined approach is illustrated by conducting an analysis of the U.S. dry bean industry as the industry has faced several changes in the past two decades.

The study involved conducting a scenario analysis and an econometric analysis of the dry bean industry and integrating the two approaches for the future analysis. Scenario analysis helped to identify the key driving forces that have affected the industry and to

understand the impact of these changes on the industry participants. From these driving forces, the two key forces likely to influence the industry in different directions were identified as – demand for dry beans and the impact of globalization. An econometric model for the U.S. dry bean industry was outlined to represent economic relationships in the industry. To integrate the two analyses, quantitative estimates of the uncertain factors identified by the scenario analysis were obtained using the Nominal Group Technique. The future scenarios for the dry bean industry were based on model simulation by incorporating the results of the scenario analysis into the econometric model. Three future scenarios outlined for the dry bean industry are: "More of the Same", which presents the baseline situation with no major changes; "Challenged in a Global Market" presents a situation where the U.S. dry bean industry is challenged by intense competition from global producers; and finally, "Saved by Consumer Demand" presents the most positive situation for the industry because of a significant upward shift in demand.

Integrating scenario analysis and econometric analysis helped to evaluate how the key industry variables evolve differently based on the possible outcomes of the key uncertain forces. The main advantage of the integrated approach is that it enables envisioning a range of fundamentally different outcomes for the industry which would not be possible using only the traditional analysis. Envisioning a broad range of outcomes enhances decision making in times of rapid change by making decisions that are likely to be robust across all outcomes.

Acknowledgements

At the completion of this project, I express my gratitude to the people who have made it possible.

My heartfelt gratitude to Dr. Vinod Ahuja, a dedicated professional and a wonderful human being, who inspired me to pursue doctoral education in this field.

My sincere thanks to my dissertation committee for their guidance, support and encouragement through the research process. I appreciate Dr. Peterson's kindness and patience in guiding me through the process. His support in exploring ideas and concepts was invaluable. I have learnt immensely from Dr. Myers about clarity of thought and attention to detail. I appreciate the help extended by Dr. Raper, who was always available to discuss issues and help clarify my thoughts. Dr. Jim Kelly provided very good insights about the dry bean industry and was always forthcoming with information. I would like to thank Dr. Dave Weatherspoon for prompting me to be creative in designing my research.

A very special thanks to my family, my parents and brothers, for being ever supportive of every endeavor I undertake. Finally, this project would not have been accomplished without continual help and support from a chorus of people – my friends, the faculty, fellow graduate students and support staff in the Department of Agricultural Economics at MSU.

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Chapter One

Introduction

1.1 Introduction and Problem Statement

In the past decade, advances in information technology, biotechnology, industrialization of agriculture, changing consumer preferences and changes in environment and trade regulations have resulted in unprecedented changes in the structure and organization of the food and agricultural industry. The impact of the ongoing changes on the structure and organization of the hog and beef industry have been extensively discussed in the literature (Hayenga et al. (1995), Paarlberg et. al. (1999). Challenges posed to various agricultural industries may differ in extent but the issues are similar in nature. The issue of changes assumes importance because of its implications for decision-making. While the most pressing issues arise in times of rapid change, at the same time it is also very challenging to plan in a rapidly changing environment. Though the discussion here focuses on implications of these changes for decision-making at the policy level, the issues are the same for managerial decision-making.

In their recent articles, Just (2001) and Boehlje (1999) discuss the nature of the ongoing changes and the immense implications for all the participants in the food and agricultural industry. At the same time, they also raise concerns regarding the analytical capacity of the traditional economic models in analyzing these changes and understanding their implications for the future of the industry. The typical approach to forecasting is to analyze historical relationships and consequences and to extrapolate implications for the future from that analysis. Their main contention is that in periods of

significant structural changes, an *ex post* approach based only on historical data does not provide any insights into what structural changes might occur and what the consequences of these changes are likely to be. Thus, analysis based only on historical data is not likely to be adequate to assist the policy process in times of rapid change. This drawback of the traditional analysis raises serious concerns for policy making in times of rapid change:

- *How do we analyze, understand, and predict the characteristics and consequence of these changes for the future of the industry?*
- *What is the role of economic analysis based on historical data for forward-looking policy analysis?*
- *How important is government foresight in influencing issues where huge investments need to be made?*

These concerns call for looking beyond standard frameworks to emphasize forward-looking approaches to develop analytical capacity for more accurate *ex-ante* analysis of what structural changes might occur and what the consequences are likely to be.

The question then is that since there are no data for the future, how can we say anything about the imminent changes? In suggesting alternate approaches, Boehlje and Just emphasize that the main indicators of the future changes are the perceptions of the key decision-makers (consumers, producers, agribusiness managers and policy makers). The argument is that the ongoing changes in agriculture are the result of the actions of these decision-makers. Their actions are preceded by their perception of the business situation. Thus, economists can learn a great deal about the potential implications of a new unanticipated event by surveys of current actions, perceptions and attitudes of the key decision-makers. Incorporating their perceptions into economic modeling can greatly enhance the decision-making process in times of rapid change. The problem statement then as aptly worded by Just (p-1147) is:

"In times of rapid change, how can the best blend of theory, econometric validation, and perceptual adaptation be achieved to best support the policy process?"

To address these concerns, the approach in this study is to combine econometric analysis with scenario analysis, a qualitative technique widely recognized in the strategic management literature for planning in an uncertain business environment (Wack, 1985a, and 1985b; Amara and Lipinski, 1983; and Schoemaker, 1995). Behravesh (1998) presents the concept of integrating scenario analysis and econometric analysis in Fahey and Randall (1998), which is a compilation of their study on the various uses of scenario analysis.

Scenario analysis follows a systematic process to create a set of three or four plausible scenarios that describe possible evolution of key areas of uncertainty. The analysis involves identifying the driving forces (social, economic, political, technological and environmental), identifying the basic trends and key uncertainties from the driving forces, and laying out several different future scenarios based on interaction of the basic trends and key uncertainties. Scenarios are presented in the form of vivid pictures of the future, which explain how the industry's dynamics can move it from the current state to several alternate futures. The purpose of scenario planning is not to predict the future, but rather to show how different forces can manipulate the future in different directions. The analysis is conducted with input from a scenario team composed of key decision makers, experts and stakeholder representatives often done during two or three one day workshops held over a period of weeks.

Integrating the two approaches strengthens traditional econometric analysis in two ways – by providing a stronger analysis of the past and enhancing *ex ante* analysis of the

imminent changes. For an analysis of the past, scenario analysis enables identifying the major driving forces and understanding the impacts of these change forces on the industry participants. This information ensures incorporating the driving forces in the econometric model and enhances the interpretation of past events. It is important to emphasize that all econometric analysis is based on a good understanding of the industry, and hence involves some form of qualitative analysis before doing the econometric analysis. However, in times of rapid change, scenario analysis provides a formal structure for comprehensive understanding of the ongoing changes.

For the future analysis, scenario analysis helps to identify the key uncertain forces which can influence the industry in different directions. The results of the scenario analysis are incorporated in the econometric analysis by conducting model simulations based on the possible outcomes of the key uncertain forces. The results of the simulation provide fundamentally different futures for the industry which helps to envision how the industry evolves along different paths based on the outcomes of the uncertain variables. Forecasting based only on historic data would not enable envisioning a broad range of different future outcomes for the industry. Thus, integrating the two approaches provides a much stronger tool for economic analysis in times of rapid change.

In general, the main advantage of mixed method approaches using qualitative and quantitative data, is that the two analyses complement each other by overcoming the weaknesses of the other (Creswell, 2003). The same holds true for this study as well: not only is econometric analysis strengthened by scenario analysis but the opposite is also true. Scenario analysis is enriched as econometric analysis provides a rigorous representation of the price and quantity relationships in the industry, and helps to

understand the economic rationale for the ongoing changes. Also, econometric analysis provides quantitative estimates of the impact of the driving forces, which may not be available otherwise. Finally, the econometric model provides an explicit framework that clarifies which assumptions were used to develop the scenarios and help to create well-researched scenarios by imposing internal consistency on scenarios (Behravesh). The main limitation of this approach is the effort involved in additional data collection and analysis versus that used in either approach by itself.

A case study of the U.S. dry bean industry, with emphasis on the traditional leading producer Michigan is presented to illustrate the approach. The U.S. has been a dominant producer of dry beans and a leading exporter. However, the dry bean industry in the U.S. has experienced significant changes in the past two decades. The major changes include consolidation at the elevator and canning/processing level, government support for competing crops, change in demand driven by changes in tastes and preferences, and trade changes associated with NAFTA and increasing globalization. As a consequence of the changing market dynamics, the U.S. which has traditionally been one of the leading exporters, became one of the leading importers of dry beans in 2002. Further, within the producing regions in the U.S., Michigan has lost its position as the traditional leading producer, while the Minn-Dak (Minnesota and North Dakota) region has emerged as the dominant producer of dry beans. In the light of these changes, the scenario analysis will give insights into how the industry might evolve in the future and the econometric analysis will give insights into how this evolution may influence key industry variables.

1.2 Research Questions

Based on the dual methods approach followed in this study, the research questions are based on scenario analysis, econometric analysis and on the results of the integrated analysis.

The scenario analysis will address the following questions:

- What are the driving forces that have affected the industry in the past and what has been the impact of these forces on the dry bean industry?
- What are the most important and the most uncertain forces that will determine the future of the industry?

The econometric analysis addresses the question:

- What is the supply and demand structure of the dry bean industry and how are equilibrium prices and quantities determined?

Integrating the results of the econometric analysis and the scenario analysis will address the following questions:

- How is the dry bean industry in the U.S. likely to evolve under the influence of the key driving forces?
- What are the future implications for the traditional producing region Michigan under different scenarios?

Finally, from a methodological perspective, a relevant research question is:

- How does this integrated approach enhance the results of econometric analysis for *ex ante* assessment of the oncoming changes?

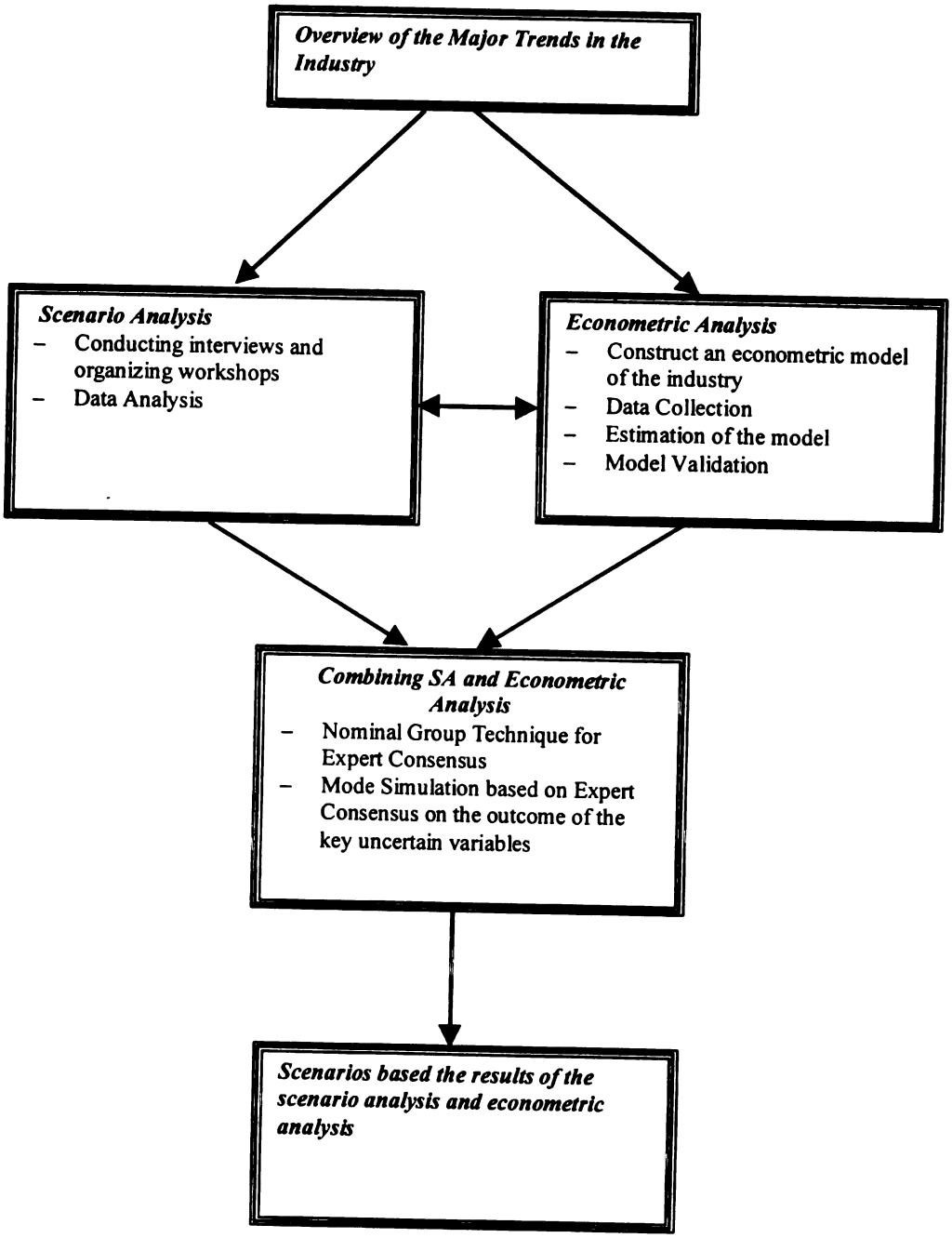
1.3 Research Design

Figure 1.1 presents a visual description of the research design. The purpose in this section is to present an overview of the research process. Detailed discussion of the data collection and analysis procedure is presented in relevant chapters in the study.

An overview of the major trends in the industry lays the background for the study by giving insights into the major changes in the industry. Following this, the scenario analysis and the econometric analysis were conducted concurrently. Conducting the two analyses simultaneously was a better option than sequential analysis since each analysis provided feedback for the other. Conducting the scenario analysis gave insights into the driving forces that should be included in the econometric analysis. On the other hand, specifying the econometric model helped to understand the structural relationships in the industry. Thus, in this study the two analyses were conducted simultaneously with feedback and interaction between them as the research progressed.

Scenario analysis is based on secondary and primary data. Secondary data includes data published on dry bean prices, acreage, production, consumption, and trade. Primary data for the analysis was collected by conducting interviews with the industry stakeholders and organizing a workshop with the scenario team. The scenario team is a group of industry participants that provide input for the scenario process. The scenario analysis helps to understand the major driving forces affecting the industry and the impact of these driving forces on the industry participants. The analysis also identifies the major uncertain variables for the future.

Figure 1.1: Research Design



The econometric analysis involved outlining an econometric model of the U.S. dry bean industry. This analysis is based on secondary data. The econometric analysis provides a structural framework to understand the interrelationships that underlie the determination of dry bean supply, demand and prices.

The scenarios for the dry bean industry are based on integrating the results of the scenario analysis and econometric analysis. The results of the scenario analysis were incorporated in the econometric model to conduct simulations to get insights into how the industry evolved under alternative scenarios. Quantitative estimates of the uncertain forces needed to incorporate these factors in the model were obtained by using the Nominal Group Technique (NGT), a widely used approach in strategic management field to get expert consensus.

1.4 Organization of the dissertation

The study is organized into seven chapters. Chapter two provides a background of scenario analysis based on strategic management literature. Chapter three reviews the major trends in the global and the U.S. dry bean industry. Chapter four presents the result of the scenario analysis, which provides an understanding of the driving forces behind the changing trends. Chapter five presents the econometric analysis of the U.S. dry bean industry. Based on the results of the scenario analysis and econometric analysis, the alternate scenarios for the industry are presented in chapter six. Finally, Chapter seven summarizes the results of the study and suggests some directions for future research.

Chapter Two

Background of Scenario Analysis

2.1 Introduction

Scenario analysis is a strategic management technique used extensively for planning in a rapidly changing business environment. This chapter reviews the strategic management literature on scenario analysis with emphasis on the background of scenario analysis, current use of the technique in strategic management and other fields, benefits of the approach and finally, the methodology for conducting scenario analysis.

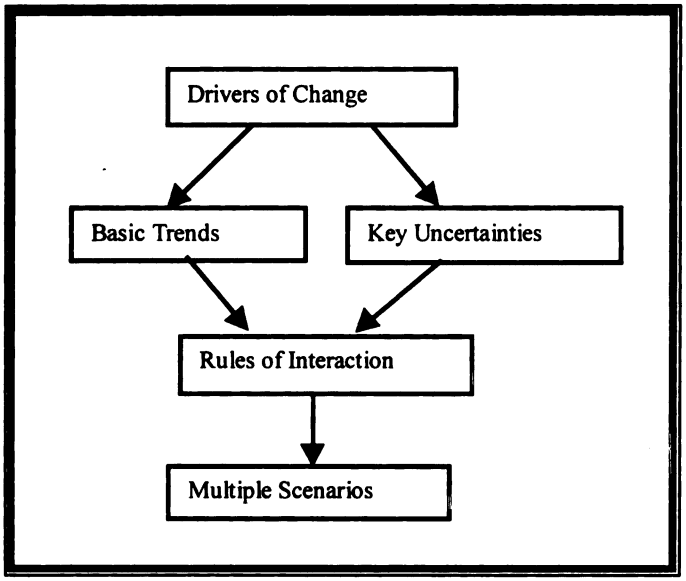
2.2 What is Scenario Analysis?

Alternate terms for scenario analysis include scenario planning, scenario learning and developing scenarios. Some of the key definitions for scenario analysis are: "Scenario analysis is a technique used to analyze future developments in situations characterized by a high degree of uncertainty and complexity" (Raubitschek, 1988). Porter (1983) defines scenarios as "an internally consistent view of what the future might turn out to be – not a forecast, but one possible future outcome."

Historically, scenario analysis emerged as a systematic tool for planning after World War II out of the defense management studies done by Rand Corporation for the Department of Defense. The content and method of these defense studies were not known outside the Corporation. However, starting in the early 1960s several of the people associated with developing the process left Rand to join various institutes where

the scenarios methods was further developed and used.[1] Consequently, there are several alternate approaches to scenario analysis, as different institutes propagated their own approach. However, the underlying features of the approaches are the same. The main steps in conducting the analysis are: identifying the driving forces affecting the system, separate the key driving forces into predetermined trends and uncertainties, and develop scenarios on the outcome of the key uncertainties (Figure 2.1).

Figure 2.1: Overview of Scenario Analysis



Source: Schoemaker

In general, scenarios are descriptive narratives of plausible alternative projections of the future. Scenarios provide vividly contrasting narrative description of how several uncertain aspects of the future might evolve. These narratives might address for example, the plausible future expansion or contraction of an industry, the advent of

[1]Some of the key institutes include Hudson Institute, Institute of Futures, Futures Group, California Institute of Technology and Stanford Research Institute

regulation or deregulation or the emergence of a new technology. They are a combination of estimations of what might happen and assumptions about what might happen, but they are not forecasts of what will happen. Thus, scenarios are projections of a potential future, not predictions. A projection should be interpreted as a view of the future that is based upon specific information and a set of logical assumptions. "The key test for scenarios is plausibility – that is, scenarios should be credible, possible and relevant. Plausible evidence should indicate that the projected narrative could take place (possible), demonstrate how it could take place (credible) and illustrate the implications for the system/industry (relevant)" (Fahey and Randall, 1998, p-9).

2.3 Benefits of Scenario Analysis

Table 2.1 presents the benefits or functions ascribed to scenarios. The benefits of scenario analysis fall in two categories – enhancing decisions by creating strategies that are robust in different outcomes and augmenting decision-makers' understanding of possible futures. The usefulness of scenario analysis in enhancing decision-making is the more traditional use of the approach (Fahey and Randall; Ringland, 1998; Porter, 1985). Envisioning a set of alternative scenarios enable decision-makers to compare and contrast how a particular future might evolve. These comparisons allow decision-makers to identify key indicators of the evolution of each future and to assess the importance of each scenario for specific strategies or decisions. Thus, the analysis helps to prepare the decision makers for changes which leads to flexibility in decision making; enables making decisions that are more robust in the face of different outcomes; and enhances the responsiveness to changes in the business environment.

Table 2. 1: Functions of Scenario Analysis

Original Functions
1. Evaluation and selection of strategies
2. Integration of various kinds of future-oriented data
3. Explorations of the future and identification of future possibilities
More recently added functions
4. Making managers aware of environmental uncertainties
5. Stretching of managers mental models
6. Triggering and accelerating processes of organizational learning

Source: Bood and Postma (1998)

The role of scenario analysis in organizational learning is being increasingly recognized in strategic management literature. Bood and Postma (1998) link scenario-development to Kolb's learning cycle, which highlights a number of bottlenecks that may hinder learning (e.g. cognitive inertia and feedback lags). They show how scenarios help to dissolve these bottlenecks and hence support strategic learning. Wood (1997) emphasizes this point as she argues, "scenario planning is probably misnamed, it is more like scenario learning." Also, Van der Heijden (1996) highlights the role of scenario analysis in bringing people together towards a shared understanding of the situation, making decisions possible.

These benefits of scenario analysis from a strategic management perspective also hold true from the policy analysis perspective. Specific uses of scenario analysis from a policy perspective are highlighted by Becker (1983): i) to estimate if various policies and actions can assist or prevent the conditions of a scenario from coming about; ii) to assess how well alternate policies would perform under the conditions depicted, i.e., to estimate risks in choosing certain course of action; and iii) raise awareness among policy makers, stake holders, citizens about new or intensifying problems.

2.4 Use of Scenario Analysis

Scenario analysis was used extensively in the corporate sector after the 1960s. However, there was a marked increase in the use of the approach after the energy crisis of 1973-74 and the subsequent turbulence in business environment. Being in the energy industry, Shell has been one of the pioneers and proponents of scenario analysis. Shell's ability to act quickly in the response to the energy crisis has been credited with moving the company into the lead in the oil industry (Van der Heijden). Simulated by the success of Shell in anticipating and exploiting oil shocks, some ten years later approximately half of the largest U.S. and European companies reportedly used scenario analysis to support long range decision making (Linneman and Klien, 1983). Maack (2001) summarizes the use of the technique– "Scenario analysis has been used by the private sector for the last 25 years to manage risk and develop robust strategic plans in the face of an uncertain future. Its success in helping firms manage large capital investments and change corporate strategy has made it a standard tool of medium to long term strategic planning."

Though traditionally used by corporates, growing uncertainty about the future has led to increasing use of scenario analysis by academia, government agencies and research groups as a part of their planning and policy analysis. Some of the recent applications of scenario analysis in different fields include: development policy issues (Maack), the U.S. national aeronautics policy (National Research Council, 1997), study on energy systems by the U. S. Environmental Protection Agency (Koomy et. al, 1998), public education in California (Oligvy, 1992), and public health systems (Venable, 1993).

2.5 Methodology for Conducting Scenario Analysis

A number of companies, consulting firms, military organizations, governmental and academic institutions have developed and refined their own approach to constructing scenarios. Fahey and Randall present a compilation of the different ways in which scenarios can be constructed. They present the scope, content, and rationale of the principal scenario methods used by business firms and other organizations. However, they also recognize that scenario analysis is not a technology that can be patented or packaged and that each organization will have to adapt the scenario-learning techniques that have been offered. The various approaches presented include the traditional approach to scenario analysis, where the scenarios are based on a logical hypothesis about how a few critical uncertain forces could interact to alter the operating environment. Other main approaches focus on envisioning a desired future and laying out a path that would lead to the desired future or using scenarios to test how the various strategies will play out in different scenarios.

The approach for scenario analysis used in this study is the traditional approach presented by Schwartz and Oglivy (1998). This approach is appropriate for an industry level analysis, as the other approaches are more demanding of input from management and hence are more suitable for use at an organization level. The analysis is conducted with a scenario team composed of participants including industry stakeholders and representatives, people with a through knowledge of the industry and its competitive environment and the critical issues to be addressed. The four key steps in conducting scenario analysis are explained here in detail.

1. **Identifying the Driving Forces:** The first step in conducting scenario analysis is to identify the key trends and the driving forces that influence the industry and understand their impact on the industry. These forces include five general categories: social, technological, economic, environmental, and political factors. These driving forces are identified by conducting interviews with key industry stakeholders and representatives. The scenario team helps to develop a comprehensive understanding of the driving forces based on the information collected from the interviews.

2. Identifying the Key Uncertain Variables: The next step in the analysis is to distinguish the predetermined elements from uncertainties. The inevitable and predetermined trends are those that are already evident and are unlikely to vary significantly in any of the scenarios. The uncertain elements of the driving forces help to define the scenarios. The key uncertain forces are identified based on information collected from the interviews and with input from the scenario team.

3. Building the Scenario Matrix: The dimensions of the scenario matrix are defined by the uncertain elements. The number of possible scenarios is 2^n, where n is the number of key uncertain variables. Three or four final scenarios are selected from the range of possible outcomes based on plausibility and internal consistency.

4. Embellishing the Scenario Plots: Scenario sets are presented in the form of vividly contrasting narrative descriptions. The most important/uncertain forces shape the logics that drive the scenarios while the other driving factors identified are used to compose the scenario plots. Each of the key factors and trends are given attention in framing the scenarios. Some of the variables like demographics etc. are likely to show up in all scenarios.

2.6 Chapter summary

This chapter reviews the strategic management literature on scenario analysis. Historically, scenario analysis was developed by Rand Corporation as a systematic tool for planning during the World War II. Starting in the early 1960s several of the people associated with developing the process left the organization to join various institutes where the scenarios methods was further developed and used. Thus, there are several approaches to scenario analysis. However, the key steps in conducting the analysis are the same: identify the major driving forces, identify the key uncertain factors from the driving forces, and develop alternate scenarios based on the possible outcomes of the key uncertain forces.

The main benefit of scenario analysis is that envisioning alternate scenarios enables making decisions that are likely to be robust in different future outcomes. The other important benefit of scenario analysis from organizational perspective is in bringing people together to a shared understanding of the situation. These benefits of scenario analysis also hold true from a policy perspective: scenario analysis helps to assess how alternate policies would perform under different conditions, and also helps to raise awareness among stakeholders and policy makers about new and intensifying problems.

In the light of these benefits scenario analysis has been used extensively by the corporate sector for planning since the oil shock of the 1973-74, and the subsequent turbulence in the business environment. Though traditionally used by corporations, increasing uncertainty about the future and the benefits of scenarios for policy making has led to increasing use of scenario analysis by academia, policy makers, and research groups in recent years.

Chapter Three

Review of Major Trends in the U.S. Dry Bean Industry

3.1 Introduction

During the past two decades the U.S. dry bean industry has experienced changes on several fronts. Analyzing the major trends will provide a good understanding of the changes in the industry and also provide the background for conducting scenario analysis and econometric analysis of the industry. The emphasis in this chapter is only on reviewing the changing trends, while scenario analysis in the next chapter provides insights into the driving forces behind the changing trends.

The next section presents an overview of the global dry bean industry to provide insights into the position of the U.S. in the global market for dry beans. Section 3.3 presents an overview of the U.S. dry bean industry, which includes trends in prices, production, consumption and trade of dry beans. Section 3.4 presents an overview of the U.S. dry bean supply chain with focus on the changes in the competitive structure of the industry and co-ordination along the supply chain. Finally, in the light of the ongoing changes, section 3.5 summarizes the key industry trends. The data presented here are for the period 1980-2003, with the exception for data on trade, which are available only up to 2002.

3.2 Overview of Major Trends in the Global Dry Bean Industry

The major producers of dry beans in the world are India and China. However, the beans grown in India and China are of Asian origin, which are different from the beans

grown in the Americas.[2] Thus, for this study, it is appropriate to focus the analysis on dry bean production in the Americas. The major market-classes of beans produced in the Americas are pinto, navy, black, great northern, and dark and light red kidney beans. Other beans produced in relatively smaller quantities include cranberry, small red, great northern, pink, brown and white kidney. Among the countries in Asia, China producers some market-classes of beans grown in the Americas, specifically, black beans and kidney beans, which are produced largely for exports.

The major producers of dry beans in the Americas are Brazil, Mexico, Canada, Argentina, and the U.S. (Figure 3.1). All major dry bean producing countries are traditional producers, where as dry bean production in Canada is relatively recent. This also explains the higher growth rate for production in Canada, where production has increased more than three-fold during the past decade. Another point of difference is that all the major producing countries grow largely pinto, black and other colored beans used in the ethnic Mexican and Central American cuisine, whereas Canada largely produces navy beans.

Of the five major producing countries, Brazil and Mexico are also the largest importers of dry beans. Thus, the major exporters are the U.S., Canada and Argentina (Figure 3.2). Most of the dry bean exports from Argentina go to Brazil. The U.S. exports about 30% of their dry bean crop while about 80% of the production in Canada is exported. Thus, the U.S. dry bean industry is facing stiff competition from Canada in the domestic and export market for dry beans.

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[2] There are two major categories of dry beans. Dry beans produced in North and South America, Europe and Africa mainly belong to *genus Phaseolus*, which is of American origin. In Asia and Australia, most dry beans produced belong to the *genus Vigna*, which is of Asian origin.

Figure 3.1: Dry Bean Production in Major Producing Countries: 1980-2003:

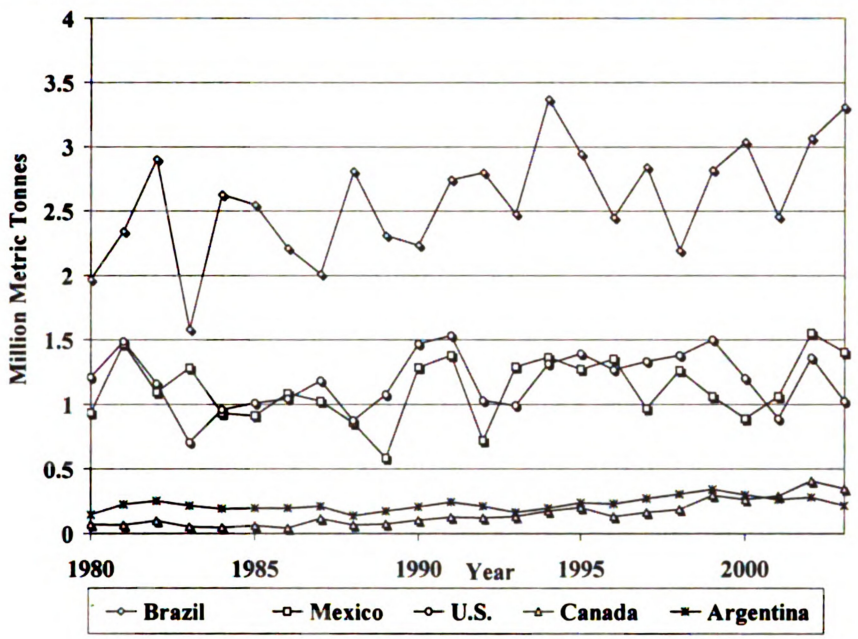


Figure 3.2: Dry Bean Exports From Major Exporting Countries: 1980-2002

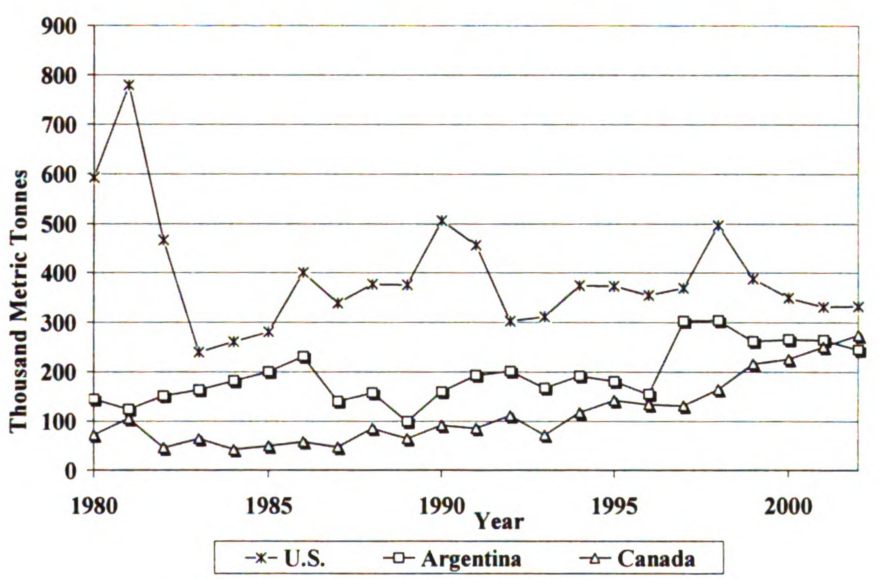
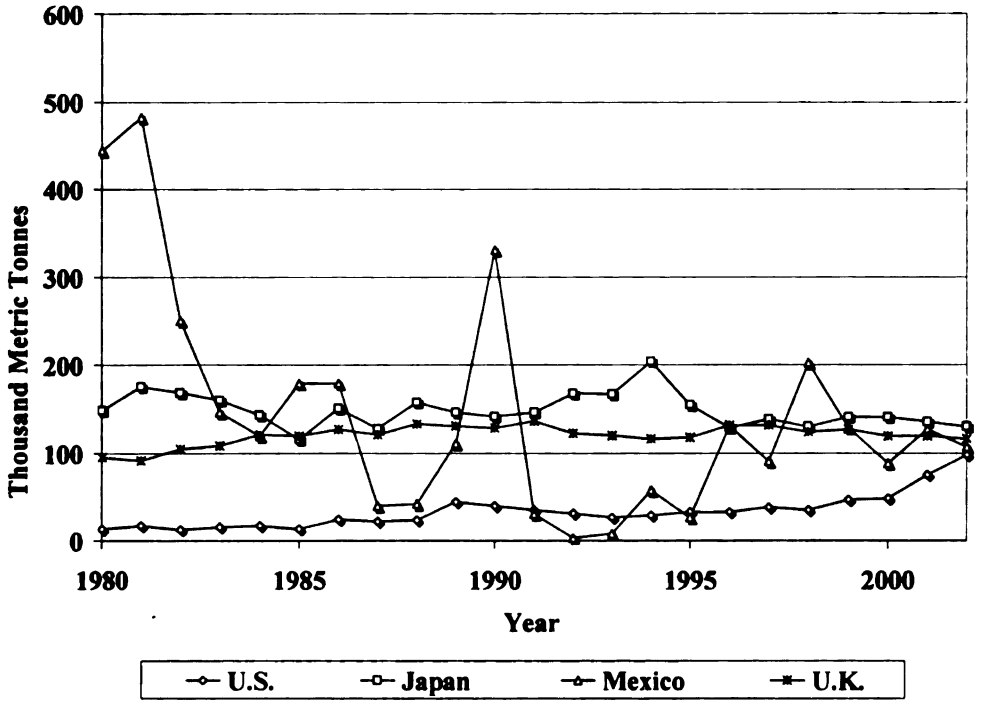


Figure 3.3: Dry Bean Imports into Major Importing Countries: 1980-2002



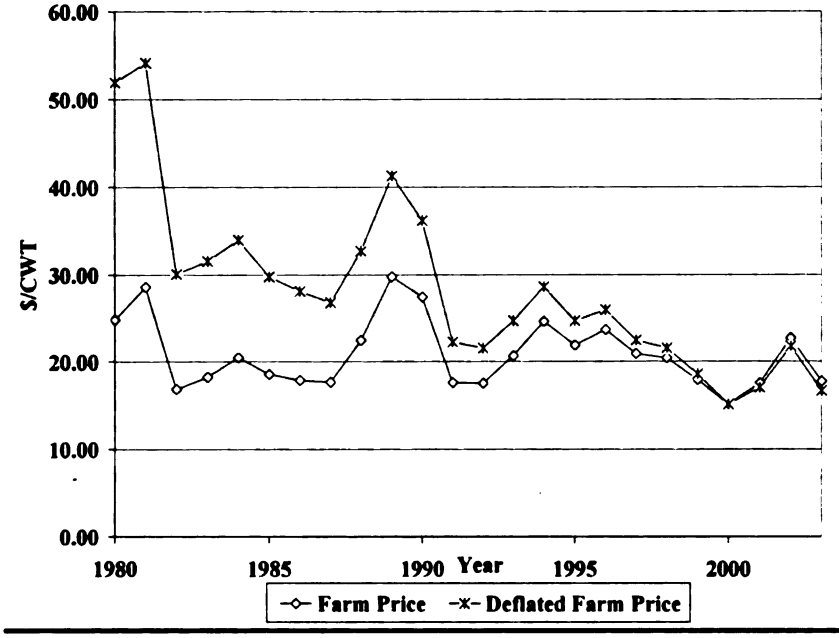
The major importers of dry beans are U.K., Mexico, Japan and in the recent years, the U.S. (Figure 3.3). Imports into U.K. and Japan have remained steady over time, whereas imports into Mexico tend to fluctuate widely, as most of the production in Mexico is rain-fed. In recent years, imports into the U.S. have increased significantly, reaching a high of almost 100,000 metric tons in 2002. U.K. largely imports navy beans, where as Mexico imports pinto and black beans. The major market class of dry beans imported into Japan are red beans, which are supplied mostly by China.

Overall, among the producing regions in the Americas, the U.S. continues to be a dominant producer of dry beans. However, on the trade front, with increasing production largely for exports, Canada is emerging to be a leading player in the global market for dry beans.

3.3 Major Trends in the U.S. Dry Bean Industry

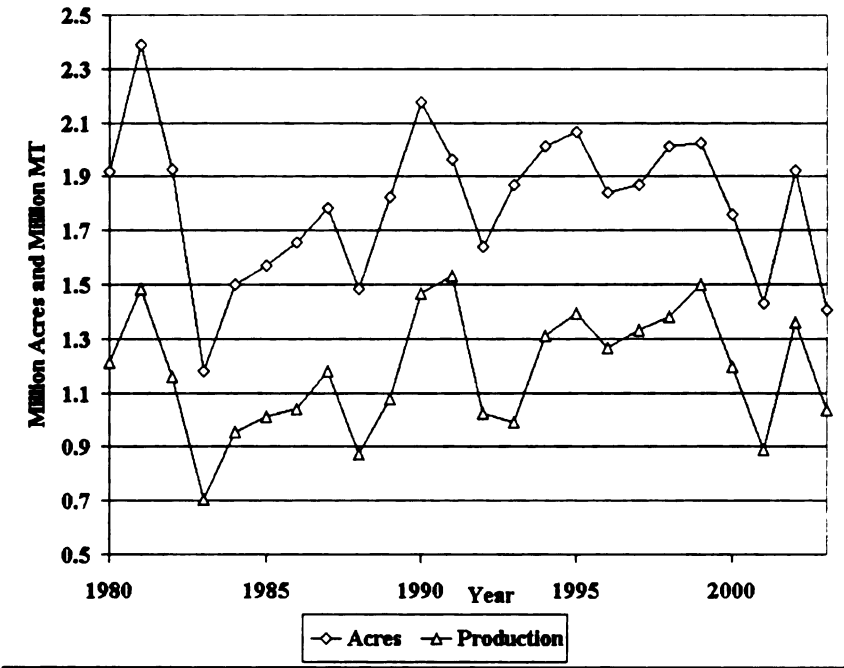
3.3.1 Production

Figure 3.4: Farm price of dry beans, Nominal and Deflated : 1980-2003



The farm price of dry beans is one of the key factors influencing dry bean acreage and hence production. Thus, the dry bean prices are reviewed here first, before discussing the trends in production. Figure 3.4 shows that the nominal farm prices of dry beans have fluctuated around $20/CWT through the study period. While the average farm price through the 1980s was below that average, in the 1990s farm prices have been above $20/CWT. However, it is important to note that in recent, dry bean prices are below $20/CWT. Since the nominal prices have not changed significantly, the real farm price of dry beans as expected have declined over time due to increase in the general price level.

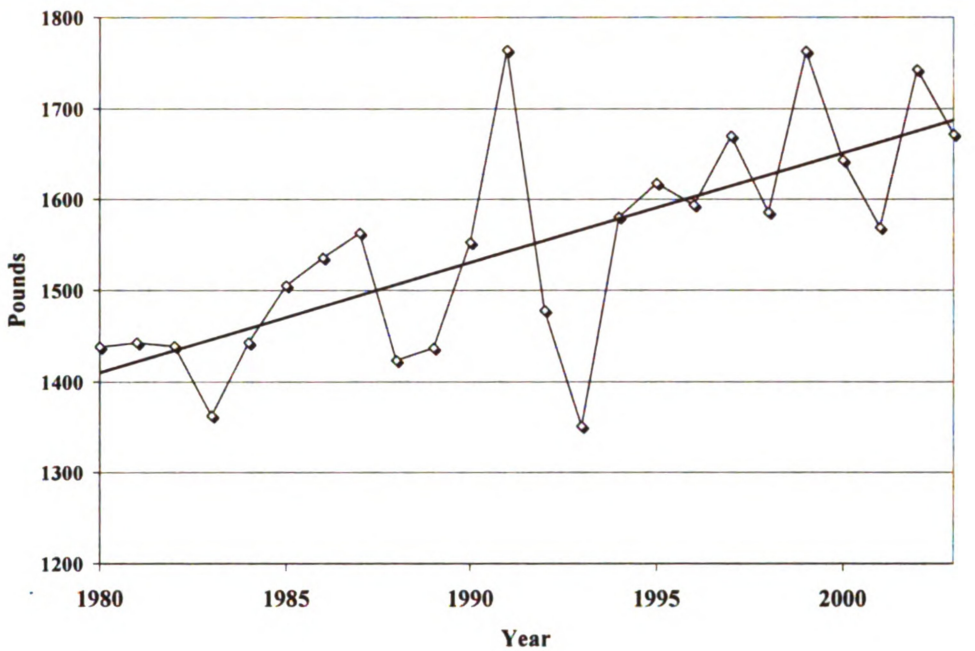
Figure 3.5: Dry Bean Production and Acreage in the U.S. : 1980-2003



Dry bean acreage in the U.S. fluctuated around 1.9 million acres through the study period, though the acreage tended to be below this average for most years in the 1980s, and has been largely been above this average through the 1990s (Figure 3.5). It is important to note that in accordance with the recent decline in farm price, the acreage 2000s has been below 1.9 million acres. Production of dry beans increased from 1.2 million MT in 1980 to a high of 1.5 million MT in 1999. This increase in production is attributed to the increase in yield per acre from about 1400 pounds to 1700 pounds (Figure 3.6). However, in accordance with the declining acreage, production has also declined in recent years.

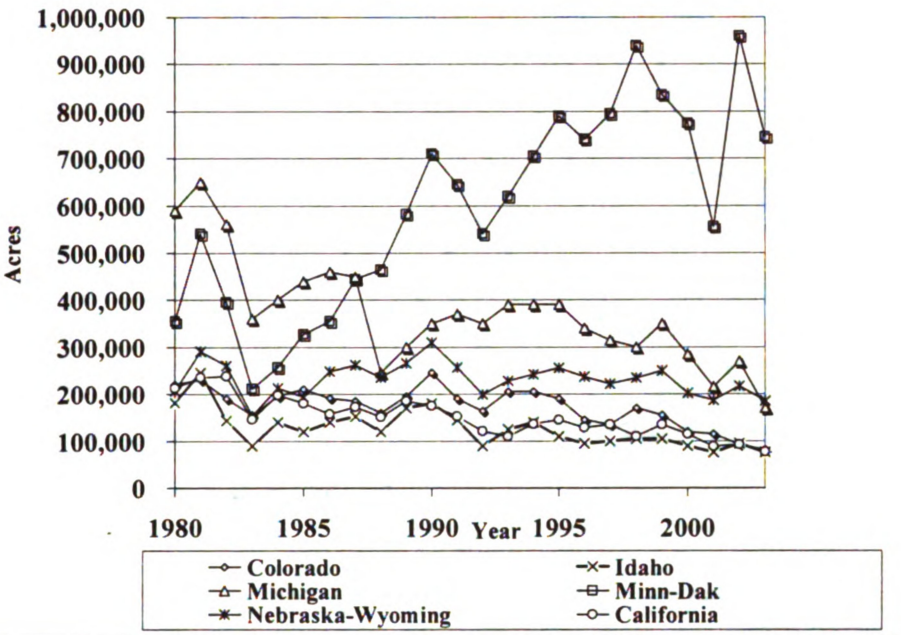
Figure 3.6: U.S. Dry Bean Yield: 1980-2003

Figure 3.6: U.S. Dry Bean Yield: 1980-2003



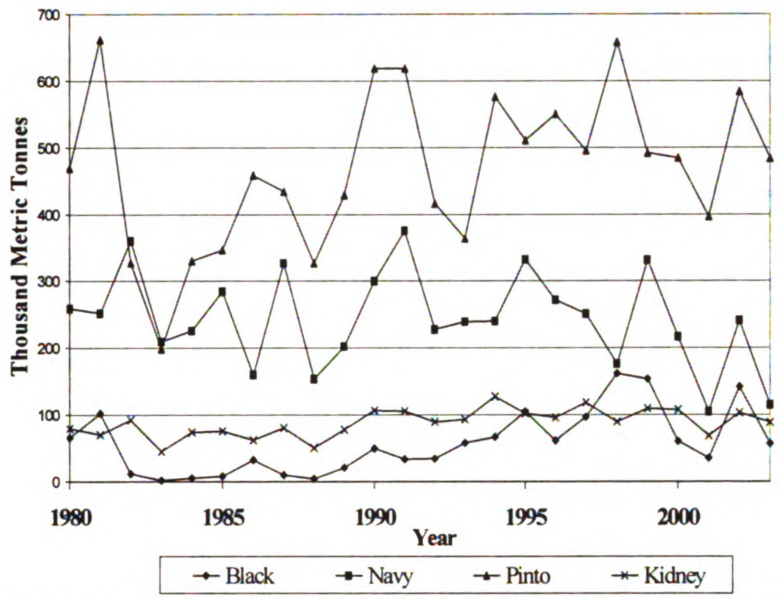
Dry beans are grown in 17 states in the U.S. Six major dry bean producing regions – Minn-Dak (Minnesota – North Dakota), Michigan, Nebraska-Wyoming, Colorado, Idaho and California, account for 90% of the dry bean acreage. There have been significant shifts in regional acreage under dry beans. As shown in Figure 3.7, the most significant change is the declining acreage in Michigan and a dramatic increase in acreage in the Minn-Dak region. Dry bean acreage in the Minn-Dak region increased from 250 thousand acres in 1980 to 750 thousand acres in 2003, reaching a high of 950 thousand acres in 2002 (about 50% of all U.S. acreage). During the same period, dry bean acreage in Michigan declined from 600 thousand acres to 200 thousand acres.

Figure 3.7: Dry Bean Production in Major Producing Regions in the U.S: 1980-2003



The market-class of dry beans produced in the U.S. has also undergone a significant change. Since 1920s navy beans were the largest market-class of dry beans produced in the U.S., followed by pinto beans. In the 1970s navy and pinto beans vied for the leading position with production at around 225,000 metric tons for each market class. However, since 1980 pinto beans have dominated the dry bean production in the U.S. (Figure 3.8). Though navy bean production continued to average around 225 thousand MT through the 1980s and 1990s, an important observation is that in recent years the production of navy beans declined to around 100 thousand MT. The production of kidney beans has increased marginally from 90 thousand MT in 1980 to 100 thousand MT in 2003, while the production of black beans has increased significantly in the 1990s from very little production to more than a 100 thousand MT in recent years.

Figure 3.8: Dry Bean Production by Market-Class: 1980-2003



The production of major market-classes of dry beans is concentrated in specific growing regions. The regional concentration by market class is as follows:

- Pinto Beans: Until the 1980s, Colorado and Idaho were the major producers of pinto beans. Currently, the Minn-Dak region dominates the pinto bean production, while acreage in Colorado and Idaho has declined considerably.
- Navy beans: Traditionally, Michigan dominated navy bean production, but in recent years, Minn-Dak region has taken lead. Also, with the increase in dry bean production in Canada, which largely produces navy beans, the production of navy beans in Michigan has declined significantly.
- Great northern: Nebraska-Wyoming specializes in the production of this market class.
- Black beans: Michigan is the dominant producer of black beans, but increasingly larger quantities of black beans are being produced in the Minn-Dak region.

- Kidney beans: California dominated kidney bean production, but Minn-Dak region is currently the largest producer of kidney beans.
- Lima beans: California dominates lima bean production.

Overall, the production of the major market-classes of dry beans produced in the U. S. – pinto, black, navy and kidney beans – is gravitating towards the Minn-Dak region, with the exception of great northerns, which continue to be produced in Nebraska-Wyoming. This also explains the growth of acreage in the Minn-Dak region.

3.3.2 Consumption

The major uses of dry beans include dry packaged beans for home use, canned beans (both whole beans and otherwise), brine-packed whole beans, and bean flour for commercial baking. Supermarket sales and restaurants are the two important marketing channels for dry beans. Supermarket sales include bagged dry beans and canned products such as refried beans, soups, chili, and baked beans. Restaurants use dry beans in foods such as tacos, burritos, and chilli. Both supermarket sales and restaurant use of dry-edible beans has increased in the past decade.

Per capita consumption of dry beans averaged 6.04 pounds in the 1980s and increased to 7.4 pounds in the 1990s (Figure 3.9). Figure 3.10 shows the dry bean consumption by market-class. Pinto bean consumption is the highest at about 3.5 pounds per person. Per capita consumption of navy beans declined from 1.5 to 1.0 pound in the 1990s. Consumption for kidney beans and black beans is about half a pound per person;h owever black beans have the fastest growth rate of per capita consumption of about 150%.

Figure 3.9 Per Capita Consumption of Dry Beans: 1980-2003

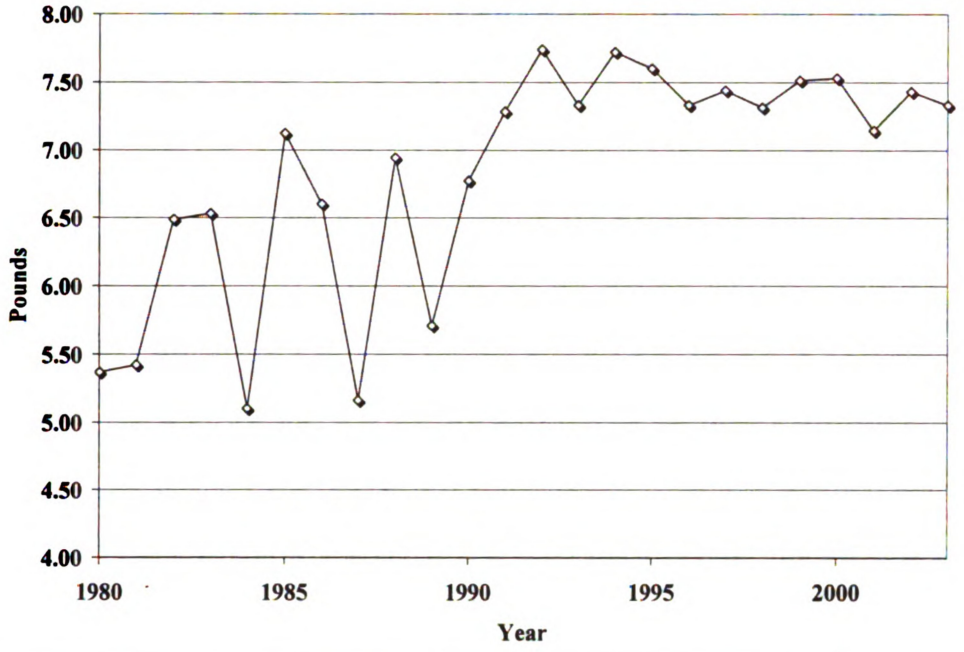
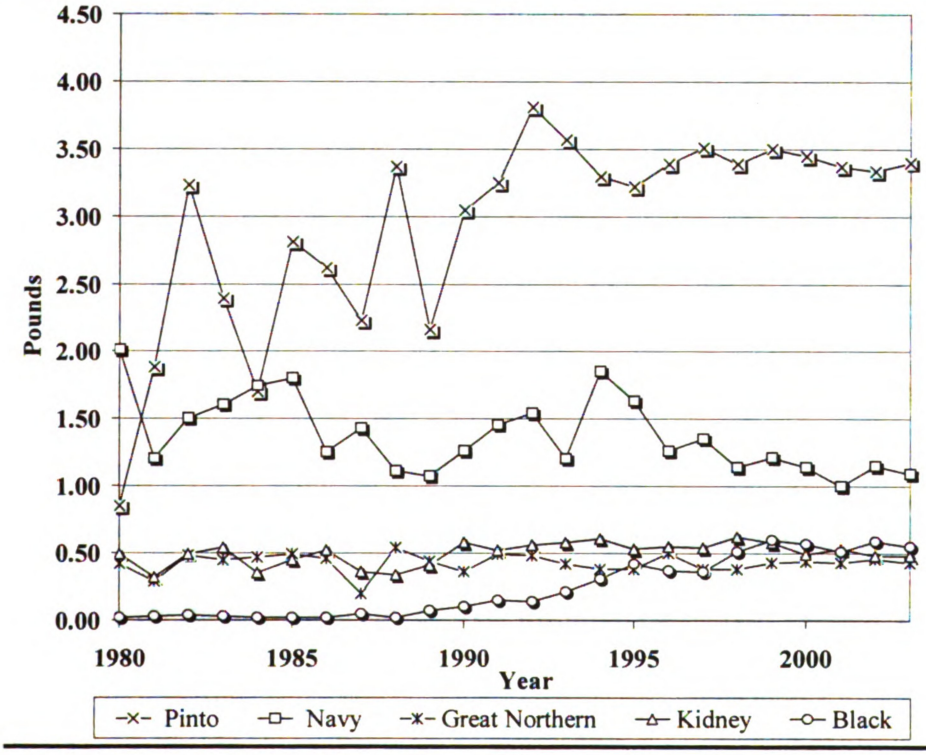
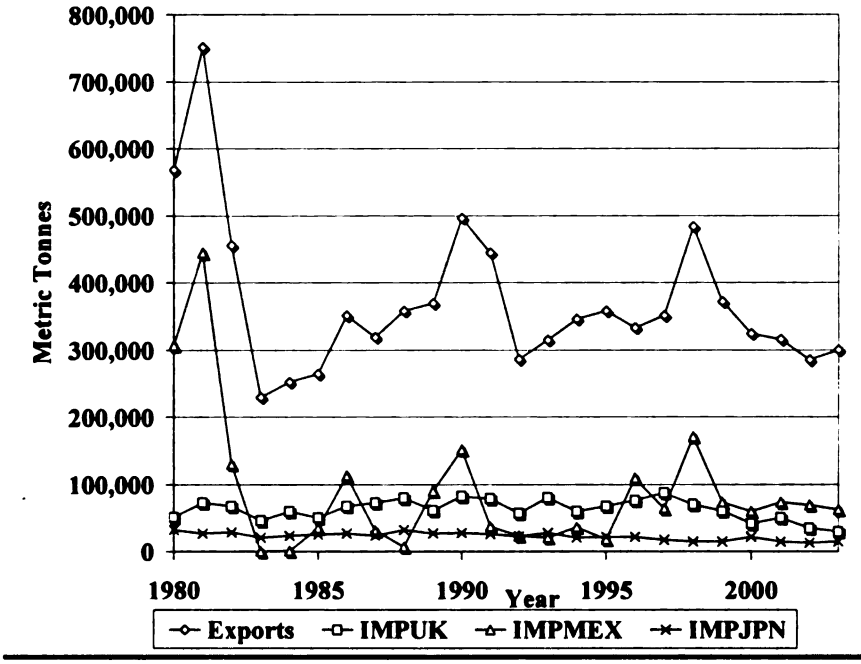


Figure 3.10:Per Capita Consumption of Dry Beans by Market Class: 1980-2003



3.3.3 Trade

Figure 3.11: Dry Beans Exports from the U.S. 1980-2003



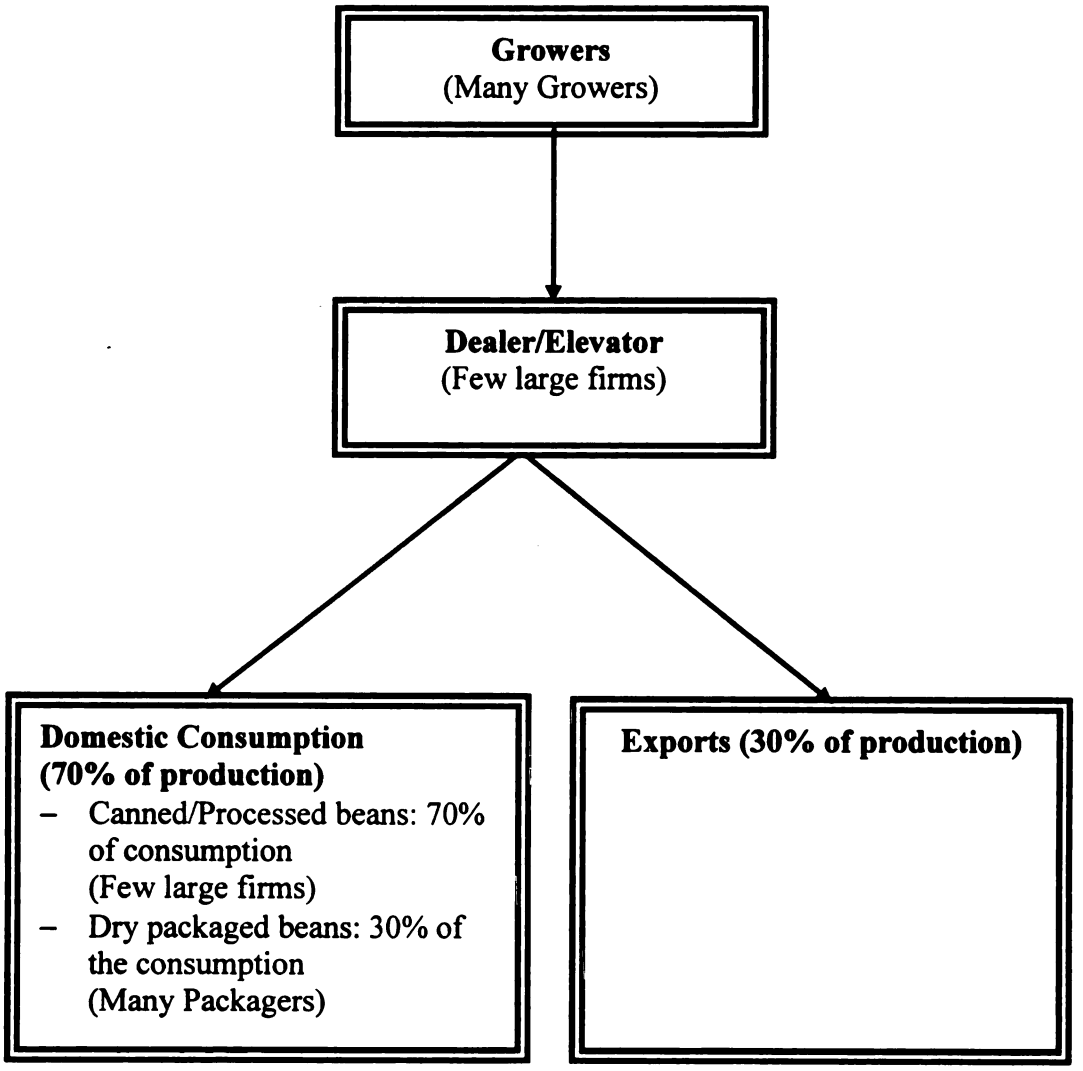
The U.S. exports dry beans to about 150 countries. Top export markets include Mexico, UK, and Japan (Figure 3.11). These markets accounted for 42 percent of the export volume in 2000. In recent years, there is increasing competition from Canada in the export markets. Competition in the U.K. market is more intense than the Mexican market because the U.K. largely imports navy beans, which is the largest market-class of beans produced in Canada, while Mexico imports mainly pinto beans and black beans, which are produced in relatively smaller quantities in Canada.

Historically, the U.S. has not been a major importer of dry beans (see Figure 3.3). Imports were marginal and spread over the different market-classes. However, imports of dry beans have increased considerably in the 1990s. The major source of imports is Canada while China and Argentina also have a small share in the U.S. imports.

3.4 Overview of the Industry Structure

The dry bean industry consists of growers, elevators, and canners/processors (Figure 3.12). The elevator stage represents the first stage of processing where the beans are sorted, cleaned, graded, and packed for transport. Elevators sell the beans to the canners/processors in the U.S. and in other countries. About 30 % of the U.S. dry bean production is exported. The two main segments in the domestic market are canned/processed and dry packaged beans. The proportion of canned/processed and dry packaged beans in total dry bean consumption has changed overtime. Through the 1980s beans were largely sold as dry packaged beans, while during the 1990s there was a significant increase in the consumption of canned/processed beans. Though exact estimates are not available, based on information from industry sources, currently around 70% of the beans are consumed in canned/processed form, while the rest are sold as dry packaged beans. In the canned/processed segment, most of the beans are sold as canned beans while the rest are processed as dry bean soup, chili and other dry bean products. The following sections present the major changes in industry structure and co-ordination mechanisms over the past two decades.

Figure 3.12: Overview of the Industry Structure



Competitive Structure of the Industry

The industry structure at the farm level is competitive with about 10,911 farms producing dry beans (Census of Agriculture, 1997). Historically, elevators and canners/processors were small independent businesses. An important change is the increased dominance of few large agribusiness firms at the elevator stage and canning/processing stage (Coyrneya, 1997; McGill 1997). The market for dry packaged beans, accounting for about 30% of the U.S. consumption is competitive with a large number of packagers.

Co-ordination along the supply Chain

Traditionally, dry beans were traded using broad USDA grades. With the increase in the use of processed foods, USDA grades are being replaced by canner specific requirements which vary from firm to firm. Complying with these requirements means tighter co-ordination among the participants in the supply chain, depending on the end use of dry beans. Chambers identifies two main categories of specifications for dry beans. The first consists of product attributes commonly found in USDA standards (but with more stringent tolerance levels) such as specifications on foreign matter, moisture content, broken seeds, color, and uniformity of size. The second category is similar to the first but includes a specification for post-canning quality which determines the appearance of the product after it has been canned.

Specifications in category one can be easily verified. Hence production contracts are not required because growers can be easily motivated to meet these requirements by offering a premium for specific attributes. Similarly, elevator processor contracts are not required either as the elevators have strong incentive to meet processor requirements.

Product attributes in category two are more difficult to test for because there is no standard definition for canning quality. Different canners have various expectations of canning quality and require elevators to perform various tests on the beans they purchase. If an elevator is unsure whether or not the canning quality specification has been met, they will send a sample to the canner for product evaluation. However, while these specifications are complex, a contract is rarely used. Instead, canners test products and monitor shipments. Canning quality specifications also complicate the farmer-elevator transaction, but they do not necessitate the use of production contracts. Elevator managers have found that education programs are more effective than production contracts in obtaining nonstandard goods because a contract alone does not guarantee quality.

It is evident form the above discussion that production contracts are not required to ensure quality. Though contracts are not needed for quality purposes, there has been an increasing use of production contracts. Elevator's motivation in production contracts is to ensure quantity, and from the grower perspective these contracts help to reduce price risk. Further, there has been an increase in marketing contracts between the growers and elevator managers to manage price risk. Marketing contracts include "price laters " and "pooling" techniques. "Price laters" are forward sales of a growing crop, where the contract provides for later delivery and establishes a price or contains provisions for setting a price later. "Pooling" entails pre-harvest pooling arrangements among a group of farmers, where the amount received by the growers is determined by the net pool receipts for the quantity sold by all farmers in the pool.

3.5 Summary of the Key Trends

The major trends in the U.S. and the global dry bean industry are summarized here with emphasis on the key issues that raise concern for the future of the industry and for the traditional producing region Michigan. The major market-classes of beans produced in the Americas are pinto, navy, black, great northern, and dark and light red kidney beans. The analysis shows that the U.S. continues to be a dominant producer of dry beans in the Americas. However, with increasing dry bean production in Canada over the past decade, there is stiff competition from Canada in the domestic and export market for dry beans.

The nominal farm price of dry beans was a little below $20/CWT during the 1980s and tended to be slightly above $20/CWT during the 1990s. However, the farm price in the 2000s was lower than $20/CWT. In accordance with the farm price, the dry bean acreage in the U.S. hovered around 1900 thousand acres during the study period. During the 1980s the acreage was below this average while for most years in the 1990s the acreage was above 1900 thousand acres. However, in accordance with the declining farm price in the 2000s, the acreage during this period was below 1900 thousand acres. Though the acreage in the U.S. did not change significantly, the production of dry beans increased from 1.1 million CWT to a high of 1.5 million MT in 1999. This increase in production is largely due to a consistent increase in dry bean yield overtime.

The market-class of dry beans produced in the U.S. has also changed over the study period. Historically, navy beans were the largest market class of dry beans produced in the U.S., while since 1980 pinto beans came to occupy the dominant position in dry bean production. Accordingly, Minn-Dak region, the largest producer of pinto

beans emerged as the leading dry beans producing region in the U.S. relegating the traditional producing region Michigan to a marginal position. Also, historically, different producing regions in the U.S. dominated the production of specific market classes, but in recent years, production of all major market classes – pinto, black, kidney and navy beans is gravitating towards the Minn-Dak region.

On the consumption front, there has been an increase in per capita consumption of dry beans in the 1990s, specifically, consumption of pinto, black and kidney beans has increased, while the consumption of the traditional navy beans is declining. Also, with increasing dry bean production in Canada there have been significant changes on the trade front. Dry bean production in Canada is dominated by navy beans. Hence the imports of navy beans into the U.S. have increased in recent years while exports to U.K., the major market for navy beans has declined. Mexico, which largely imports pinto and black beans, is currently the dominant export market for the U.S. dry beans.

Finally, there have been significant changes in the competitive structure of the industry and the co-ordination along the supply chain. Traditionally, there were several small firms operating at the elevator and the canner/processer level, while currently, a few dominant firms dominate the elevator and the canner/processor level. Co-ordination along the supply chain has changed on two fronts: first, there is tighter co-ordination between the elevator and canning/processing level to meet the needs of the canners, and second, there has been an increase in the use marketing contracts such as "price laters" and "pooling" at the farm level.

Chapter Four

Scenario Analysis of the U.S. Dry Bean Industry

4.1 Introduction

A review of major industry trends in Chapter three lays the background for conducting the scenario analysis, which will give insights into the driving forces behind the changing trends. This analysis is based on secondary data presented in the previous chapter and primary data collected by interviewing industry participants and conducting a workshop with the scenario team. Additionally, information from several other sources such as extension bulletins, government publications and reports from market research groups are used to substantiate the arguments presented in the analysis. The next section reviews the procedure for the primary data collection and analysis, based on which the results of the scenario analysis are presented in section 4.3. Alternate future scenarios for the dry bean industry are presented in section 4.4 and finally, the key findings of scenario analysis are summarized in section 4.5.

4.2 Collecting Data for Scenario Analysis

4.2.1 Interviewing Industry Stakeholders

Interviews were conducted with industry stakeholders at all levels in the supply chain – growers, elevators, and processors – to understand the impact of the driving forces on all industry participants. Interviews were conducted in the form of conversations rather than formal surveys. The questions were open-ended and phrased to move the conversation without directing it. To identify the driving forces, the approach

chosen was to ask questions regarding changes in their dry bean related operations and hence understand the driving forces behind these changes. The questionnaire was modified for different levels in the supply chain. The survey instruments for interviewing the growers, elevators and processors are presented in Appendix 1A, 1B and 1C respectively. The questionnaire consisted of four parts: i) collecting background information; ii) questions for identifying the major driving forces affecting the industry participant; iii) questions to understand the impact of general driving forces affecting the industry, and iv) clairvoyant questions, to understand the key uncertainties for the future. The clairvoyant questions are a standard set of questions to assess the future uncertainties (Van der Heijden, 1996; Maack, 2001).

The scenario approach usually requires 10 to 15 interviews with key decision-makers, likely to have different perspectives and concerns. The analysis is usually conducted at the firm level. Since this is an industry level analysis more interviews were required to incorporate the views of the different interest groups. Thirty-four interviews were conducted in all. The interviews at the grower level and elevator level were conducted in the two main growing regions – Minn-Dak and Michigan. Ten growers and four elevator managers were interviewed from each region. The growers and elevator firms were identified based on the information provided by the dry bean association in each region. At the grower level, the objective was to include growers with large, medium and small farms. At the elevator level, a dominant firm, medium-sized operation, co-operative, and producer owned elevators were included in the sample. Six interviews were conducted with the dry bean purchasing staffs in packaging, canning and processing facilities in the U.S. – two in each category.

4.2.2 Conducting Workshop with the Scenario team

As mentioned in Chapter two, scenario analysis is not an individual process. The analysis is conducted with input from the scenario team. The scenario process requires that the team members be chosen based on their ability to represent distinct viewpoints on the issue being discussed. Ideally, all participants will also be champions of the scenario process and generate support for its ideas among their colleagues and communities. For this study, the scenario team consisted of ten industry representatives – growers, elevator managers, representatives of canning/processing industry, university research specialists, extension agents, representatives of the American Dry Bean Industry Association and the Michigan Bean Commission. The details of organizing the workshop and the questionnaire used with the scenario team are presented in Appendix 2.

The preliminary interviews helped to identify the driving forces affecting the industry and understand their implications for industry participants at different levels in the supply chain. The idea in the workshop was to get a comprehensive understanding of how the driving forces had jointly affected the industry in the past and what was the likely future impact of these driving forces. In the workshop discussions, some factors which were identified as important factors in the preliminary interviews were collectively not found to be important, e.g., demand of dry beans for food aid and the impact of technology on co-ordination along the supply chain.

4.3 Scenario Analysis of the Dry Bean Industry

4.3.1 Identifying Key Industry Driving Forces

As identified by the interviews and the scenario team meeting, Table 4.1 presents the major driving forces and the impact of these forces on the dry bean industry. The driving forces encompass socio-demographic, economic, political, technological and environmental factors. These forces are discussed here with an emphasis on how these factors have affected the industry in the past and the likely future implications of these driving forces.

Socio-Demographic Factors

Increase in Hispanic Population

Increase in Hispanic population in the U.S. was identified as an important factor leading to an increase in per capita consumption of dry beans. Consumption trends presented in Chapter three shows a significant increase in the consumption of pinto, black and kidney beans, which are widely used in Mexican foods. The USDA food consumption survey also reports that the people of Hispanic heritage consume proportionately more beans than any other ethnic groups (Lucier, et. al., 2000)

Hispanic population in the U.S. increased by about 140% over the period 1980 - 2000 and is likely to increase by another 30% over the period 2000 – 2010 (U.S. Bureau of Census). With the continuing trend of the increase in Hispanic population, the per capita consumption of pinto, black, and kidney beans is likely to increase.

Table 4. 1: Driving Forces Affecting the Dry Bean Industry

Driving Forces	Impact of the Driving Forces
Socio-Demographic Factors	
Increase in Hispanic population in the U.S. Increase in consumption of ethnic foods	■ Increase in per capita consumption of dry beans ■ Change in production pattern – increase in the production of pinto beans, black beans, and kidney beans, decline in the production of navy beans
Increasing health consciousness Industry efforts to publicize the health benefits of dry beans	■ Potential increase in per capita consumption of dry beans
Increase in consumption of processed foods	■ Tighter co-ordination between elevators and canners /processors
Food safety concerns	■ Changes in technology at the elevator level
Demand for upscale and trendy Products	■ Emergence of niche market for dry beans
Economic Factors	
Increasing consolidation at elevator and processor level	■ Implications for farm level prices ■ Increase in processor owned elevators
Profitability from competing crops	■ Negative impact on dry bean acreage
Real exchange rate	■ Competitiveness in the global market
Regional differences in cost of production	■ Dry bean production gravitating towards the Minn-Dak region and in the recent years, Canada ■ Lower grower prices of dry beans
Import demand	■ Change in production pattern – increase in the production of pinto beans, kidney beans and black beans, decline in the production of navy beans
Political Factors	
Globalization	■ NAFTA ■ Increase in access to the Mexico market ■ Increase in dry bean production in Canada ■ Increasing competition with Canada in the export and domestic market ■ Low grower prices ■ Increasing imports from low other producers, specifically, China and Argentina
Technological Factors	
Agricultural Research	■ Improving agronomic traits for higher yields ■ Improving canning quality ■ Future increase in low cost producing regions in Canada
Research on Cancer Preventive Aspects of dry beans	■ Potential to increase dry bean demand in the future
Environmental Factors	
Climate Factors	■ Implications for quality of dry beans

Increase in Consumption of Ethnic Foods

With increasing popularity of ethnic foods in 1990s, consumption of Mexican foods such as tacos, burritos, etc. has increased significantly. This increase in consumption of ethnic foods has had the same effect as that of increase in Hispanic population – an increase in per capita consumption of pinto beans, black and kidney beans. Further, according to a Mintel[3] study on the consumption of ethnic foods in the U.S., among the several ethnic foods, Mexican foods will have the largest growth rate in the next decade.

Increasing Health Consciousness

With increasing health consciousness among consumers, health fads such as high protein diets and vegetarianism are becoming increasingly popular. Dry beans are considered an extremely beneficial component of all diets.[4] Dry beans are an excellent source of protein and are also high in fibre and complex carbohydrates. Given the content and quality of the protein in dry beans, they may be used as an effective meat extender and/or substitute. Thus, the combined effect of increasing popularity of high protein diets and increasing vegetarianism can potentially lead to an increased demand for dry beans.

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[3] Mintel is an international consulting group and a leading supplier of consumer intelligence.

[4] Beans are found in two places on the U.S.D.A Food Guide Pyramid – with high protein foods such as meat, eggs, poultry and fish, and also with vitamin rich vegetables.

Industry Efforts

In the light of the beneficial nutritional aspects of dry beans, the industry has launched an initiative called the Pulses for health alliance.[5] The alliance is a public-private partnership formed with the objective of promoting the health aspects of dry beans and other pulses. These industry efforts could potentially lead to higher dry bean consumption, as people become more aware of the nutritional and health benefits of dry beans.

Consumption of Processed foods

Traditionally, dry beans were marketed as dry packaged beans. However, currently, most of the dry beans are consumed as canned beans or processed in some form. This change in consumption pattern has brought about changes in the co-ordination along the supply chain.

Traditionally, the industry has used broad quality measurements to assess the value of beans. Although these standards are still used, they are being replaced with tighter specifications where quality is stipulated by the needs of the end user. As discussed in Chapter three, these changes have brought about changes in the co-ordination mechanisms. In the case of dry beans, production contracts are not required to meet the quality requirements. Growers can be motivated to produce the required quality of dry beans either by giving a premium for the required traits or through education programs. However, there is tighter co-ordination between the elevators and canners/processors to meet the requirements of the canners/processors.

[5] Founding members are American Dry Bean Board, National Dry Bean Council, Bush Brothers, & Company, H. J. Heinz, and World Vision

Food Safety Issues

Food safety concerns have also emerged as an important issue in the dry bean industry. These concerns have brought about mechanical changes in elevator operations. Traditionally, beans were passed on a gravity table and hand picked for quality. The current norms include passing the beans on a magnetic belt to remove foreign material and low quality seeds. After being sifted, beans are run through an electronic eye to remove discolored beans. This change in technology at the elevator level involves investment in the installation of expensive equipment.

Demand for Upscale and Trendy Products

Traditionally dry beans have been considered an inferior good. The image of dry beans as an inferior good is a reflection of the World War II period when beans were largely used by the poor as a source of protein. However, in recent years, with increasing consumption of ethnic foods and increasing consumer health consciousness, the image of dry beans is changing to that of a trendy and healthy food. Black beans specifically are considered an upscale product. With increasing consumer incomes, there is increasing demand for upscale and trendy dry bean products. Currently dry beans are sold largely as canned beans, which is not very appealing to the quality conscious consumer. Hence, to increase or maintain future demands, food manufacturers are producing a variety of convenience products such as breakfast burritos, hand-held snacks, and dinner entrees. Some specific products include D.L. Jardine's Buckshot Black Bean Salsa, Dr. McDougall's Right Foods: Vegetarian Pinto Beans & Rice Soup (Mintel Report). This increase in the demand for upscale dry bean products has created a niche market for quality beans.

Economic Factors

Increasing Consolidation at the Elevator and Processor levels

As mentioned in Chapter three, one of the significant changes in the dry bean industry structure is the increasing consolidation at the elevator and processor level. Increasing consolidation at the elevator level can potentially lead to oligopsony power and depressed grower prices. Use of marketing contracts such as "price laters" and "pooling" are increasingly being used for marketing various crops, and are also widely used in the case of dry beans. There is concern in the industry organizations that the use of these marketing contracts has the potential to depress grower prices (Michigan Bean Commission, North Harvest Growers Association). Further, a study on the impact of marketing contracts on competitive markets expressed concern regarding the implications for grower prices, especially in the case where there are few purchasers (Hayenga et. al., 2001).

Overall, with the increase in consolidation at the elevator level, the growers have fewer options to sell beans. Increasing consolidation along with the use of price mechanisms such as "price later" contracts and "pooling", has led to increasing discontent at the grower level. There are initiatives from the large growers to co-ordinate directly with the processors. Consequently, in recent years there has been an increase in the number of grower owned processing facilities. As the processors require beans in large volumes, it might not be possible for individual growers to meet their demands. In the niche market, however, there is possibility for direct co-ordination between the processors and growers.

Regional Differences in Production Costs

In an extension bulletin, Burgener and Feuz (2001) provide a comparative cost structure of the dry bean production under different production systems in the producing regions in the U.S. and Canada. Minn-Dak region has the lowest production costs among producing regions in the U.S. and hence has emerged as the dominant dry bean producer in the U.S. in the 1990s. However, Manitoba, the largest growing region in Canada, has lower production costs as compared with the Minn-Dak region. The break-even price at expected yield in 2001 U.S. dollars was $11.73 in Manitoba and $16.27 in Minn-Dak. The recent increase in the dry bean production in Canada is driven by the lower production costs. Increasing production in low cost producing regions has led to lower grower prices in recent years.

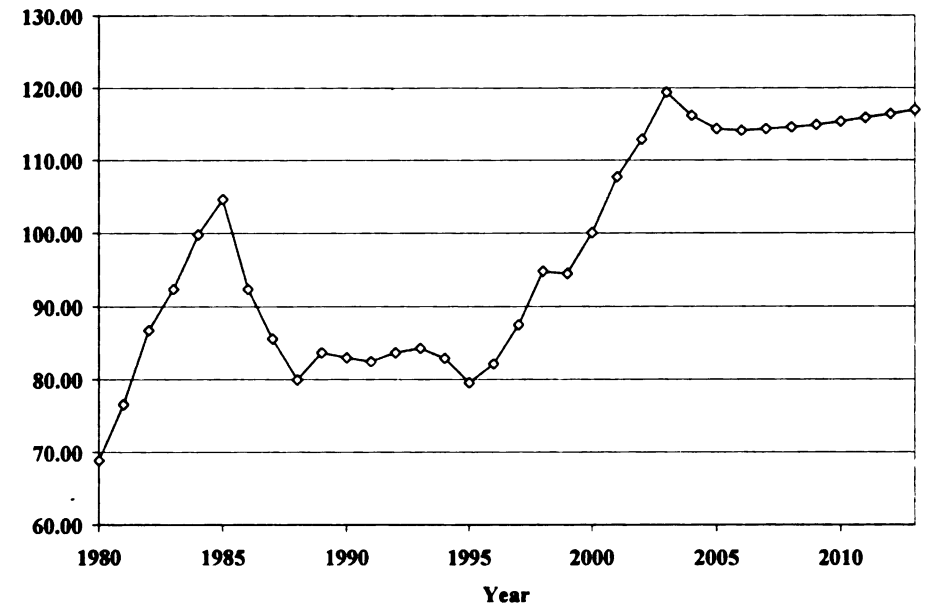
Profitability from Competing Crops

Soybeans are the key competing crop for dry beans in terms of crop rotation. Three important reasons for preference of soybeans over dry beans are: federal farm program for soybeans, availability of roundup ready soybeans which is easier to manage and control for weeds, and the ease of farm credit for soybeans. These factors make soybeans less risky and a more profitable crop than dry beans. Further, based on USDA projections, the price cost ratio for soybeans is likely to increase over the next decade, making soybeans a strong competitor for dry bean acreage.

Real Exchange Rate

Figure 4.1: Real Trade Weighted Exchange Rate for U.S.

(2000 = 100)



The U.S. exports dry beans to about 150 countries. Hence, the world trade weighted exchange rate of the U.S. dollar is used to analyze the impact of real exchange rate on the competitiveness of dry beans in the international market. Figure 4.1 shows the U.S. trade weighted exchange rate for the period 1980 to 2003 based on USDA data, while for the period 2004-2013 projections from the same source are used. Since 1980 the dollar has appreciated significantly as compared with its major trading partners, negatively affecting the competitiveness of the U.S. dry beans in the international market. However, the projections for the period 2004-2013 show that the dollar is likely to hold steady in the next decade, implying that the exchange rates are not likely to have a negative impact on the U.S. exports of dry beans.

Import Demand

Historically, Mexico, U.K. and Japan have been the most important import markets for the U.S. dry beans. Import demand influences the market-class of dry beans produced in the U.S. Traditionally, U.K. was the largest importer of dry beans from the U.S., largely importing navy beans. A decline in import demand from U.K. is one of the major factors leading to declining navy bean production in recent years. Mexico is currently the largest importer of dry beans from the U.S. The major market classes of dry beans imported to Mexico are pinto and black beans, which is reflected in the increase in the production of these beans in the U.S.

Globalization

The two most important aspects of globalization affecting the U.S. dry bean industry are the implementation of NAFTA and increasing imports from China. NAFTA has given the U.S. increased access to the Mexican market for dry beans. According to NAFTA regulations the initial duty-free quota for dry beans in the Mexican market was 50,000 MT in 1994, which grows at a 3-percent annual compounded rate over the 15-year transition period. Dry bean exports to Mexico have equaled 100% or more of the quota. Another important aspect of NAFTA is that the opening of the North American markets created a market for Canadian dry beans. As mentioned earlier, Canada has a total advantage in dry bean production costs in the North American region. Consequently, following NAFTA, dry bean production in Canada has increased significantly leading to increasing competition from Canada in the U.S. domestic and export markets. This is evident in the decline in the U.S. exports and the sharp increase in imports in the recent years.

Imports from China also increased significantly in 2001-2002. However, the future imports from China are likely to be driven by quality requirements. Because of increasing quality consciousness and food safety issues, processors may limit dry bean procurement to the North American region.

Technological Factors

Agronomic Research

Agronomic research is an important link between the changes in consumer preferences and development of new bean varieties. Dry bean research in the U.S. has focused on agronomic traits and canning characteristics. The most important agronomic traits include architecture of the plant, acceptable maturity, disease maintenance and yield. Because of the ongoing agronomic research, dry bean yield in the U.S. has continued to increase overtime. Important canning traits developed are drained weight and post canning texture.

Another important aspect of the ongoing agronomic research is the implications for expansion of dry bean production in Canada. As mentioned earlier, Manitoba, the largest growing region in Canada, has the dry beans lowest production costs in the North American region. Currently, the navy beans are the largest market-class of dry beans grown in Manitoba. However, there is ongoing research to develop bean varieties for pinto and black beans suitable to the local climatic conditions. Success of this ongoing research has immense potential for expansion of dry bean production in Manitoba, which can potentially challenge the dominance of Minn-Dak region in the coming years.

Research on Cancer Preventive Aspects of Dry Beans

Apart from the nutritional aspects of dry beans discussed above, there is ongoing research at Michigan State University (MSU) emphasizing the cancer preventive effects of dry beans. Research shows that many of the nutrients found in dry beans help to block the onset of cancer and slow cancer growth. According to a recent report issued by nutrition experts at MSU, eating two to four cups of cooked dry beans every week resulted in positive health benefits that lowered one's risk of developing certain cancers including breast, prostate and colon cancer. Awareness of these cancer preventive benefits of dry beans can potentially lead to a higher demand for dry beans in the future.

Environmental Factors

Climate

Table 4. 2: Climatic Change in the Dry Bean Producing Regions in the U.S. (1981-2000)

	Michigan		**Minn-Dak**	
	1981-1990	1991-2000	1981-1990	1991-2000
Temperature				
Mean	61.7	61.6	60.0	58.8
C.V.	2.0	2.9	1.9	1.8
Precipitation				
Mean	3.2	3.2	2.2	2.6
C.V.	22.7	27.3	29.3	22.1

Note: C.V is a measure of dispersion measured as (Standard Deviation/Mean)*100

Quality and appearance of dry beans is significantly influenced by temperature and precipitation rates in the producing regions. Table 4.2 shows the mean summer (April – August) temperature and precipitation rates for the two main producing regions in the U.S. – Minn-Dak and Michigan. Because of warmer temperature and higher

precipitation rates, the quality and appearance of beans from Michigan is better than beans from Minn-Dak region.

4.3.2 Identifying the Key Uncertain Variables

Analysis of the industry driving forces helped to understand the impact of these forces on the industry participants. An important part of the future analysis is to distinguish the pre-determined elements of these driving forces from the key uncertainties, which are likely to significantly change the direction of the scenarios. This assessment is measured by two criteria – how uncertain is the net effect of the driving force, and how important is its outcome for the future of the industry. Scenarios are based on the consequences of forces that are highly important and highly uncertain.

As a part of the workshop discussion, the scenario team helped to identify the key uncertainties for the future. The team was asked to rank the most important and the most uncertain forces for the future (see workshop questionnaire in Appendix 2). The key uncertain forces for the dry bean industry were identified as follows:

- Upward shift in demand: Per capita consumption of dry beans in the U.S. averaged around 6.04 pounds in the 1980s, and increased to 7.3 pounds in the 1990s. As emphasized above, dry beans have very beneficial nutritional effects. In the light of the increasing health consciousness of the consumers, and increase in health fads (such as, high protein diets and vegetarianism), there is potential for further increase in the per capita demand. Also, increasing awareness of the cancer preventive effects of dry beans can positively influence dry bean demand. To capitalize on these health effects, the industry has launched a project to publicize the beneficial health effects of dry beans. The joint impact of these factors can lead to an upward shift in the demand for dry beans

in the coming decade. This increase in demand is an important factor in how the industry will evolve in the future. Despite the immense potential for increased demand, the future demand for dry beans is uncertain at this point because consumers have many other substitute health products which are not dry bean based. The industry expectation of an upward shift in demand may not materialize and the future demand of dry beans may continue to be at the current level of consumption of 7.4 pounds per capita.

- Impact of Globalization: Two main aspects of globalization affecting the U.S. dry bean industry are the increase in dry bean production in Canada and the increase in imports from China. Dry beans production in Canada has increased dramatically following NAFTA as Canada is the lowest cost of production amongst the major dry bean producing regions in North America. Currently, Canada largely produces navy beans. A major factor limiting further expansion of dry bean production in Canada is the lack of pinto and black bean varieties suitable to the local climate. Success in developing new varieties or adaptation of the existing varieties to the local climatic conditions may lead to a significant increase in the dry bean production in Canada. Since Canada produces beans largely for exports, increasing production in Canada can significantly affect the competitiveness of the U.S. dry bean industry in the domestic and export markets. However, the uncertainty here arises from whether new pinto and other colored bean varieties can be successfully adapted to the local climatic conditions in Canada.

Further, in recent years, increasing imports from other low cost producing regions, specifically China, has also been a cause for concern for the U.S. dry bean industry. However, the future imports from other low cost producing regions around the world are uncertain. It is likely that domestic processors may increase sourcing from

global markets due to lower prices. Conversely, buyers may become reluctant to source globally due to stringent food safety measures. Although globalization will lead to increasing competition, the impact of globalization can be expansive or constrained at the present level depending upon both the quality issue related to Chinese beans and the variety issue related to Canadian production.

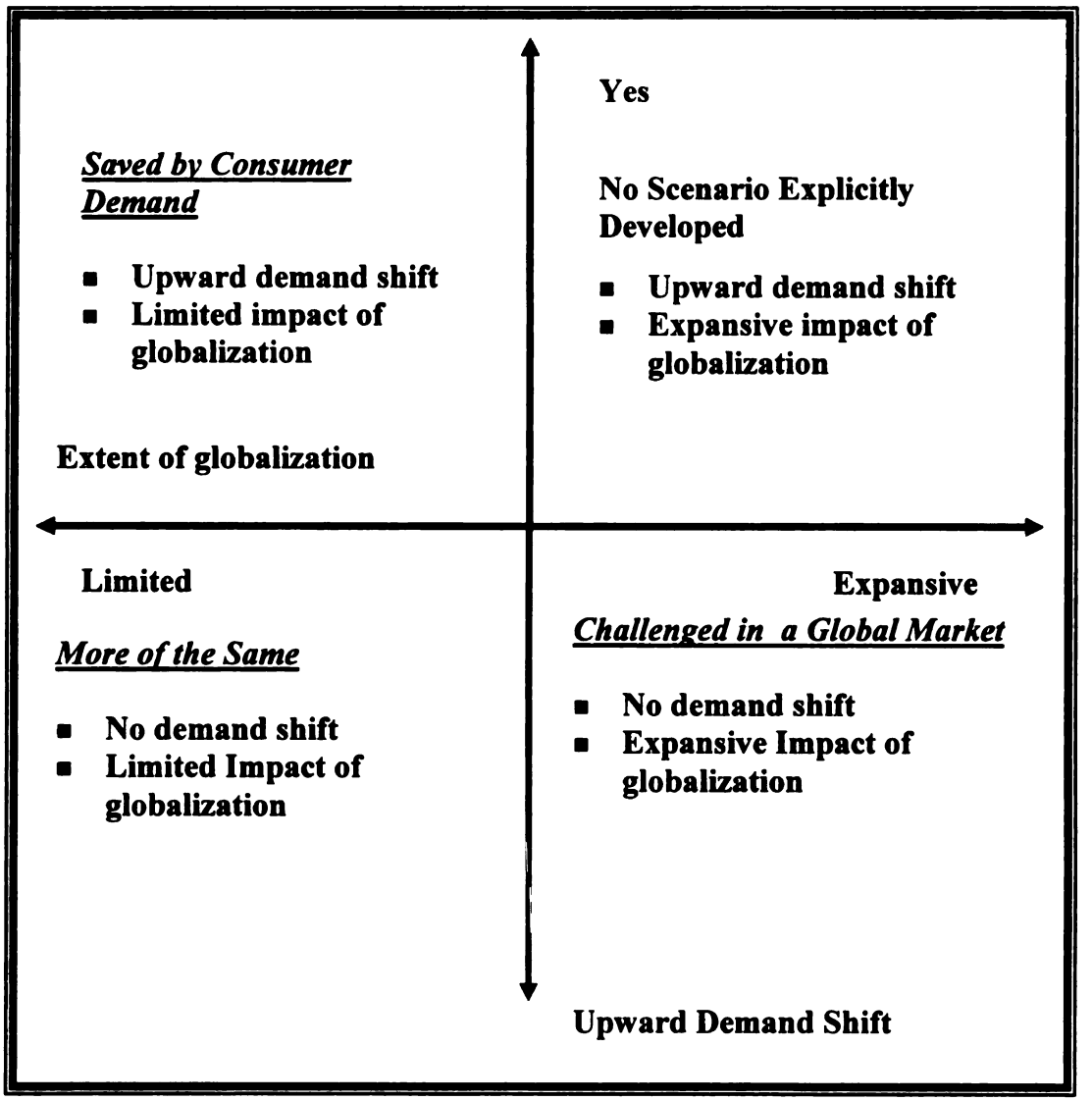
4.3.3. Defining the Scenarios

The key uncertain elements define the dimensions of the scenario matrix. The number of number of possible scenarios is 2^n, where n is the number of uncertain elements. In this case, since there are only two uncertainties the matrix is represented as a two dimensional scenario space. Based on the possible outcomes of the two uncertain forces – demand shift and impact of globalization, four scenarios for the dry bean industry are identified in Figure 4.2.

"More of the Same" is the baseline scenario which presents a future with no demand shift and limited impact of globalization. In the scenario "Challenged in a Global market", the U.S. faces intense competition from global low cost producers in the domestic and export market for dry beans and the expectation of an upward shift in demand does not materialize. This scenario presents the worst case situation for the industry. "Saved by Consumer Demand" scenario presents the situation with an upward shift in demand and limited impact of globalization. This is the situation with the most positive outcome for the industry. The final scenario which depicts a shift in demand as well as high impact of globalization is not studied in detail in this analysis. The outcome of this scenario is likely to be similar to the outcome for the base line scenario, as high imports will likely offset the impact of increase in demand. The idea in the scenarios is

to consider the broadest range of outcomes to enable the industry participants to make decisions that are likely to be robust across all outcomes. Therefore, this scenario adds little to the future analysis. Though this scenario is not developed in detail as the other three scenarios, the simulation results for all the four scenarios are discussed in Chapter six which will help to see how close this scenario is to the baseline scenario.

Figure 4.2: Scenario Space for the U.S. Dry Bean Industry



4.3.4 Embellishing the Scenario Plots

After identifying the main scenarios, the next step in the analysis is to develop scenario scripts. Scenarios are presented in the form of vividly contrasting narrative descriptions of how several uncertain aspects of the future might evolve. However, as mentioned in the research design, final scenarios are developed fully based on integrating the results of the econometric analysis and scenario analysis. A brief script for each of the three scenarios is presented here. The projection is for the period 2003-2014. As a rule of thumb, the future projection is about half the number of years for which the secondary data is available.

Scenario 1: More of the same
Driven by no demand shift, limited impact of globalization

Despite the challenges from increasing globalization, the U.S. dry bean industry has maintained its position in the global market for dry beans. At the turn of the century there were concerns in the industry regarding increasing competition from Canada and China. However the impact of globalization has been limited. One of the major factors responsible for constrained impact of globalization is limited success in developing pinto and black bean varieties in Manitoba. Thus, dry bean production in Canada is limited largely to navy beans. Also, the imports from China have been limited because of quality concerns. While the industry's worst fears did not come about, the expectation of an upward shift in demand also did not materialize. With the increasing health consciousness of consumers and the highly beneficial health effects of dry beans, the industry anticipated an increase in dry bean consumption. Industry efforts were also

launched to publicize the health benefits to capitalize on the potential to increase demand. However, the industry efforts did not have the desired results because consumers chose to meet their health needs through other products not based on dry beans. Thus, through the decade of 2000s, the industry has remained steady with no dramatic changes affecting the industry.

Scenario 2: Challenged in a Global Market
Driven by no shift in demand and expansive impact of globalization

In an increasingly global marketplace, the U.S. dry bean industry has been severely challenged by low cost producers. Increasing production in Canada following NAFTA has affected the competitiveness of the dry bean industry in the global as well as domestic market. Consequently, imports into the U.S. have increased, while exports have declined. Higher imports from China have further worsened the situation. To add to these challenges, the news has not been good on the domestic front as well. There were expectations that the health and nutritional benefits of dry beans and increasing health consciousness in the consumers would potentially lead to higher dry bean demand. However, this potential upward shift in demand did not materialize. Overall, the past decade has been very challenging for the dry bean industry, and there has been a significant cut back in dry bean acreage in the U.S.

Scenario 3: Saved by Consumer Demand
Driven by demand shift and limited impact of globalization

In the past decade, the dry bean industry has benefited on two fronts. First, there has been an increase in the per capita consumption of dry beans. The main driving force behind this higher demand is increasing health consciousness of the consumers and the

health and nutritional benefits of dry beans. Second, in an increasingly global market place, the industry has maintained its position in the international market for dry beans. At the turn of the century there were serious concerns in the industry regarding the increasing competition from Canada, and increasing sourcing from other low cost producing regions. However, the impact of globalization has also been low with limited production in Canada due to lack of suitable plant varieties and limited sourcing from China due to quality concerns. Overall, the industry has decade of 2000s has been favorable for the industry.

4.5 Synopsis

This section summarizes the results of the scenario analysis and gives an idea of how the U.S. dry bean industry has evolved under the joint impact of the ongoing changes. On the demand front, there has been an increase in the per capita consumption of dry beans driven by demographic changes such as increase in Hispanic population and increasing consumption of ethnic foods in the U.S. Consequently, the production of pinto, black and kidney beans has increased, while the production of the traditional navy beans has declined. High import demand from Mexico for pinto and black beans, and lower demand for navy beans in the U.K. market in the recent years has further advanced the trend of increasing pinto and black beans and declining navy bean production. Another change on the demand front is increasing demand for upscale and trendy dry bean products driven by increasing quality consciousness, which has created a niche market for dry beans. The future changes in demand are likely to be driven by the increasingly health conscious consumer and the popularity of health fads such as high

protein diets and vegetarianism. There are ongoing industry efforts to capitalize on the potential for increased demand by publicizing the health effects of dry beans.

On the trade front, implementation of NAFTA has been one of the most important changes affecting the U. S. dry bean industry. There has been a considerable increase in the dry bean production in Canada following NAFTA. Because of lower production costs, Canada is a strong competitor in the domestic and export market for dry beans. Currently, Canada largely producers navy beans. Thus, there has been an increase in navy bean imports from Canada, while exports to U.K., the major market for navy beans, has declined. Ongoing research to develop local bean varieties for pinto beans and black beans in Canada can potentially challenge the dominance of the Minn-Dak region as the dominant producing region in North America. Increasing imports from China in recent years have also been a source of concern for the U.S. dry bean industry. The future imports from China will depend on the quality considerations. The processors may continue to source from China, or they may limit procuring dry beans to the North American region because of quality issues.

On the supply front, driven by cost considerations, the Minn-Dak region has emerged as the dominant producer of most major market-classes of dry beans in the U.S. Consequently, dry bean acreage in the Minn-Dak region has increased dramatically, while dry bean acreage in Michigan has declined significantly. Increasing production of navy beans in Canada, the largest market-class of dry beans produced in Michigan, has also severely affected dry bean acreage in Michigan. Soybeans are a strong competitor for dry bean acreage because of the farm programs for soybeans and the availability of

round up ready soybeans, which are easier to manage and control for weeds as compared with dry beans.

Finally, the industry structure has changed significantly with increasing consolidation at the elevator and canning/processing level. Also, increasing quality consciousness in the consumers have brought about tighter co-ordination along the supply chain to meet the quality requirements. Though production contracts are not required to meet the quality requirements, production contracts are used by growers to ensure prices and by elevators/processors to ensure quantity. Further, marketing contracts such as "pooling" and price later contracts are being widely used in the industry. The use of marketing contracts in an imperfect market has the potential to drive down producer prices. Combination of these factors has brought about an increase in the number of producer owned co-operatives in the dry bean industry.

Looking ahead, the two uncertain forces that are likely to alter the course of the U.S. dry bean industry are – potential for an upward shift in demand and the impact of globalization. Based on these uncertainties, three scenarios for the dry bean industry are developed. "More of the Same" presents the base line scenario with no significant changes on the demand front and limited impact of globalization. The "Challenged in the Global Market" scenario presents the worse case scenario for the industry, a situation in which the potential for increased demand does not materialize and the industry's worst fears regarding the implications of expansive globalization come true. Finally, the scenario "Saved by Consumer Demand" presents the most positive future for the industry with a significant increase in demand and low impact of globalization.

Chapter Five

Econometric Analysis of the U.S. Dry Bean Industry

5.1 Introduction

The purpose of this chapter is to outline an econometric model of the U.S. dry bean industry. Several examples of industry analysis for agricultural commodities were found in literature. Some examples include oat industry (Brandt, et. al., 1992), cling peach industry (French and King, 1986), apple industry (Willet, 1993) and California raisin industry (Nuckton et. al, 1975). However, an econometric analysis of the U.S. dry bean industry has not been done so far. Thus, this study presents the first such analysis.

The econometric analysis will provide a framework to understand the interrelationships that underlie the determination of dry bean supply, demand, and prices. A set of behavioral relationships are specified and integrated to form a complete model that can be used to make conditional projections of short-term, intermediate-term, and long-term adjustments in prices, outputs and consumption. This econometric model will provide a structural framework that allows simulations of alternative future industry paths based on the scenario analysis.

5.2 Conceptual Framework and Econometric Specification

The study of the California raisin industry by Nuckton et. al. provided a good background for the dry bean industry analysis because of similarity of crop characteristics, as dry beans and raisins are both storable commodities. Also, there are

some similarities in the industry structure as the raisin industry as well as the dry bean industry are characterized by oligopoly at different levels in the supply chain.

The econometric model in this study consists of two blocks, one representing supply response and the other representing marketing of dry beans. The supply response block determines the production of dry beans based on planted acreage, yields and harvested acres. The marketing block explains price determination at the farm, wholesale, and processor level as well as domestic consumption, export demand, and storage demand for dry beans. Imports of dry beans are treated as exogenous in this study because before 1994 the imports of dry beans were very minimal and mostly served to offset shortfalls in production.

5.2.1 Supply Response

Acreage Response

The acreage response for dry beans is based on the expected utility maximization model of a risk-averse farmer making decisions between alternative risky options. Thus, the optimal acreage planted for dry beans is specified as:

(1) $ACRESP_t = f(EPDB_t, EPSB_t, DBRISK_t, SBRISK_t, ACRESP_{t-1})$

where $ACRESP_t$ represents the acres planted for dry beans. EPDB and EPSB are the expected prices of dry beans and soybeans, the key competing crop for dry beans. DBRISK and SBRISK represent the price risk associated with dry beans and soybeans respectively. Lagged planted acreage ($ACRESP_{t-1}$) is included in the model to account for adjustment costs, which implies that a period of more than one year is required to complete acreage adjustments in response to changes in prices and risk.

One period lagged prices of dry beans and soybeans were used as expected prices. However, in the case of soybeans, price support plays an important role in forming producers price expectations and has to be incorporated in the forming of price expectations. Several approaches have been used to incorporate price support in supply response models. Approaches used by Shumway (1983) and Bailey and Womack (1985) do not place any weight on the government program when expected market price is anticipated to be higher than the support price. Duffy et. al (1994) argue that producers are likely to respond at least in part to the guaranteed minimum price even when the market price is high. They calculate the supply-inducing price (SIP) as follows. If the effective support price is higher than the market price, use the support prices. Otherwise use a weighted average calculated as follows using expected price (EP) and support price (SP):

PPR = EP/SP
WG = 1/(1+PPR)
SIP = WG * PS + (1-WG) * EP

This approach has the advantage that in forming price expectations the guaranteed minimum price influences supply, but as the expected market price becomes increasingly high relative to the effective support price the role of the effective support price in determining supply response diminishes. Thus, the Duffy et. al approach is used in this study. Since there have been no acreage compliance requirements for soybeans, the effective support price (SP) for soybeans is the marketing loan rate. Lagged price of soybeans was used as the expected price. Finally, the expected price for dry beans and the SIP for soybeans were deflated by the respective variable cost of production. This SIP in equation (1) is represented by EPSB.

The risk variables for dry beans and soybeans, DBRISK and SBRISK, are measured as squared deviation of prices from a three-year moving average of past prices. Prices deflated by the cost of production were used to compute the price risk.

Yield

Yield is specified as a trend to capture the increase in yield due to technological research over time (Equation (2)). Actual yield fluctuates around this trend depending on weather conditions. However, yield fluctuations due to weather are treated as a random component in the model.

(2) $YIELD_t = f(TREND)$

Acres Harvested

The production of dry beans is determined by the acres of dry beans harvested and the yield per harvested acre. In the case of dry beans, more than 95% of the acres planted are harvested. Acres harvested (ACRESH) for dry beans are specified as a function of the acres planted ($ACRESP_t$).

(3) $ACRESH_t = f(ACRESP_t)$

Overall, the supply response model determines the acreage response for dry beans, the yield and the harvested acres, which together determine the total dry beans produced for the current period based on past prices, the profitability of competing crops, and changes in technology.

5.2.2 Marketing of Dry Beans

The supply of dry beans for the current period is predetermined based on the past years prices for dry beans, the past year prices for competing crops, and past years production costs. Given the production level for the current period, the endogenous

variables in the marketing model are prices at the farm, elevator and processor level, and the domestic, export and storage demand for dry beans.

Before presenting a framework for analyzing the price and quantity determination, it is important to recapitulate the market structure at the different levels presented in Chapter three. There is perfect competition at the farm level, with many growers planting dry beans. The elevator level is characterized by oligopoly as there are few elevators in each region. Thus, there is potential for oligopsonistic and/or oligopolistic behavior at the elevator level. At the processor level, beans are sold in canned/processed form and in dry packs. In the canned/processed segment, canned beans account for the majority of beans. Through the 1980s dry packaged beans dominated the domestic consumption. Currently about 70% of the beans are marketed as canned beans or processed in various forms, while the rest are sold as dry packaged beans. The canned/processed beans sector is consolidated with few large firms dominating the market, while there are a large number of firms in the dry package segment.

Farm Price Determination

The farm price of dry beans is determined by the growers' decision to sell dry beans and the elevators decision to buy them. In the industry, farm price is set and quoted by the elevators. Given the oligopolist structure of the market, in the short run the elevators may establish a very low price for dry beans because the beans have already been produced and farmer costs are mostly sunk. However, the production of beans in the next period is determined by the prices the growers receive this year. Thus, in order to ensure production of beans for the next period, the growers must cover the marginal cost incurred for producing beans in the previous period. Apart from the production

costs, the farm price of dry beans is likely to be influenced by the available supply of beans. However, given the potential for oligopsonist behavior by the elevators as well as the possibility of some competition at the elevator level, the farm price of dry beans is likely to vary dramatically with the supply of beans. In years of high supply, it is possible that the farm price of dry beans will be lower than the marginal cost of production but in years of low supply prices may be competed well above costs of production. The imports and storage of beans is also undertaken at the elevator level. Thus, the farm price of beans is likely to be influenced by the total available supply (SUPPLY) which includes the stocks with the elevators, imports, and production. Based on these considerations, the farm price of dry beans is specified in equation (4) where PDBF and the MCF represent the price of dry beans at the farm level and the marginal cost of production at the farm level respectively. The supply of dry beans is included in per capita form to account for the change in market size.

(4) $PDBF_t = f(MCF_{t-1}, SUPPLYPC_t)$

Price Determination at the Elevator Level

The elevator level represents the wholesale level, and the prices received by the elevators represent the wholesale prices (PDBW). Price received by the elevator is based on the elevator supply of beans to the processors. Thus, the price determination at the elevator can be expressed as the elevators inverse supply function. Based on this approach, the wholesale price of dry beans is a function of the farm price (PDBF), which represents an input cost to the elevator, the processing cost at the elevator level (COSTW), and the quantity of dry beans supplied (SUPPLY).

Further, structure of the industry at the elevator level as well as the processor level is oligopolistic. Thus there is potential for oligopolistic behavior by the elevators as sellers. At the same time, processors may also exercise oligopsonist power. Thus, the price of dry beans at the elevator level will be between the range of perfectly competitive prices and monopoly prices based on the bargaining power of the elevators and processors. In this case, sales of dry beans, including domestic sales and exports are used as a proxy for elevator price markup. While, as in the case of farm price, wholesale price may vary dramatically based on the available supply of beans, because of the potential for oligopsonist behavior by the processors. Thus, the elevator price mark-up is likely to be captured by SALES, while the processors oligopsony power is likely to be captured by SUPPLY. Further, according to equation (4) there is potential for high degree of correlation between supply (SUPPLY) and the farm price (PDBF). Thus, the variables SALES and SUPPLY are included as a ratio SLSSR in the model. Based on these considerations, the wholesale price determination is specified as follows:

(5) $PDBW_t = f(PDBF_t, COSTW_t, SLSSR_t)$

Processor Price Determination

The processed bean segment consists of canned/processed beans and beans sold in dry packs. Similar to price determination at the elevator level, the processor price determination can be specified as the processors inverse supply function. However, because of lack of data on consumption and processor prices, price determination at the processor level could not be included in the industry model. The data for consumption of dry beans is available in a consolidated form, while the analysis requires disaggregated data for canned and packaged bean consumption. Also, the processor price of canned

beans is available only as producer price index for canned beans. For the packaged segment, processor prices are not available but retail prices are available for the period 1996 onwards. Because of these data limitations the processor price determination cannot be explicitly modeled. However, equations (i) and (ii) shown below are used to forecast the price of canned/processed and packaged beans for demand estimation.

(i) $PDBRC_t = f(PDBW_t, PDBW_{t-1}, COSTC_t)$

(ii) $PDBRP_t = f(PDBW_t, PDBW_{t-1}, COSTP_t)$

PDBRC[6] and PDBRP[7] represent the processor price index and the retail price of packaged beans respectively. Canned beans comprise the majority of beans in the canned/processed segment, hence the price for this segment is represented by the price of canned beans. PDBW is the wholesale price of dry beans. Since dry beans are a storable commodity, processors and packagers usually buy beans in advance, hence the current and lagged wholesale prices are included in the equations. COSTC and COSTP represent canning and packaging costs respectively.

Domestic Demand for Dry Beans

Based on demand theory, domestic consumption is a function of the own price of the commodity, price of substitute goods, income levels, population and variables that account for changes in tastes and preferences over time. Equation (6) specifies the demand for dry beans based on these considerations. CONSPC is the consumption of dry beans expressed in per capita form to account for the increase in population. PDBRC and PDBRP represent the retail price of canned beans and packaged beans respectively. The

[6] Retail prices of canned beans are likely to follow processor prices, hence the processor price index is used as a proxy for retail prices in demand estimation.

[7] The retail price of packaged beans is available for the period 1996-2003. Equation (ii) is used to forecast the missing values from 1980 onwards.

income level in the U. S represented by GDPPC. Two demographic factors that are likely to have an impact on the demand for dry beans are also included in the demand specification. First, the variable HISPOP represents the share of Hispanic population in the U.S., as people of Hispanic origin are the largest consumers of dry beans. Apart from the Hispanic population, there has been an increase in the consumption of Mexican ethnic foods by people of non-Hispanic origin as well. This change in tastes and preferences for ethnic foods is captured a dummy variable, which takes the value 0 before 1990 and 1 1991 onwards. Since the demand for dry beans has been higher in the 1990s, the coefficient of this dummy variable will represent the extent of the upward shift in demand.

(6) $CONSPC_t = f(PDBRC_t, PDBRP_t, GDPPC_t, HISPOP_t, DUM90_t)$

Dry Bean Exports from the U.S.

Economic theory suggests that the key variables to be included in the export demand equation are the price of dry beans in the exporting country, price of dry beans in the competing exporting countries, price of dry beans in the importing countries, GDP in the importing countries, exchange rates in the importing countries and population in the importing nations.

Canada is the largest competitor for the U.S in the export market. The variable price ratio PRATIO is the ratio of PDBW in the U.S. to the wholesale price in Canada. As dry beans from U.S. are exported to about 150 countries, the GDP of the importing countries is the GDPPCO which is GDP in the rest of the world (ROW) excluding the U.S. Similarly, REXCHUS is the exchange rate of U.S. with the trade weighted exchange rate for the ROW. Finally, to account for the population in the importing

countries, the U.S. exports are divided by population in the ROW. The export demand equation is specified as:

(7) $EXPPC_t = f(PRATIO_t, GDPPCO_t, REXCHUS_t)$

Storage Demand

Storage for dry beans occurs at the elevator level. The key factors influencing the storage demand are the carrying charge and storage costs. Carrying charge is the cost of carrying dry beans to the next period, which is based on the current and expected prices of dry beans and the interest rate. The dependent variable in the storage demand equation is the ending stocks of dry beans (ENDSTK). In equation (8) the variables PDBW represent the current wholesale price of dry beans, whereas the lagged wholesale price represents the expected price. INTRATE is the short-term interest rate and COSTS is the storage cost.

(8) $ENDSTK_t = f(PDBW_t, INTRATE_t, PDBW_{t-1}, COSTS_t)$

5.2.3 Complete dynamic system

The supply response and the marketing block along with the assumption that imports are exogenous and the required identities form the complete dynamic system for the dry bean industry. Given the values for exogenous variables and lagged endogenous variables the system of equations may be solved for total supply, demand and prices.

5.3 Data for the model

The dry bean acreage, and dry bean and soybeans farm prices were obtained from USDA--NASS database. The variable cost of production is obtained from the USDA cost and returns database. The production costs for dry beans are not published by

USDA. However, based on dry bean production costs considered in extension bulletin published by the Jefferson Institute, the production costs for dry beans are calculated as 1.5 times soybeans production costs. The data for soybeans target price was obtained from the ASCS Commodity Fact Sheet. The marketing cost index for the wholesale level, processor level and the storage costs were calculated from the Food Marketing Cost Index published by the USDA. The data on domestic consumption of dry beans was obtained from the ERS, USDA. The Producer price index for canned beans, retail price of dry packaged beans and the data on CPI were obtained from the Bureau of Labor Statistics, USDL. Import and export data were obtained from the online database of Foreign Agricultural Trade of the United States.

The wholesale prices of dry beans were available for the major market classes of dry beans, but an aggregate U.S. wholesale price was not available. Also, there are no data available on the sales of the individual market classes. A likely proxy for sales was the consumption and exports for specific market class. Thus, the aggregate wholesale price of dry beans was computed by multiplying the wholesale price for specific market class by the ratio of sales of that market class to total sales. The wholesale price for dry beans in Canada was not available. However, data on export volume and value of dry bean exports from Canada were obtained from FAO. Based on this, the unit value of exports was used as a proxy for the wholesale prices of dry beans in Canada.

5.4 Model Estimation

Table 5.1 presents the results of the estimated model and specifies the identities which form the complete system. The complete list of variables is presented in Table 5.2.

The period of analysis is from 1980 – 2003, with lagged variables extending before 1980. The data for the period 1980-2001 are used for estimation and the data for 2002 and 2003 are used for out of sample prediction. All the U.S. and foreign price and cost variables have been deflated by the relevant Consumer Price Index (CPI) to account for the changes in general price level. All equations in the model are assumed to be linear in parameters.

The supply section, that is, acreage planted, yield and acreage harvested equations are usually known at the beginning of the crop year and are independent of the market allocation. Consequently equations (1a), (2a), and (3a) were estimated individually using OLS. The market allocation equations were treated as a system of equations to account for endogeniety and to account for possible correlation in the error terms across the equations. Thus equations (4a) – (8a) were estimated using 3SLS. Equations (ia) and (iia) used to forecast the processor prices of canned and packaged beans are estimated individually using OLS.

5.4.1 Supply Response

Acreage Response

The conceptual framework in equation (1) specifies the acres planted of dry beans as a function of the expected price of dry beans, expected price of the competing crop soybeans, the price risk and lagged acres. The final estimation results estimated by OLS are shown in equation (1a). Figures in parenthesis represent the p-values.

Table 5.1: Econometric Model of the U.S Dry Bean Industry

(1a) $ACRESP_t = 1637 + 290.12\ EPDB_t - 117.9\ EPSB_t - 37.09\ DBRISK_t$
(.001) (.000) (.084) (.016)
R-squared = .63, D.W. = 1.61

(2a) $YIELD_t = -40325.1 + 20.94\ TREND + 36.5754\ EDBP$
(.000) (.000) (.049)
R-square = .51 D.W. = 1.91

(3a) $ACRESH_t = -56.37 + .97\ ACRESP_t$
(.453) (.000)
R-squared = .97, D.W. = 1.61

(4a) $PDBF_t = 18.09 + 3.23\ MCF_{t-1} - 1.44\ SUPPLYPC_t + 33.29\ DUM8182$
(.043) (.005) (.000) (.000)
R- squared = .88, D.W. = 1.31

(5a) $PDBW_t = - 2.93 + - 1.00\ PDBF_t + 17.2487\ SLSSR_t$
(0.000) (.043) (.000)
R-square = .98, D.W = 2.73

(6a) $CONSPC_t = 12.66 - 0.006\ PDBRC - 0.04\ PDBRP_t - 0.001\ GDPPC_t + .87DUM90$
(.000) (.111) (.002) (.000) (.000)
R- squared = .62, D.W = 2.25

(7a) $EXPPC_t = 3.83 - 0.62\ PRATIO - 0.011\ REXCHUS + .167\ DUM8182$
(.000) (.102) (.022) (.000)
R-squared = 0.78, D.W. = 1.65

(8a) $ENDSTK_t = 41285 - 301.67\ COSTS - 238\ PDBW_t + 199.3\ PDBW_{t-1}$
(.000) (.001) (.003) (.001)
R-squared = .54 D.W. = 1.69

Identities

$QTY_t = ACRESH_t * YIELD_t$
$QTYAVL_t = .96 * QTY_t$
$SUPPLY_t = QTYAVL_t + ENDSTK_{t-1} + IMPORTS_t$
$SLSSRt = SALES_t / SUPPLY_t$
$SALES_t = CONS_t + EXPORTS_t$
CONS = CONSPC *POPUS
EXPORTS = EXPPC * POPO
$ENDSTK_t = QTYAVL_t + IMPORTS_t + ENDSTK_{t-1} - CONS_t - EXPORTS_t$

Table 5.2: List of Variables

ACRESP	Dry Bean Acres Planted
ACRESH	Dry Bean Acres Harvested
CONS	Domestic Consumption of Dry Beans
CONSPC	Per Capita Domestic Consumption of Dry Beans
COSTC	Costs incurred by canners
COSTP	Costs incurred by packagers
COSTS	Storage Costs
COSTW	Cost at the Wholesale Level
DBRISK	Dry bean price risk
DUM8182	Dummy variable for Dry Bean Farm Price
DUM90	Dummy variable change in consumption
ENDSTK	Ending stocks of dry beans
EPDB	Real Expected Price of Dry Beans Deflated by Cost of Production
EPDBDUM	Dummy variable 0 for the period 1980 – 1990, EPDB thereafter
EPSC	Real Expected Price of Soybeans deflated by Cost of Production
EXPORTS	Export Demand for U.S. Dry Beans
EXPPC	Exports/POPO
GDPPCUS	Per capita GDP in the U.S.
GDPPCO	GDPPC for ROW
HISPOP	Percentage share of Hispanic Population in the U.S.
IMPORTS	Imports of Dry Beans into U.S.
INTRATE	Short Term Interest Rate
MCF	Marginal Cost at the Farm Level
PDBF	Farm Price of Dry Beans
PDBW	Wholesale Price of Dry Beans
PDBRC	Producer price index for canned beans
PDBRP	Retail Price of dry beans
POPO	Population in ROW.
POPUS	U.S. Population
PRATIO	Ratio of the U.S. to Canada wholesale price
QTY	Total Production of Dry Beans
QTYAVL	0.96*QTY
REXCHUS	Real Trade Weighted Exchange Rate
SALES	EXPORTS + CONS
SBRISK	Soybeans price risk
SLSSR	SALES/SUPPLY
SUPPLY	QTYAVL + IMPORTS + ENDSTK (-1)
SUPPLYPC	Per capita supply of dry beans
TREND	Trend variable
YIELD	Dry bean yield

Note: The variables represented in bold are the endogenous variables in the model

(1a) $ACRESP_t = 1637 + 290.12\ EPDBD_t - 117.9\ EPSBD_t - 37.09\ DBRISK_t$
(.001) (.000) (.084) (.016)

R-squared = .63, D.W. = 1.61

Based on the coefficient for expected prices of dry beans, the own price elasticity of dry beans was estimated to be 0.75 and the cross price elasticity with respect to soybeans is -0.30. The elasticity of own price risk for dry beans is -0.03. The risk variable for soybeans was found to be statistically insignificant and was dropped from the final estimation. A possible explanation is that soybeans are supported by market loan program. Hence the growers are assured of the minimum price they receive for soybeans, which makes soybeans risk less important in decision making. Finally, contrary to expectations, the lagged acres for dry beans had a positive sign, but was also statistically insignificant, hence the variable was dropped in the final estimation. Possible reasons for the positive sign on lagged acreage this are that dry beans have low adjustment cost and it is easily to switch in and out of dry bean production. Also, for biological reasons, dry beans are not grown consecutively for two years on the same plot of land.

Yield

The yield for dry beans as specified in equation (2) was estimated as a function of time trend to capture the increase in yield due to technological changes. The coefficient of the trend variable in equation (2a) indicates an annual increase in yield of about 20 pounds. Further, the low R- squared for the equation suggests that there is significant variability in yield due to changing weather conditions.

(2a) $YIELD_t = -40325.1 + 20.94\ TREND$
(.000) (.000)
R-squared = .51 D.W. = 1.91

Acres Harvested

The estimation of the acres harvested to the acres planted in equation (3a) reflects that about 97 percent of the acres planted are harvested.

(3a) $ACRESH_t = -56.37 + .97\ ACRESP_t$
(.453) (.000)

R-squared = .97, D.W. = 1.61

5.4.2 Marketing of Dry Beans

The farm price of dry beans was specified as a function of the marginal cost of production in the previous period and the supply of beans in the current period. In the estimated model, a dummy variable DUM8182 was also included in the model as the farm price of dry beans was considerably higher in the years 1981 and 1982 because of extremely high demand from Mexico. The estimated farm price equation is presented below.

(4a) $PDBF_t = 18.09 + 3.23\ MCF_{t-1} - 1.44\ SUPPLYPC_t + 33.29\ DUM8182$
(.043) (.005) (.000) (.000)

R- squared = .88, D.W. = 1.31

The elasticity of farm price to the production costs is unity, that is, a 1% increase in production costs leads to a proportionate increase in farm price, while the elasticity of farm price with respect to supply is 2.15. This high elasticity of supply in farm price is probably an indicator of oligopsony power, whereby in years of high supply, the farm price decreases significantly.

Price Determination at the Elevator Level

(5a) $PDBWD_t = -2.93 + -1.00\ PDBFD_t + 17.2487\ SLSSR_t$
(0.000) (.043) (.000)

R-squared = .98, D.W = 2.73

Equation (5a) is the estimated elevator price determination equation. The elasticity of farm price to wholesale price is close to unity, suggesting that an increase in farm price, results in a proportionate increase in wholesale price. The variable SLSSR is unitless, however, its coefficient can be interpreted by taking the partial derivatives first with respect to sales and then with respect to supply and evaluating the results at the mean as follows:

$\partial PDBWD/\partial SALES = 17/SUPPLY = 0.00064$

$\partial PDBWD/\partial SUPPLY = 17*(SALES)/(SUPPLY)^2 = -0.00024$

This implies that if the sales of dry beans increased by a 1000 CWT the elevators would set the price about 64 cents higher, but if supply increases by 1000 CWT the price would fall by 24 cents.

Contrary to expectations, the coefficient of the cost of processing at the wholesale level was found to be negative. However, it was also statistically insignificant and hence was dropped from the final estimation. A possible explanation is that the processing costs are a small percent of the total costs at the wholesale level.

Processor Price Determination

Equation (ia) is estimated equation used to forecast the processor price of canned.

(ia) $PDBRC_t = 63.08 + 0.25COSTC_t$
(.000) (.001)
R-squared = 0.85 D.W. = 1.4

In equation (i) the price of canned beans was specified as a function of the current and lagged wholesale price and canning costs. However, the wholesale prices were not stastically significant. This is probably because the canning costs represent the highest proportion of costs at the canning level. Also, there is significant variation in the wholesale prices, while the prices for canned beans are relatively stable. Equation (ia) shows that about 85% of the variation in canner price index is explained by canning costs.

Equation (iia) is used to forecast the retail price of packaged beans. The results of the estimation suggest that the current and lagged wholesale prices of dry beans and the packaging costs explain about 99% of the variation in the retail prices.

(iia) $PDBRD_t = -104.27 + 0.15\ PDBW_t + .28\ PDBW_{t-1} + 0.92\ COSTP_t$
(0.056) (0.064) (0.009) (0.029)

R-squared = .99, D.W = 2.06

As mentioned earlier, the data for retail price is available only for 1996-2003. Thus, the above estimation is based on the data for these 8 years. The retail price used in the domestic demand estimation for the period 1980 –2003 is predicted from this model.

Domestic Demand

Equation (6a) represents the estimated domestic demand for dry beans.

(6a) $CONSPC_t = 12.66 - 0.006\ PDBRC - 0.04\ PDBRP_t - 0.001\ GDPPC_t + .87DUM90$
(.000) (.111) (.002) (.000) (.000)

R- squared = .62, D.W = 2.25

The prices of canned and packaged dry beans have the expected sign, though, the coefficients on the retail prices are very small. The significance level for canned beans is

very close to 10%, hence it was retained in the final estimation. A possible explanation for this low significance in determining consumption is that canned beans have been increasingly used in the 1990s. However, in the 1990s, the consumption of dry beans is largely driven by changes in tastes and preferences as represented by the dummy variable DUM90. Thus, the prices have possibly played a smaller role in determining consumption.

As mentioned in Chapter four on scenario analysis, the demand for dry beans has a dual nature – traditional concept of dry beans as inferior good and the more recent image of dry beans as a trendy and health food. In the estimated demand model, the variable DUM90 captures the latter demand for dry beans as a trendy product, while the negative coefficient for GDPPC reflects the image of dry bans as an inferior product.

Export Demand

Equation (7a) is the estimated exported demand equation. PRATIO is the ratio of the U.S. price to the price of dry beans in Canada, the major competitor for the U.S. dry beans in the export market. As in the case of farm price, the dummy variable for the years 1981 and 1982, DUM 8182 was also used in the export equation to capture the impact of very high exports in those years.

(7a) $EXPPC_t = 3.83 - 0.62\ PRATIO - 0.011\ REXCHUS + .167\ DUM8182$
(.000) (.102) (.022) (.000)

R-squared = 0.78, D.W. = 1.65

The coefficient on the price ratio indicates that a relative increase in the U.S. price of decreases the U.S. exports by .62 per capita. Finally, equation (7a) also reflects the negative impact of real exchange rates on the U.S exports of dry beans. The variable on

the income levels in the importing countries, GDPPC had a negative sign, indicating that dry beans are probably an inferior good, but was statistically insignificant and was not included in the final estimation.

Storage Demand

Equation (8a) shows the estimated storage demand equation. As expected, with an increase in the current price the stocks of dry beans decline and increase with an increase in the expected price. Also, increasing storage costs have lead to declining stocks. The coefficient on interest rate however was negative, and statistically insignificant and hence was not included in the final estimation.

(8a) $ENDSTK_t = 41285 - 301.67\ COSTS - 238\ PDBW_t + 199.3\ PDBW_{t-1}$
(.000) (.001) (.003) (.001)

R-squared = .54 D.W. = 1.69

5.5 Predictions for 2002 and 2003

Given the overall favorable statistical results, the econometric model is an acceptable representation of the structure of the U.S. dry bean industry. The estimated behavioral equations may be used to make conditional short-run predictions. The exogenous variables were updated for the period 2002 and 2003. Actual and Predicted values for the endogenous variables and the 95% confidence interval based on the standard errors of the forecast are presented in Table 5.3. Most of the predicted values fall within the 95% confidence interval of the forecasts. The predicted values for ENDSTK are much below their predicted values. This is because of the drastic reduction in supply because of very low yields in 2001.

5.6 Summary Comments

This chapter formulated an econometric model of the U.S. dry bean industry. The model included two blocks. The first block determined the supply of dry beans for the current year by estimation equations for acres planted, acres harvested and the yield. The second block consisted the marketing of dry beans, which included equations for determination of farm price, wholesale price and retail price of dry beans along with the domestic, export and storage demand for dry beans.

The validity of the model as a representative of the dry bean industry is determined by the appropriateness of the theoretical specifications, and the statistical properties of the estimated equations. In this regard, the behavioral specifications appear logically sound and are supported by coefficient estimates that have signs consistent with theory. The out of sample predictions also fall in the range of 95% confidence interval of the standard error of the predictions for most of the endogenous variables. Overall, the model provides the structural framework to conduct simulation experiments by incorporating the results of the scenario analysis to see how the industry evolves under different scenarios.

Table 5.3: Actual and Predicted Values for 2002 and 2003

	Year	Actual	Predicted	95% Confidence Interval of Forecast	
				Lower Limit	Upper limit
ACRES	2002	1922	1515	1477	1959
	2003	1406	1746	974	2177
ACRESH	2002	1727	1770	1622	1875
	2003	1347	1289	1241	1395
YIELD	2002	1743	1674	1612	1805
	2003	1672	1683	1544	1811
PDBFD	2002	21.27	19.77	15.06	27.48
	2003	16.22	19.16	10.0	22.45
PDBWD	2002	26.83	24.18	20.97	27.38
	2003	19.48*	26.11	22.83	29.38
CONSPC	2002	7.43	7.15	5.9	8.3
	2003	7.33	6.9	5.5	8.0
EXPPC	2002	.10	.136	.03	.168
	2003	.11	.137	.03	.172
ENDSTK	2002	375*	284	455	812
	2003	173*	223	462	620

*Values outside the 95% confidence interval of forecast

Chapter Six

Scenarios for the Dry Bean Industry

6.1 Introduction

The objective in this chapter is to integrate the results of scenario analysis and econometric analysis to present the future scenarios for the U.S. dry bean industry and to understand the implications for Michigan under alternate future scenarios. The scenario analysis helped to identify the two key uncertain forces for the future of the dry bean industry: i) demand for dry beans, and ii) impact of globalization. The impact of these factors on key industry variables can be evaluated by conducting econometric simulations based on possible different outcomes of these factors. However, quantitative estimates of the uncertain forces are needed to incorporate these factors into the model. The Nominal Group Technique (NGT) was used to get the quantitative estimates from the scenario team. Before describing the scenarios, the next section reviews the Nominal Group Technique used to obtain the quantitative estimates of the key uncertain variables. Section 6.3 reviews the assumptions used for simulation under each scenario and discusses the simulation results. Based on simulation results and scenario analysis, alternate scenarios for the U.S. dry bean industry are presented in Section 6.4. Section 6.5 presents the implications for Michigan under different scenarios and the last section presents a chapter summary.

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6.2 Quantitative Estimates of Uncertain Forces Using Nominal Group Technique

6.2.1 Overview of Nominal Group Technique

The overview of NGT presented in this section is based on Delbecq et al., (1975). NGT and Delphi Technique are formal methods widely used in strategic management literature to obtain expert opinion. These group techniques take advantage of pooled judgments of a group of people who are familiar with different aspects of the issue under consideration. Delphi Technique is most used when face-to-face interaction of the experts is not possible. The use of NGT is appropriate to get consensus within a small group of about ten people. The scenario team for this study consists of ten members, who could meet as a group, thus, use of NGT is appropriate in this case.

The NGT provides a structured format to get consensus on specific issues. The participants are brought together for a discussion session led by a moderator. After the topic has been presented to session participants and they have had an opportunity to ask questions or briefly discuss the scope of the topic, they are asked to take a few minutes to think about and write down their responses. The session moderator then asks participants to read and elaborate on their responses. These are noted on a flipchart. Sometimes the results are given back to the participants in order to stimulate further discussion or readjust the responses after the discussion. The main steps in conducting the process are presented in Table 6.1.

Table 6.1: Steps in Conducting the Nominal Group Technique

Step 1: Silent Generation of Ideas in Writing

The first step of the NGT meeting is to have group members write key ideas silently and independently.

Step 2: Round-Robin Recording of Ideas

The second step of NGT is to record the ideas of group members on a flip chart visible to the entire group. Round-robin recording means going around the table and asking for one idea from one member at a time. The leader writes the idea of a group member on the flip chart and then proceeds to ask for one idea from the next group member, and so on.

Step 3: Serial Discussion

The purpose of the third step of the NGT method is to discuss each idea in turn for the purpose of clarification.

Step 4: Preliminary Vote

The purpose of this step is to aggregate the judgments of individual members to determine the relative importance of individual items.

Optional Steps

If desired, two additional steps can be added to the process. *Step 5* adds a brief discussion held after the group sees the ratings of the entire group. This discussion focuses on those ideas that were most highly rated during the preliminary vote and again concentrates on clarification of the issues. After this discussion, the leader proceeds to *Step 6*, in which a new (final) vote is taken. The final vote is then tallied to identify the group's most favored actions

Source: Delbecq et al.

The process of conducting NGT has several advantages that make it a useful tool to obtain expert opinion. Obtaining input from people of different backgrounds, experiences, and ages, allows for a range of individual ideas and concerns. All participants have an equal opportunity to express their views. Discussion and clarification of ideas enables creative thinking and effective dialogue. The key limitations of the approach are that assertive personalities may dominate unless the moderator exercises leadership and facilitation skills. Further, lack of anonymity can make participants play it safe and, finally, the process is difficult to conduct if the group size gets too large. Although, there is no specific number, the rule of thumb is to limit the group size to about 8-10 people.

6.2.2 Results of the Nominal Group Technique

In this study, the NGT was conducted with the scenario team (consisting of ten members) to get quantitative estimates of the key uncertain variables – demand shift and the impact of globalization. Also, one of the main factors driving globalization is the potential increase in dry bean production in Canada. Thus, before understanding the impact of globalization, it was important to get an idea of the potential expansion of dry bean production in Canada. The questionnaire used to get estimates of these variables from the scenario team is presented in Appendix 3.

Table 6.2 presents the results of the NGT. These results show the average of estimates provided by the group. The data on these variables for the past decade is also presented in the table to enable a comparison of the extent of change in these trends estimated by industry experts. The estimates show that driven by the health aspects of dry beans, there is potential for demand to shift from the current per capita level of 7.4

pounds to 8.2 pounds. Dry bean production in Canada increased from 171 –270 thousand MT over the period 1994-2003. The experts estimate that with the success of the ongoing agronomic research, there is potential for the production to increase up to 600 thousand MT. As shown in Chapter three imports into the U.S. increased from 28 thousand MT in 1994 to 47 thousand MT in 2003.[8] With expansive globalization, the imports of dry beans in the U.S. can go up to 120 thousand MT over the next decade. Dry bean exports from the U.S. hovered around 345 thousand MT during the past decade, but had declined to 300 thousand MT in the 2000s. With high impact of globalization, exports can decline to around 240 thousand MT. The next section describes how these results are incorporated in the econometric model and presents simulation results based on this input provided by the industry experts.

Table 6.2: Results of the Nominal Group Technique

Scenario Variables	1994-2003	Estimate for 2013 provided by Experts
Average Demand (Pounds Per Capita)	7.4	8.2
Trend in Dry bean production in Canada ('000 MT)	171-270	600
Trend in Dry Bean Exports ('000 MT)	345-300	240
Trend in Dry Bean Imports ('000 MT)	28-43	120

[8] During 2002 imports into the U.S. reached 100 thousand MT. However, this high imports was an aberration from the trend during the 1990s.

6.3 Model Simulation

To conduct the simulations, all the exogenous variables used in the model were extended up to 2013. Projections for all the exogenous variables were obtained from the USDA Agricultural Baseline Projections available online. However, projections for the processing costs incurred by wholesalers, canners and packagers, and storage costs at the elevator level were not available. Based on information obtained from USDA marketing specialists,[9] these marketing costs are likely to increase in accordance with the inflation rate. Thus, these variables were adjusted accordingly for the projected period.

The two key scenario variables are the demand for dry beans and the impact of globalization. Demand for dry beans and exports are endogenous variables in this model. Ideally, the key scenario variables would be exogenous and model simulation would provide insights into how the change in these exogenous variables brings about changes in the endogenous variables. However, given the nature of the uncertainties in this study, it was easier to collect information on these variables. In the case of demand, there is likely to be an upward shift in demand because of a shift in tastes and preferences. Thus, the data obtained in this case was for the extent of the potential upward shift in demand. Regarding globalization, the change in exports is likely to come about as a change in the relative production costs between the U.S. and Canada. Since the scenario team consisted not only of growers but also of processors and other industry representatives, the team collectively could provide more accurate input regarding the potential change in exports rather than changes in production costs. Finally, the imports for dry beans are treated as exogenous in this model, thus the change in imports can be incorporated as an

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[9] This information was based on electronic communication with the USDA marketing specialists.

exogenous change. The changes in these variables were incorporated for model simulation under different scenarios identified in Chapter four (Figure 4.2) as described below. As discussed earlier, scenario four, that is the scenario with high demand and high impact of globalization, is not developed in detail in this study as the results of the scenario are likely to be very similar to the baseline scenario. However, the simulation results are discussed here for all four scenarios.

– ***"More of the Same"*** (Base Line Scenario) assumes that the average per capita consumption continues to be an average of 7.4 pounds. This scenario also assumes a limited impact of globalization. Thus, for this scenario the imports and exports of dry beans are maintained at the current level. To maintain the exports of dry beans at the current level, the price of Canadian dry beans for the projected period is the average price of the past three years. Imports of dry beans are held constant at 45 thousand MT, the average imports for the past three years (excluding 2001 and 2002 when imports were very high).

– ***"Challenged in a Global Market"*** considers the impact of expansive globalization by examining the change in the U.S. exports and imports driven by globalization. According to expert estimates, with expansive globalization, imports of dry beans into the U.S. would reach a high of 120 thousand MT by 2013. The increasing imports are incorporated in the model by increasing the trend imports by 13% every year, which leads to an increase in imports to around 120 thousand MT by 2004. In this scenario the exports can decline to 240 thousand MT. To evaluate this decline in exports, the prices of Canadian dry beans were reduced by 25 % as compared with the prices in the baseline scenario, to see the impact of this change on the U.S. dry bean industry. This price

difference of 25% was based on the differences in production costs between the between the two regions. Because this scenario assumed no upward shift in demand, the per capita consumption was continued at the 1990s consumption level of 7.4 pounds.

– ***"Saved by Consumer Demand"*** presents the scenario with an upward shift in demand to reflect changing tastes and preferences with increasing popularity of dry beans as a health food. According to expert estimates the per capita consumption of dry beans would increase from an average of 7.4 pounds to an average of 8.2 pounds over the next decade. This change is incorporated in the analysis by changing the value of the trend variable in the demand model. For the simulation, the trend variable is 0 for the period 1980 to 1989, 1 for the period 1990 to 2003, and 2 for the period 2004 to 2013. Because this scenario assumed limited impact of globalization, the values for the imports and the average price of dry beans in Canada were the same as those used in the base line scenario.

– ***Scenario Four*** presents a situation with high demand and high impact of globalization. To incorporate these changes in the model, high demand was included in the model as explained in the "Saved by Consumer Demand". Similarly, the high impact of globalization was included as described in the "Challenged in a Global Market scenario".

Simulation Results

The simulation results for each of the scenarios – "More of the Same", "Challenged in a Global Market", "Saved by consumer demand", and Scenario Four are presented in Table 6.3A, 6.3B, 6.3C, and 6.D respectively.

Table 6.3 A: Simulation Results for "More of the Same" Scenario

YEAR	ACRES	YIELD	FARM PRICE	WHOLESALE PRICE	CONSUMPTION PER CAPITA	EXPORTS	IMPORTS
	('000)	(POUNDS/ACRE)	$/CWT	$/CWT	POUNDS	('000 MT)	('000 MT)
2004	1923	1700	16.45	21.46	6.95	308.	45
2005	1626	1712	18.69	24.91	7.42	294	45
2006	1968	1724	19.11	24.16	6.91	310	45
2007	1820	1736	19.67	25.13	7.64	301	45
2008	1959	1748	19.86	24.25	6.96	313	45
2009	1905	1760	19.52	24.32	7.91	315	45
2010	1938	1772	19.91	23.69	6.93	322	45
2011	1954	1784	19.01	23.36	8.10	327	45
2012	1917	1796	19.68	22.95	6.79	333	45
2013	1978	1808	18.37	22.51	7.91	338	45
AVG 2004-13	**1899**	**1754**	**19.03**	**23.67**	**7.35**	**316**	**45**
AVG 1994-03	**1834**	**1644**	**20.72**	**24.55**	**7.43**	**346**	**47**

Table 6.3 B: Simulation Results for "Challenged in a Global Market" Scenario

YEAR	ACRES	YIELD	FARM PRICE	WHOLESALE PRICE	CONSUMPTION PER CAPITA	EXPORTS	IMPORTS
	('000)	POUNDS/ACRE	$/CWT	$/CWT	POUNDS	('000 MT)	('000 MT)
2004	1923	1700	16.45	20.84	7.10	236	51
2005	1626	1712	18.10	22.94	7.43	224	56
2006	1968	1724	18.08	21.59	6.93	250	62
2007	1820	1736	18.23	21.90	7.67	243	68
2008	1959	1748	18.11	20.72	7.00	262	75
2009	1905	1760	17.49	20.42	7.96	268	82
2010	1938	1772	17.60	19.58	6.92	280	90
2011	1954	1784	16.48	18.97	7.95	289	99
2012	1917	1796	16.90	18.36	6.97	298	109
2013	1978	1808	15.35	17.62	8.10	309	120
AVG 2004-13	**1899**	**1754**	**17.28**	**20.29**	**7.40**	**265**	**81**
AVG 1994-03	**1834**	**1644**	**20.72**	**24.55**	**7.43**	**346**	**47**

Table 6.3 C: Simulation Results for :"Saved by Consumer Demand" Scenario

YEAR	ACRES	YIELD	FARM PRICE	WHOLESALE PRICE	CONSUMPTION PER CAPITA	EXPORTS	IMPORTS
	('000)	(POUNDS/ACRE)	$/CWT	$/CWT	POUNDS	('000 MT)	('000 MT)
	('000)	ACRE	$/CWT	$/CWT	(POUNDS)	('000 MT)	('000 MT)
2004	1923	1700	16.40	22.46	7.82	300	45
2005	1627	1712	19.52	27.53	8.27	271	45
2006	2010	1724	20.46	27.54	7.94	281	45
2007	1864	1736	21.43	29.32	8.46	264	45
2008	2027	1748	21.88	28.64	7.87	274	45
2009	1973	1760	21.78	29.04	8.72	274	45
2010	2018	1772	22.31	28.49	7.84	280	45
2011	2035	1784	21.57	28.29	8.90	283	45
2012	2005	1796	22.32	27.92	7.90	288	45
2013	2067	1808	21.12	27.54	8.80	292	45
AVG 2004-13	**1955**	**1754**	**20.88**	**27.68**	**8.25**	**280**	**45**
AVG 1994-03	**1834**	**1644**	**20.72**	**24.55**	**7.43**	**346**	**47**

Table 6.3 D: Simulation Results for Scenario Four

YEAR	ACRES	YIELD	FARM PRICE	WHOLESALE PRICE	CONSUMPTION PER CAPITA	EXPORTS	IMPORTS
	('000)	(POUNDS/ACRE)	$/CWT	$/CWT	POUNDS	('000 MT)	('000 MT)
2004	1923	1700	16.45	21.66	7.82	224	51
2005	1626	1712	18.90	25.04	8.27	195	56
2006	1978	1724	19.33	24.18	7.94	214	62
2007	1824	1736	19.89	25.02	8.46	199	68
2008	1968	1748	19.99	23.97	7.87	216	75
2009	1906	1760	19.59	23.90	8.72	220	82
2010	1940	1772	19.85	23.11	7.84	230	90
2011	1949	1784	18.85	22.61	8.90	238	99
2012	1911	1796	19.36	22.02	7.90	246	109
2013	1964	1808	17.90	21.35	8.80	256	120
AVG 2004-13	**1899**	**1754**	**19.01**	**23.29**	**8.25**	**223**	**81**
AVG 1994-03	**1834**	**1644**	**20.72**	**24.55**	**7.43**	**346**	**47**

The simulation results for "More of the Same" are reflective of the scenario title. The average dry bean acreage in the U.S. over the projected period is 1898 thousand acres, which is higher than the average acreage of the 1994 – 2003, but close to the average acreage of 1900 thousand during the 1990s. Lower acreage for the period 1994-2003 is because of the significantly low acreage during 2001 and 2003. Yield is specified as a function of the trend variables, hence, projected yield at 1754 pounds/acre as expected is higher than the yield during the past decade. The projected average farm price is $ 19.03/CWT as compared with the average of $20.72/CWT for the past decade. This decline in farm price is in accordance with decreasing trend in farm prices in the 2000s. The projected average wholesale price is $23.68/CWT, marginally lower than average wholesale price in the past decade. Also, because of increasing competition from Canada in the 2000s, the projected average exports at 316 thousand MT are lower than the average exports for the past decade. The imports are exogenous and maintained at 45 thousand MT for the projected period. Since no structural change in demand is assumed for this scenario, the average projected consumption is 7.4 pounds per capita, which is similar to the average of the past decade.

The projected average acreage for the scenario "Challenged in a Global Market" is 1846 thousand acres, which is lower than the baseline acreage as expected. The decline in acreage is driven by lower farm prices, which averaged $17.28/CWT over the projected period as compared with the baseline average of $19.03. The average wholesale price in this scenario is $20.29/CWT, much lower than the base line average because of lower sales to stock ratio. The sales of dry beans comprise the domestic consumption and exports. The average demand in this case averages 7.4 pounds per

capita as in the past decade, however, the exports in this case are much lower leading to lower sales to stocks ratio. The projected exports averaged 265 thousand MT as compared with 316 thousand MT for the baseline scenario. This decline is driven by the lower prices of exports from Canada because in this scenario a 25% decline in Canadian prices was assumed. Also, the imports in this period are higher, growing at a 13%, where as the imports for the baseline scenario are maintained at 45 thousand MT.

The average per capita consumption in the "Saved by Consumer Demand" scenario is 8.2 pounds, which is higher than the average of 7.4 pounds in the base line scenario. The impact of this increased demand is reflected in the higher average farm price which is $20.80/CWT as compared with the base line average of $19.03/CWT. Consequently, the average acreage projections is 1954 thousand acres, as compared with the baseline average of 1898 thousand acres. Higher farm prices, along with higher sales to stocks ratio considerably increases the projected wholesale price which averaged $27.68 as compared with the baseline average of $23.68. Projected average exports in this scenario is 280 thousand MT, lower than the base line scenario because of higher wholesale prices. For this scenario also, the imports were maintained at 45 thousand MT as in the baseline scenario.

The results of scenario four as expected are very close to the base line scenario. The average projected acreage is 1893 thousand acres, very close to 1989 thousand acres for the baseline scenario. Similarly, the farm prices for the baseline scenario and Scenario four are $19.03/CWT and $19.01/CWT respectively, where as the comparative wholesale prices in are $23.68/CWT and $23.90/CWT. A big difference between the two scenarios however, is on the exports front. For the baseline scenario, the exports are 316

thousand MT, whereas in scenario four, the exports average 223 thousand MT for the projected period. The combined effect of high demand in the domestic market, and higher competition from Canada significantly drive down the exports in this scenario. Also, in accordance with the high impact of globalization, the imports in this scenario were increased at 13% annually.

Overall, the results of the simulation are reasonable and in accordance with expectations. Two important observations can be made. First, dynamics between the farm and the wholesale prices in different scenarios reflect the industry structure. In the case of the "Saved by Consumer Demand" scenario the increase in wholesale price is much higher than the increase in the farm price, indicating that the wholesalers probably benefit more from the increased demand than the growers. This observation is expected given the oligopsonistic nature of the industry at the elevator level. The second observation is regarding the acreage difference across scenarios, which is a difference of about 50 thousand acres in each case. The magnitude of the difference given the changes seems small. However, as reflected in the acreage response in estimation in Chapter five, the elasticity of acreage response to dry bean expected price is 0. 75. Thus, the decline in acreage is less than proportionate to the decline in expected prices.

6.4 Scenarios for the Dry Bean Industry

This section presents the three scenarios for the dry bean industry. As mentioned in the methodology section of Chapter two, scenarios are presented as contrasting narrative descriptions of how several uncertain aspects of the future might evolve. A typical scenario includes a representation of the initial situation and a story line that

represents the key driving forces and the changes that led to a particular image of the future. Thus, in general, scenarios are written in the past tense. Note that scenarios are neither forecasts nor predictions, but projections of a future based on a specific set of assumptions.

Scenario 1: More of the Same
Driving Forces: No shift in demand, low impact of globalization

At the turn of the century there were severe concerns amongst the dry bean industry participants about increasing competition from low cost producers, mainly Canada and China. With the initiation of NAFTA in 1994, the dry bean production in Canada had increased significantly, with severe negative consequences for the U.S. dry bean industry. Dry bean imports into the U.S. had increased from 28 thousand MT in 1994 to 43 thousand MT in 2003, while the exports had declined from 345 thousand MT to 300 thousand MT over the same period. In the 1990s, Canada largely produced navy beans. However, in the early 2000s, there was ongoing agronomic research to develop plant varieties of pinto, black and other colored beans suitable to the local climate. Further expansion of dry bean production in Canada would have had severe consequences for the U.S. dry bean industry. However, because of limited success in the development of plant varieties suitable to the local climate, dry bean production in Canada did not increase significantly.

Another factor of concern on the trade front was the increase in imports from China. However, because of quality concerns by the processors, imports from China did not increase significantly. Thus, the impact of globalization over the period 2004-2013 has been limited. Imports of dry beans have been maintained at around 45 thousand MT and exports of dry beans have averaged 316 thousand MT.

Much as the industry's worse fears did not play out, the expectation of an upward shift in demand also did not materialize. During the period 1994-2003, the per capita consumption of dry beans in the U.S. averaged 7.4 pounds per person. With increasing health consciousness by consumers, and the popularity of health fads such as high protein diets, there was expectation among the industry participants that dry beans would pick up as a health food because of its beneficial nutritional and cancer preventive attributes. The expectation was that these health benefits could lead to an upward shift in per capita consumption to around 8.2 pounds per person. To capitalize on this potential the industry had also launched a project to publicize the health aspects of dry beans. However, the expected shift in demand did not materialize, as consumers preferred other health products not based on dry beans to meet their wellness needs. Though there was no shift in demand, because of increasing consumer preferences for quality foods and upscale and trendy products, there has been a significant transformation in the dry bean products available in the market. Consequently, the traditional "beans in a can" have been replaced by a variety of trendy, upscale and gourmet products.

Overall, the U.S. dry bean industry has not evidenced any dramatic changes in the past decade. Dry bean acres for the period 2004-2013 has averaged around 1898 thousand acres, close to the average of the 1990s at around 1900 thousand acres. The farm and wholesale price for dry beans averaged $19.03/CWT and $23.68/CWT respectively, marginally lower than that in the past decade.

Scenario 2: Challenged in a Global Market
Driving Forces: No shift in demand and expansive globalization

In an increasingly global market place, the U.S. dry bean industry has faced stiff competition from low cost producers around the world in the past decade. Canada has

emerged to be a dominant player in the international market for dry beans and has proved to be stiff competition for U.S. dry beans on the domestic as well as export front. Implementation of NAFTA has been one of the major factors leading to increased dry bean production in Canada. Before NAFTA came into effect in 1994, the market for Canadian dry beans was very limited, as the domestic consumption of dry beans is very low.[10] However, following NAFTA, tariffs for dry beans between the U.S. and Canada were abolished, and Canada also had access to the Mexico market. Thus, NAFTA created a market for Canadian dry beans. This increase in market access combined with the fact that Canada has the lowest production cost for dry beans in the North American region gave a significant boost to dry bean production in Canada.

Furthermore, agronomic research has played a key role in the expansion of dry bean production in Canada. At the turn of the century, dry bean production in Canada was limited to navy beans, because of lack of plant varieties of pinto, black and other colored beans, suitable to the local climate. Development of cultivars suitable to the local climate contributed significantly to increased dry bean production in the past decade. Consequently, dry bean exports from the U.S. have declined from an average of 346 thousand MT in the 1990s to 265 thousand MT in the past decade. Furthermore, imports from other low cost producing countries have also increased from 43 thousand MT to 120 thousand MT in the past decade.

To add to the increased competition from globalization, the news has not been very great on the demand front as well. With increasing health consciousness in the consumers, there was potential for a further increase in the dry bean demand. In the early

[10] Per capita consumption in Canada is around 2 pounds per person as compared with 34 pounds in Mexico, the highest in the world and an estimated 8 pounds in the entire world (ERS, USDA).

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2000s, the industry launched a project to publicize the health benefits of dry beans to capitalize on this potential. However, the expected upward shift in demand did not materialize and the per capita consumption throughout the 2000s has remained steady at around 7.4 pounds as consumers opted for other health foods not based on dry beans. Though the per capita consumption has not changed much, the increasing consumer preference for trendy and upscale products has brought about a change in the processed sector of dry beans. The traditional beans in a can have been replaced by a variety of gourmet dry bean products. This increase in upscale products has created a niche market for quality dry beans.

Overall, the past decade has been very challenging for the U.S. dry bean industry. Declining exports and increasing imports have resulted in lower grower prices in the U.S. The average U.S. grower prices over the period 2004-2013 was $17.28/CWT as compared with an average of $20.72 in the earlier decade. Consequently, the acreage of dry beans declined to an average of 1846 thousand acres over the past decade as compared with an average of 1900 thousand acres for the 1990s.

Scenario 3: Saved by Consumer Demand
Driving Forces: Demand shift and limited impact of globalization

In the decade of 2000s, the per capita consumption of dry beans in the U.S. increased to 8.2 pounds as compared with 7.4 pounds in the 1990s. This increase in demand is the result of the increase in consumer health consciousness. The importance of dry beans in the very popular high protein diets and the cancer preventive effects of dry beans have made beans a popular health food. Industry efforts to publicize the health benefits of dry beans played an important role in bringing about this change. Apart from the increase in consumption, there has also been a demand transformation brought about

by the quality and health conscious consumer. Earlier, the most prevalent form of processed beans was canned beans. However, canned products were not considered fresh and healthy foods. In response to these consumer preferences, the industry has responded with a variety of upscale, trendy, and gourmet dry bean products, which have created a niche market for dry beans.

Because of this higher demand, farm prices in the U.S. have been maintained at an average of $20.80/CWT during the past decade. The dry bean acreage has also increased from an average of 1834 thousand acres to 1954 thousand acres over the same period. This high demand also led to higher wholesale prices driven by higher sales to stock ratio at the elevator level. Consequently, the wholesale prices averaged $27.68/CWT over the past decade, as compared with $24.55/CWT for the 1990s. One of the negative fall-outs of this high demand is that higher wholesale prices made the U.S. dry beans uncompetitive in the international market as compared with Canadian beans. Thus, there has been a decline in exports from 346 thousand MT in the 1990s to an average of 280 thousand MT in the 2000s.

6.4 Implications for Michigan

One of the objectives of this study is to analyze the implications of the ongoing changes for the traditional dry bean producing region Michigan, which has evidenced a significant cutback in dry bean acreage in the past decade.

The econometric analysis of the dry bean industry was conducted at the national level because of a lack of relevant data to conduct the analysis at the regional level. This analysis helped to understand how the key endogenous variables such as farm price and

acreage are likely to evolve under different scenarios. Based on the results of the simulations with insights provided by the scenario analysis, some conclusions can be drawn for Michigan.

First, the Minn-Dak region has a total cost advantage among the dry bean producing regions in the U.S. Thus, in the "More of the same" and "Challenged in the Global Market" scenarios, dry bean acreage in the U.S. is not likely to increase, while in the "Saved by the Consumer Demand" scenario higher demand for dry beans lead to higher farm prices. Consequently, in the latter scenario, Michigan dry bean acres may be maintained over the next decade. Overall, because of cost considerations, Michigan is not likely to be a major producer of dry beans.

Second, as highlighted in the scenario analysis, because of the climatic conditions, the appearance and quality of dry beans produced in Michigan are better than the beans produced in the Minn-Dak region. The scenario analysis also emphasizes that because of increasing quality and health consciousness, the traditional canned beans are likely to be replaced by high quality gourmet dry bean products, which will create a niche market for quality beans. Michigan bean producers can capitalize on this niche market because of higher quality beans.

6.5 Summary of findings

The future scenarios for the dry bean industry based on the outcome of the scenario analysis and econometric analysis are presented in this chapter. To combine the results of the econometric analysis and scenario analysis, quantitative estimates of the key uncertain variables were obtained using the nominal group technique with the study's

scenario team. Based on these estimates, simulation experiments were performed to see how the industry evolves under alternate future scenarios. The results of the simulation are summarized in table 6.4.

Table 6. 4: Summary of Simulation Results

Key Factors or Variables	**Scenario 1 More of the Same**	**Scenario 2 Challenged in a Global Market**	**Scenario 3 Saved by Consumer Demand**
Key Uncertainty			
Upward Demand Shift	No	No	Yes
Impact of Globalization	Limited	Expansive	Limited
***Key Endogenous Variables* (Average 2004-2013)**			
Acres ('000)	1898	1846	1954
Yield (Pounds/Acre)	1754	1754	1754
Farm Price ($/CWT)	19.03	17.28	20.30
Wholesale Price ($/CWT)	23.68	20.50	27.68
Consumption Per Capita* (Pound/Person)	7.4	7.4	8.2
Imports* ('000 MT)	45	75	45
Exports* ('000 MT)	316	265	280

* Key uncertain variables which were manipulated to scenarios assumptions about the key uncertainties

The dry bean acreage across the three scenario ranges from 1846 thousand acres in the worse case scenario of "Challenged in a Global Market" to 1954 thousand acres for the "Saved by Consumer Demand" scenario, which presents the best case situation for the industry. This change in acreage is driven by the changes in farm price which ranges from $17.28/CWT to $20.30/CWT across the scenarios.

The wholesale price of dry beans also exhibits a wide range across the scenarios. In the "Challenged in a Global Market scenario, the wholesale price is driven to a low of $ 20.59/CWT, where as in the high demand scenario, "Saved by consumer demand", the wholesale price reaches a high of $27.68/CWT because of an upward shift in demand. The exports for dry beans is determined by the comparative U.S. and Canadian wholesale prices. In the "Challenged in a Global Market" scenario the U.S. exports decline to an average of 265 thousand MT during the period 2004-2013 because of high competition from Canada. The exports decline to 280 thousand MT in the high demand scenario as well because wholesale price are driven up by a higher sales to stocks ratio, which makes the U.S. less competitive as compared with Canada. Overall, the results of the simulations under alternate scenarios depict a wide range in the key industry endogenous variables.

Chapter Seven

Conclusions and Future Research

7.1 Conclusions

The motivation for this study was the ongoing changes in the agriculture and food industry in the U.S. and the need for alternate approaches to analyze these changes. In the recent agricultural economics literature, there is strong recognition of the implications of these changes for all the participants in the food system. But at the same time there is concern about the analytical capacity of traditional econometric models in analyzing these changes and understanding their implications for the future of the industry. The main contention against the traditional approach is that in times of rapid change, analysis based only on historical data is not likely to be very effective in *ex ante* assessment of the imminent changes.

This study is an attempt to address these concerns by integrating scenario analysis, a strategic management technique for planning in a rapidly changing environment, with econometric forecasting. The approach is illustrated by conducting an analysis of the U.S. dry bean industry which like several other agricultural industries in the U.S. has undergone several changes in the past decade. This study contributes to the knowledge base from two aspects: 1) analytical or problem solving, and 2) methodological.

7.1.2 Analytical Perspective

The research involved conducting a scenario analysis and an econometric analysis of the U.S. dry bean industry and integrating the two analyses to better understand the

future of the industry. Scenario analysis provides a comprehensive understanding of the change forces that have affected the industry and the impact of these changes on the various industry participants. This analysis of the driving forces is very crucial to understanding the implications of the ongoing changes for the future of the industry. From these driving forces, the critical uncertain factors were identified, the outcome of which can significantly influence the industry in different directions. A potential upward shift in demand and the impact of globalization were identified as the key uncertain variables for the U.S. dry bean industry. Based on these two uncertain forces, three scenarios for the U.S. dry bean industry were identified. "More of the Same" as suggested by the title is the baseline scenario in which the outcome of the key uncertain variables – demand shift and the impact of globalization – reflect the past trends. "Challenged in a Global Market" scenario presents the situation where the demand does not shift, but the industry faces intense competition from global players, specifically Canada and to some extent China, leading to declining acreage of dry beans in the U.S. Finally, "Saved by Consumer Demand" scenario is driven by limited impact of globalization and an upward demand shift driven by increase in demand for dry beans as an important health food. This situation presents the best outcome for the dry bean industry, resulting in expansion of dry bean production in the U.S.

A complete dynamic econometric model of the U.S. dry bean industry was outlined to understand and represent the structural relationships between the supply, demand, and prices for dry beans in the U.S. The econometric model consisted of two blocks – supply response and marketing model. The supply response model determined the total production of dry beans in the U.S. by predicting acreage planted of dry beans,

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yield and harvested acres. The marketing model of dry beans included specified structural equations for determining prices at the farm level, elevator level, and processor level and the consumption, exports and storage demand for dry beans. The validity of the model as a representation of the dry bean industry was evaluated by the appropriateness of the theoretical specifications and the statistical properties of the estimated equations.

The two analyses were integrated by conducting simulation experiments based on the results of the scenario analysis. The simulation results helped to evaluate the impact of the possible outcomes of the uncertain variables on the other key industry variables. Quantitative estimates of the key uncertain variables were obtained from the study's scenario team using the Nominal Group Technique, a widely used technique in strategic management to get expert consensus.

The results of the analysis under the three scenarios suggest that in the "More of the Same" scenario, as expected, the average acreage in the U.S. is around 1889 thousand acres, in accordance with the declining acreage in the 2000s. This is because of the declining trend in farm prices. The wholesale price is also lower by a small margin. In the "Challenged in the Global Market" scenario, intense competition from Canada and to some extent China, lead to a worsening trade scenario for the U.S. Imports increase to a high of 120 thousand MT from the average imports 43 thousand MT for the period 1994-2003. Also, driven by lower prices in Canada, exports decline from an average of 346 thousand MT in the period 1994-2003 to a low average of 265 thousand MT in the projected period. In this scenario, significant changes on the trade front drives down the farm price and consequently the acreage. Finally, the "Saved by Consumer Demand" scenario presents the best future outcome for the U.S. dry bean industry driven by a shift

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in per capita consumption from 7.4 pounds in the period 1994-2003 to 8.2 pounds in the period 2004 – 2013. Consequently, the farm prices are higher, leading to higher acreage. Due to high sales to stocks ratio, the wholesale price are also much higher which drives down exports.

One of the objectives of the study was to understand the implications of the ongoing changes for the traditional producing region, Michigan. In this study, the econometric analysis is conducted at a national level, because of unavailability of data to conduct the analysis at the regional level. However, based on the simulation results under different scenarios and insights provided by the scenario analysis, two implications can be drawn for the Michigan dry bean industry. First, a review of the production costs across producing regions in the U.S. shows that Minn-Dak region has the lowest production costs in the U.S. Thus, the implications for acreage may vary under different scenarios. In "More of the Same" scenario Michigan may continue to maintain the dry bean acreage. However, in the "Challenged in a Global Market" increased production in low cost producing regions around the world may drive down the Michigan acreage for dry beans significantly. Obviously, with higher farm prices the "Saved by Consumer Demand" scenario presents the most positive situation for Michigan. Second, because of climatic conditions, the quality and appearance of dry beans produced in Michigan is better than the beans produced in the Minn-Dak region. Thus, under all the scenarios, increasing quality consciousness in consumers may provide opportunity for Michigan producers to capitalize on the quality of dry beans and cater to the niche market.

Alternate scenarios presented for the dry bean industry will be useful to the industry decision-makers. Envisioning different future scenarios will enable the

decision-makers to make decisions that are likely to be robust across the different outcomes. From a policy perspective, the analysis provides information regarding the impact farm programs for soybeans has on dry beans which is a non-program crop, and the impact of NAFTA and WTO on the agricultural industry.

7.1.3 Methodological Perspective

From a methodological perspective, the research question addressed in this study was to examine how the proposed approach enhances the results of the traditional econometric analysis in *ex ante* assessment of oncoming changes. The results of the analysis suggest that the integrated approach enhances the *ex ante* assessment of the imminent changes by incorporating the perceptions of the decision-makers to envision how the change forces can manipulate the future in different directions. Forecasting based only on historic data would not enable envisioning several fundamentally different outlooks for the future of the industry. The baseline scenario would probably be the outcome of the traditional forecasting approach. Furthermore, scenario analysis also provides a comprehensive understanding of the impact of the driving forces in the past, which enhances the interpretation of the econometric analysis.

It is important to emphasize that not only is the econometric analysis enhanced by the scenario analysis, but in fact both the approaches reinforce each other. Scenarios based on econometric analysis enable understanding the economic rationale of the ongoing changes. Also, econometric analysis provides quantitative estimates of the direction of change, which may not be available otherwise. Finally, the econometric model provides an explicit framework that clarifies which assumptions were used to

develop the scenarios and helps to create well-researched scenarios by imposing internal consistency on scenarios.

Overall, the analysis conducted in this study suggests that the two approaches reinforce each other and that the combined approach leads to a much richer analysis as each approach complements the weakness of the other. The major drawback is the additional time and effort involved in conducting the two analysis.

7.2 Future Research

A good step towards extending the framework is to assign probabilities to the scenarios. However, there are advantages and disadvantages to this. On the one hand, assigning probabilities will help to know which scenarios are more likely and hence help to prepare for it. The downside of this approach is that scenarios with high impact may be given less importance because they have lower probability, which undermines the purpose of the analysis.

In terms of application to other industries, an analysis of the U.S. dry bean industry in this study shows that this technique is a useful tool for analysis for agricultural industries in times of rapid change. The approach will be specifically useful for analysis in the case of beef industry and other specialty crop sectors beyond dry beans which are undergoing significant changes in recent years.

Appendices

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Appendix-IA

Dry Bean Producer Interview

Date: _____

IDENTIFICATION

Interviewee:

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Address:_____

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Telephone/Fax/Email:

_____

Interviewer(s):_____

I GENERAL BACKGROUND

1. Age: ___Below 30 ___30-40 ___40-50 ___ 50-60 ___ Above 60
2. Education: ___ Less than High School ___ Diploma ___ Bachelors ___ Graduate
3. Size of the farm: _____ acres

II IDENTIFYING THE DRIVING FORCES AT THE GROWER LEVEL

A. Production of dry beans

1. What different crops do you grow?
2. How do you decide the cropping plan – the proportion of each crop in the cropping plan?
3. Can you describe the cropping plan for the last 3 years? What is your expected plan for 2003?
4. For how many years have you been growing dry beans? _____ years
5. Has there been a significant change in the acreage of dry beans you cultivated?

(Discuss possible reasons – low prices of dry beans, prices of competing crops, government support for other crops, etc.)

6. What have been the changes in the market-class of dry beans you grow? (Discuss possible reasons – difficulty in selling certain market-classes of beans)
7. Where do you get information regarding the dry bean market? (Example: Industry newsletter, industry meetings, talking to other farmers, internet, extension agents, field days, other)
8. Has there been a change in the input use – use of seeds, fertilizers etc.(effect of change in environmental regulations)
9. Has there been a change in the process of harvest methods (e.g. using different harvesters, etc.)? Why?
10. What are some of the government regulations that affect dry beans production? (price support for competing crops, environment regulations, etc. or any other?)
11. Any other significant changes/issues in the production of dry beans in the recent years that you would like to mention?

B. Marketing of dry beans

1. Do you grow beans by contract? Why or why not?
2. Where do you sell your beans and how has that changed if at all?
3. What are the key problems that you face in marketing (e.g. deciding when to sell, quality issues, etc.)
4. Do you use price laters? Why or why not?
5. Any other significant changes/issues in the marketing of dry beans that you would like to mention?

III IDENTIFYING DRIVING FORCES AFFECTING THE INDUSTRY

Some of the driving forces affecting the industry are emphasized here. Please comment on the relative importance of these changes. Or add any other factors that you feel have had a significant influence on the industry.

- Social/Demographic (increasing Hispanic population in the U.S., health consciousness, demand for processed food)

- Economic (Size of farms, economies of scale, land price, labor issues)
- Political (Globalization, Regional Trading blocs, farm policy, land use regulations etc.)
- Technological (technology at elevator level, research at MSU, absence of GMOs, risk of GMOs, new varieties, etc.)

IV QUESTIONS REGARDING FUTURE UNCERTAINTIES

1. If I could answer three questions about the future of the dry bean industry for you, what would they be?
2. Imagine that the future were very good, happening exactly as you would wish – what would the outcome of these questions be? What would cause this to happen?
3. Imagine that the future developed along the worst possible lines, happening exactly as you would wish – what would the outcome of these questions be? What would cause this to happen?
4. What are one or two critical strategic decisions on the immediate horizon for you?
5. What are your future goals as a producer of dry beans?
6. What should I have asked you about the industry that I did not?

Appendix-IB

Dry Bean Elevator Interview

Date: _____

IDENTIFICATION

Interviewee:

_____

Address:_____

_____

Telephone/Fax/Email:

_____

Interviewer(s):_____

I GENERAL BACKGROUND

1. When was the elevator established? _____
2. What are the different grains handled at this elevator?

   _____
3. For how long has this elevator been dealing in dry beans?

   _____
4. What are the benefits and risks/costs associated with handling dry beans versus other crops?

II IDENTIFYING THE DRIVING FORCES AT THE ELEVATOR LEVEL

A) Procurement of dry beans

1. Have there been any changes in the market-classes of dry beans purchased in the recent years? If yes, what are they?
2. Has there been a significant change in the quantity of dry beans handled by the elevator? If yes, how has this changed?

3. How do you purchase most of your beans (contract or open market etc)? How has this changed in the recent years, if at all?
4. Has there been a change in the growers you purchase from? If yes, what are these changes?
5. Do you use price laters? Why or why not?
6. What are some of the main issues in purchasing beans? (e.g. Quality requirements etc.)
7. Are there any other significant changes/issues in procurement of dry beans that you would like to mention?

B) Processing of dry beans

1. What are some of the significant changes in the processing of dry beans in the recent years? (e.g use of magnetic belt, electronic eye, etc.)
2. Are the same equipment used for processing all types of dry beans?
3. Are you able to obtain the quantity of beans required to maintain processing at capacity?
4. Are there any other significant changes/issues in processing of dry beans that you would like to mention?

C) Marketing of dry beans

1. How do you sell most of your beans? (e.g contracts, etc.)
2. Who are some of your key customers? Have there been any significant changes in your customer base in the recent years?
3. What are the significant changes in terms of quality requirements from the buyers? How have these changed if at all? Does this significantly affect the procurement of beans?
4. Are there any other significant changes/issues in marketing of dry beans that you would like to mention?

III IDENTIFYING DRIVING FORCES AFFECTING THE INDUSTRY

Some of the driving forces affecting the industry are emphasized here. Please comment on the relative importance of these changes. Or add any other factors that you feel have had a significant influence on the industry.

- Social/Demographic (Education Factors, increase in Hispanic population, health consciousness, demand for processed foods, consumption of ethnic foods,)
- Economic (size of farms, economies of scale, consolidation at the processing level)
- Political (NAFTA, government regulations (e.g. change in standards))
- Technological (technology at elevator level)

IV QUESTIONS REGARDING FUTURE UNCERTAINTIES

1. If I could answer three questions for you about the future of the dry bean industry, what would they be?
2. Imagine that the future were very good, happening exactly as you would wish – what would the outcome of these questions be? What would cause this to happen?
3. Imagine that the future developed along the worst possible lines -- what would the outcome of these questions be? What would cause this to happen?
4. What are one or two critical strategic decisions on the immediate horizon for you?
5. What are your future goals as the manager of the elevator dealing in dry beans?
6. What should I have asked you about the industry that I did not?

Appendix-IC

Dry Bean Processor Interview

Date: _____

IDENTIFICATION

Interviewee:

_____

Address:_____

_____

_____

Telephone/Fax/Email:

_____

Interviewer(s):_____

_____

I GENERAL BACKGROUND

1. In what year was the company established? _____
2. How long has the company being processing dry beans?
3. What are the different dry bean products produced by the company?

   _____

II IDENTIFYING DRIVING FORCES AT THE PROCESSOR LEVEL

A. Purchase of Dry Beans

1. Has the quantity of beans purchased by the company changed in the recent years, if at all?
2. Has there been a significant change in the variety (market class) of beans purchased?
3. What have been some of the key changes in the quality requirement of dry beans purchased by the company?

4. Where do you source your beans and if that has changed significantly in the recent years?
5. Do you expect the source to change significantly in the coming years?
6. What have been some of the key changes in the method of procurement (e.g. more purchase through contracts, etc)?
7. Any other significant changes/issues in the procurement of beans you would like to mention?

B. Processing of Beans

1. What are the key dry bean products of the company? Have these changed significantly in the recent years?
2. What are significant changes in the consumer demand that have influenced the product variety?
3. Has there been any significant change in the method of processing with regard to food safety regulations, environment regulations etc.?
4. Any other significant changes/issues in the processing of beans you would like to mention?

C. Marketing of processed beans

1. Who are the customers the company directly sells to? Has there been a significant change in customer base in the recent years?
2. What are some of the key changes in the marketing canned/processed dry beans? (e.g, co-ordination with retailers etc)
3. Any other significant changes/issues in the marketing of beans that you would like to mentions.

II IDENTIFYING DRIVING FORCES AFFECTING THE INDUSTRY

Some of the driving forces affecting the industry are emphasized here. Please comment on the relative importance of these changes. Or add any other factors that you feel have had a significant influence on the industry.

- Social/Demographic – Increase in Hispanic population, health consciousness, demand for processed foods, consumption of ethnic foods
- Economic – retail consolidation, economies of scale
- Political – Regional Trading blocks (NAFTA), government regulations e.g. change in standards of dry beans
- Technological – technology at elevator level, etc.

IV QUESTIONS REGARDING FUTURE UNCERTAINTIES

7. If I could answer three questions about the future of the dry bean industry for you, what would they be?
8. Imagine that the future were very good, happening exactly as you would wish – what would the outcome of these questions be? What would cause this to happen?
9. Imagine that the future developed along the worst possible lines -- what would the outcome of these questions be? What would cause this to happen?
10. What are one or two critical strategic decisions on the immediate horizon for you?
11. What are your future goals a processor of dry beans?

Appendix-II

Workshop for Scenario Analysis of Michigan Dry Bean Industry

April 15, 2003

Generating Research and Extension to meet Economic and Environment Needs (GREEN) Research Project

Michigan State University Extension
Michigan Agricultural Experiment Station
Michigan Department of Agriculture
Michigan Farm Bureau

Research Co-ordinators:

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Department of Agricultural Economics
Michigan State University
East Lansing MI – 48823

Workshop Outline: Scenario Analysis of Michigan Dry Bean Industry

Fritz's, 9264 W. Saginaw Rd., Richville, MI – 48758 ◆Tuesday, April 15 ◆ 9:00 a.m. – 4.00 p.m.

Morning Session

- Introduction to the study
- Presentation on the major change forces that have affected the industry based

Key Trends

Overview of trends in production, exports, imports and consumption.

Survey Results: Change Forces Affecting the Industry

Summary of findings of the survey of the key demand and supply side issues. Surveys based on interviewing participants at different levels in the dry bean supply chain – growers, elevators and canners. Demand side issues were surveyed through interviewing experts in the industry.

- Discussion of the relative importance of the key factors affecting the industry

Lunch Break

Afternoon Session

- Based on the discussion in the morning session, identify the most important and the most uncertain factors that will affect the future of the industry and understand the implications for the future of the industry.

Scenario Analysis of Michigan Dry Bean Industry: An Overview

Need for the Study

The U.S. has been a dominant producer of dry beans and a leading exporter. However, the dry bean industry in the U.S. has evidenced major changes in the past two decades. The major changes include consolidation of the elevators, consolidation at the canning/packing level, government support for competing crops, change in demand patterns due to change in ethnicity and demand for value added products, and trade changes associated with NAFTA and increasing globalization. As a consequence of the changing market dynamics, the U.S. which had been one of the leading exporters, became one of the leading importers of dry beans in 2002. Further, within the producing regions in the U.S., Michigan has lost its position as the traditional leading producer, while the Minn-Dak (Minnesota and North Dakota) region is currently the dominant producer of dry bean production in the U.S.

In the light of the significant changes affecting the industry, it is important to understand the impact of the ongoing changes and the implications of these changes for the future of the industry.

Objectives:

The objective of the study is to present future scenarios for the dry bean industry based on scenario analysis and econometric analysis of the U.S. dry bean industry. This analysis will help to create alternate future scenarios for the U.S. dry bean industry and understand the implications for Michigan under these scenarios.

Method:

The industry analysis is based on conducting a scenario analysis and an econometric analysis of the U.S. dry bean industry. Future scenarios for the dry bean industry are based on integrating the two analyses. A brief of the research method is presented here.

i) Scenario Analysis

Scenario analysis is a technique that has been used extensively by businesses for planing under uncertainty brought about by significant changes in the business environment. This analysis helps to develop an understanding of how an industry's underlying dynamics can move it from the present state to several alternative futures.

The key steps in the analysis are:

Step 1: Conduct preliminary surveys with industry stake-holders and experts to assess the key demand side and supply side change forces affecting the industry. (See Exhibit 1)

Step 2: Conduct a workshop with industry experts to categorize the key forces as predetermined trends and key uncertainties.
Step 3: Identify three or four most important and most uncertain factors that will determine the future of the industry.
Step 4: Build scenarios for the future of the industry based on the possible outcome of the key uncertain factors.

The workshop participants will provide input for step 2 and 3 of the analysis.

ii) Econometric Analysis

The econometric analysis consists of outlining an econometric model of the U.S. dry bean industry. This analysis will provide a structural framework to understand the interrelationships that underlie the determination of dry bean output, prices, and demand.

iii) Integrating scenario analysis and econometric analysis

Future scenarios for the dry bean industry will be based on conducting model simulation based on the information provided by the scenario analysis.

Follow up

Identify the opportunities and needs for the Michigan dry bean industry under different alternate scenarios

Outcomes

A report presenting visions of multiple, credible industry futures in the form of formal scenario write ups, which will be shared with industry participants at an industry wide workshop.

Key Advantages

Sharing the results of the scenario analysis helps to bring people to a shared understanding of the ongoing changes.

This will help to begin a dialogue on potential industry collaborative efforts for "creating" a desired future (as opposed to merely reacting to the future).

Key Trends

Figure 1: Dry Bean Production in Major Producing Regions in the U.S

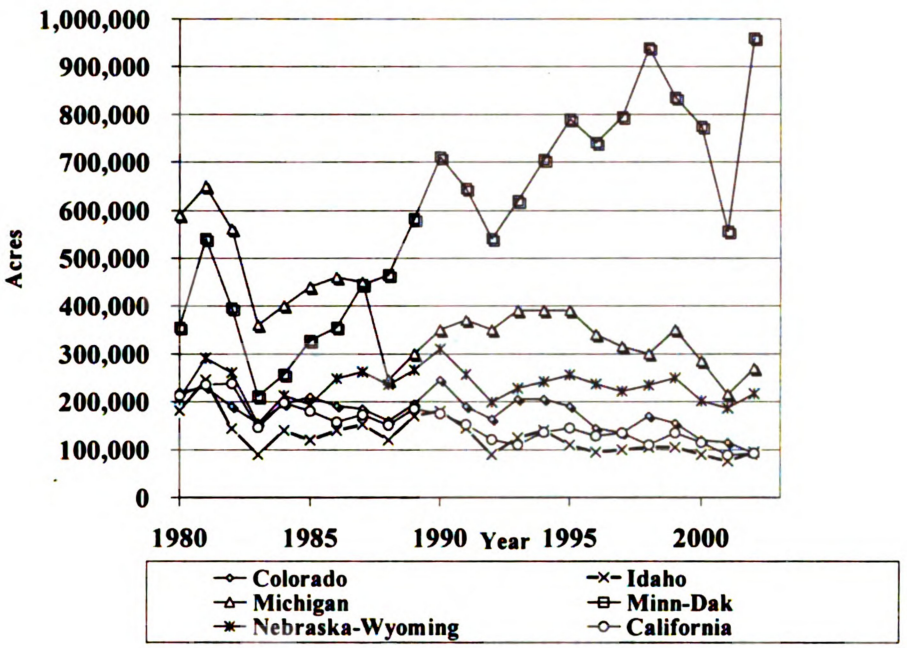


Figure 2: Per Capita Consumption of Dry Beans in the U.S.

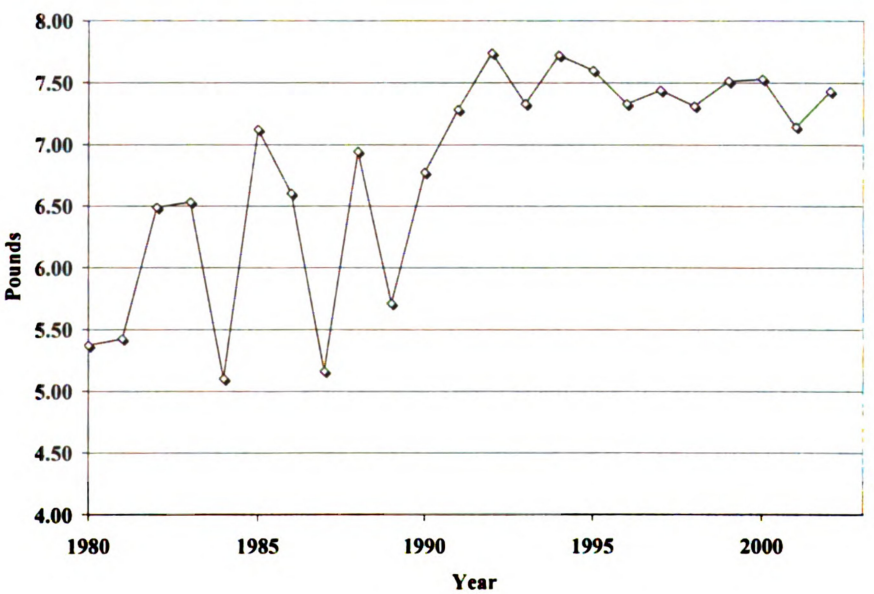


Figure 3: Per Capita Consumption of Dry Beans by Market-Class

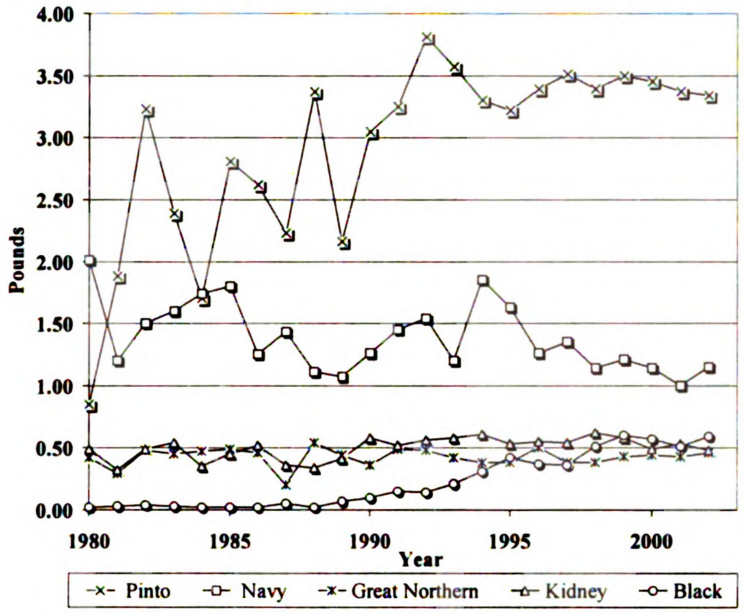


Figure 4: Dry Bean Exports from the U.S.

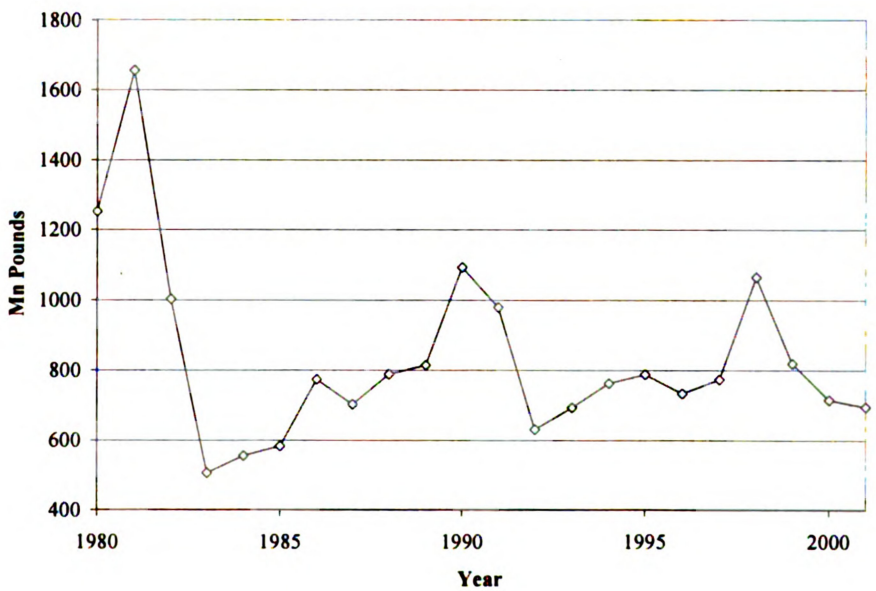
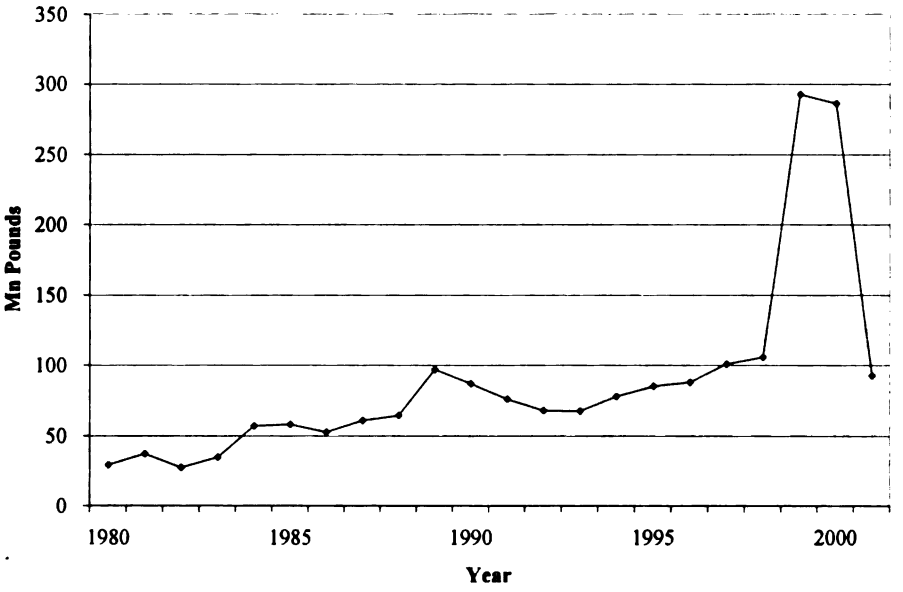


Figure 5: Dry Bean Imports into the U.S. 1980-2001



Summarizing the key drivers of Change Based on the Preliminary Interviews

1. Changing demand patterns arising from increase in Hispanic population, increase in consumption of processed foods, decrease in traditional uses of dry beans
   - implications for production – increasing pintos and blacks, decreasing navies
   - implications for research on varieties
2. Future demand patterns arising from new product development at consumer level, convenience products, upscale/trendy products, recognition of health aspects of dry beans
3. Demand of dry beans for Food Aid
4. Globalization
   - impact of NAFTA
   - impact of sourcing from other countries
5. Increasing consolidation at canning level, elevator level
   - implications for market participants
   - changing co-ordination mechanisms
6. Changing geography of dry beans driven by cost considerations and weather conditions. Where will dry beans be grown in future?
   - other regions outside of U.S.?
   - other producing states in U.S.?
7. True value of quality?
   - Move from a specialty crop to commodity
8. Competitiveness of soybeans as alternative crop for farmers arising from govt. farm programs
9. Effective supply chain management
   - Technology and other means

Assessing the Implication of the Key Driving Forces for the Future of the Industry

1. ***Changing demand patterns arising from increase in Hispanic population, increase in consumption of ethnic foods, decrease in traditional uses***

a) How has this factor affected the industry in the past?

b) What are the likely future outcomes?

c) What will be the likely implications of these outcomes for the future of the industry?

2. ***Demand patterns arising from new product development at consumer level, convenience products, upscale/trendy products, recognition of health aspects of dry beans***

a) How has this factor affected the industry in the past?

b) What are the likely future outcomes of this trend?

c) What will be the likely implications of these outcomes for the future of the industry?

3. Demand of dry beans for Food Aid

a) How has this factor affected the industry in the past?

_____

_____

_____

b) What are the likely future outcomes?

_____

_____

_____

c) What will be the likely implications of these outcomes for the future?

_____

_____

_____

4. Globalization—impact of NAFTA and sourcing from other countries.

a) What has been the impact of globalization in the past?

_____

_____

_____

b) What are the likely future outcomes of globalization?

_____

_____

_____

c) What will be the likely implications of these outcomes for the future of the industry?

_____

_____

_____

5. Impact of exchange rates on dry bean trade

a) How has this factor affected the industry in the past?

_____

_____

_____

b) What are the likely future outcomes?

c) What will be the likely implications of these outcomes for the future of the industry?

6. ***Demographic changes, increase in preference for processed foods, food safety issues, leading to increasing consolidation and changing co-ordination mechanisms.***

a) How have these factors affected the industry in the past?

b) What are the likely future outcomes of these factors?

c) What will be the likely implications of these outcomes for the future?

7. ***Changing geography of dry beans driven by cost considerations and weather conditions – production in other regions outside of U.S. and production in other producing states in U.S.***

a) What have been the impacts of these factors in the past?

b) What are the likely future outcomes?

c) What will be the likely implications of these outcomes for the future?

8. ***True value of quality? Loss of quality with increasing processing of dry beans.***

a) What has been the impact of this trend?

b) What are the likely future outcomes?

c) What will be the likely implications of these outcomes for the future of the industry?

9. ***Competitiveness of soybeans as alternative crop for farmers arising from govt. farm programs?***

a) What has been the impact of this factor?

b) What are the likely future outcomes?

c) What will be the likely implications of these outcomes for the future of the industry?

_____

_____

_____

10. Effective supply chain management -- technology and other means

a) What have been the impact of these factors?

_____

_____

_____

b) What are the likely future outcomes?

_____

_____

_____

c) What will be the likely implications of these outcomes for the future of the industry?

_____

_____

_____

Ranking of Key Trends

From the list of key driving forces, select five for each ranking below. The two lists need not match.

1. Five most important change forces:

1)_____

2)_____

3)_____

4)_____

5)_____

2. Five most uncertain change forces:

1)_____

2)_____

3)_____

4)_____

5)_____

Appendix – III

Follow-up Workshop for Scenario Analysis of Michigan Dry Bean Industry

November 7, 2003

Generating Research and Extension to meet Economic and Environment Needs (GREEN) Research Project

Michigan State University Extension
Michigan Agricultural Experiment Station
Michigan Department of Agriculture
Michigan Farm Bureau

Research Co-ordinators:

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East Lansing MI - 48823

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Nowlin Chair of Consumer Responsive Agriculture
Department of Agricultural Economics
Michigan State University
East Lansing MI – 48823

Workshop Outline: Scenario Analysis of Michigan Dry Bean Industry

Fritz's, 9264 W. Saginaw Rd., Richville, MI – 48758 ◆Friday, Nov. 7 ◆ 9:30 a.m. – noon.

- Present an overview of the quantitative model
- Presentation/Discussion on the major change forces that have affected the industry
- Expert Consensus on the key uncertain variables using Nominal Group Technique
  - Discussing the key questions
  - Silent Generation of Ideas in Writing
  - Recording Round-Robin Listing of Ideas on Chart
  - Discussion and Clarification of Each Idea on Chart
  - Preliminary Vote
  - Discussion of Preliminary Vote
  - Final Vote

Overview of the Quantitative Analysis*

Supply Response

Acres of dry beans =F(Price of dry beans, Price of Competing Crop, Input Prices, Price risk)

Total Production = Acres*Yield

Marketing Margin

Farm Wholesale Level

Marginfw = F(Quantity, Wholesale prices, index of costs, concentration ratio, price risk and technological changes)

Wholesale Retail Level

Marginwr = F(Quantity, Retail price of dry beans, index of costs, concentration ratio and technological changes)

Domestic Demand for Dry Beans

Demand for dry beans = F(Price of dry beans, Price of substitutes, Population, Tastes and preferences, total population, % of Hispanic Population)

Demand for Exports

Demand for exports = F(Price of dry deans in U.S., Price of dry beans in other importing countries, Exchange rates, Production in Importing countries, population, tariff rates)

Storage Demand

Storage demand = f(wholesale price, expected price, interest rate, storage costs)

Overall Industry

Total Demand = Total Supply

Domestic Demand + Export Demand + Demand for Food Aid + Storage = Total Production + Imports

* The model was refined as the study progressed

Table 1: Key driving forces

Driving Forces	How have these trends played out in the past?	How are these trends likely to play out in the future?
Increase in Hispanic Population	Hispanic population increased by about 140 % during the period 1980-2000	Hispanic population likely to increase by 30% over 2000 – 2010
Consumption of ethnic foods	There has been an increase in the consumption of ethnic foods	
Consumer preferences	Increase in the market of processed/canned beans versus bagged beans	***Demand increases along the same trend***
		Upward shift in demand as a result of publicizing the health benefits
		Transformation in Demand due to quality consciousness of the consumer
Food Safety Concerns	Move towards canner specific standards and specification requirements	Continued use of canner specific requirements.
Increasing Consolidation at the canner and elevator level	Major processors in U.S. and U.K. have declined to one or two The number of elevators in Michigan declined from about 9 to 2-3 elevators accounting for 80% of the market share	Further consolidation at the elevator level
Strength of the dollar	Dollar appreciated against all major trading partners since 1995.	Continued appreciation of the dollar
NAFTA	Increasing access to the Mexico market.	Increasing access to the Mexico market, though increasing competition from Canada after 2008
	Increase in dry bean production in Canada which has led to increase in the boarder trade to U.S. and an erosion of the U.S. export market	Continuation of the same trend though limited by the expansion of dry beans in the U.S.
Globalization	Increasing competition from Argentina, China and prarie provinces Canada in the recent years	***Competitiveness of U.S. in face of increasing globalization is uncertain***

Table 1 (Continued)

Competing crop – Soybean	Soybean has been a strong competitor for dry bean acres	Soybean continues to be a strong competitor for dry bean acres in price and convenience
Regional differences in the cost of production	Movement towards production in low cost producing region, specifically Minn-Dak and Canada	Further expansion of production in the low cost producing regions – specifically Manitoba, Saskatchewan and Alberta
Research for plant market-classes	Research for plant market-classes has had limited success in Canada	***Success of plant varieties in Canada***
Climatic Changes	Favorable climatic conditions for dry bean production in the upper mid-west and prarie Canada region	Future climatic changes likely to favor dry bean production in the upper midwest and prarie Canada region
Food Aid		

Note: i) The analysis was further developed with data from other secondary sources of information such as extension bulletins, government publications and other research reports.
ii) The factors for which the future trend is uncertain are highlighted in the table

Key Uncertain Issues for the future

1. ***Demand Shift***: Current demand for dry beans in the U.S. is about 1 million MT. Average per capita consumption in the 1980s was 6.04 pounds, which increased to 7.4 pounds in the 1990s. Per capita consumption in 2000-2002 also averages 7.4 pounds (Figure 1). Figure 2 shows the per capita consumption of the different market-classes of dry beans.

It is believed that the increase in per capita consumption of dry beans in the U.S. is a consequence of the increase in Hispanic population. Preliminary analysis on impact of Hispanic population on the dry bean consumption reveals that the increase in the 1980s is likely due to the increase in Hispanic population. However, the increase in demand in the 1990s is attributed to the overall increase in ethnic food consumption in the U.S. Figure 1 shows that though the Hispanic population has continued to increase in the 1990s, the per capita consumption has leveled off at around 7.4 pounds per person. Thus, overall the increase of 1.3 pounds in per capita consumption in 1990s is largely attributed to increasing consumption of ethnic foods in the U.S.

Figure 1

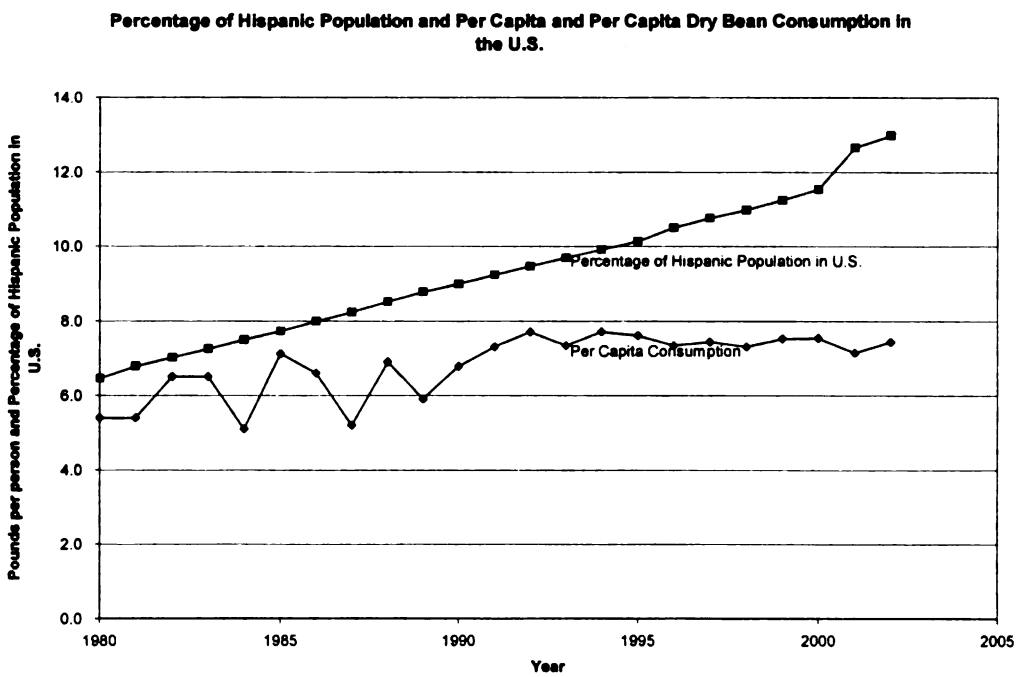
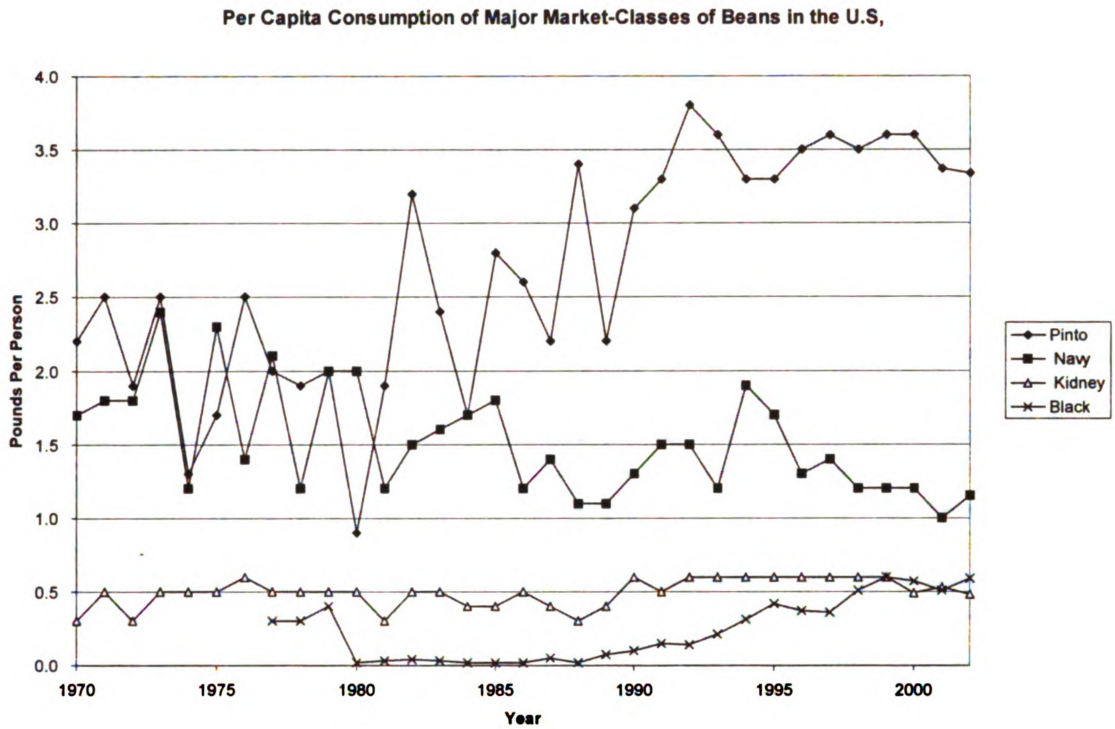


Figure 2



For scenario analysis of the industry, it is important to get some insights into the future demand for dry beans. One of the important factors affecting future demand is the increasing health consciousness of the consumers. Increasing health consciousness along with the ongoing industry effort to publicize the health effects of dry beans has the potential to increase future demand for dry beans. To what extent are these efforts likely to increase the demand for beans? Please give an estimate of the future per capita demand of dry beans for different market classes.

Table 1: Per Capita Consumption of Dry Beans by Market-Class

	Average consumption of dry beans			
	1980-1989	1990-1999	2000-2002	***2004-2013***
All dry beans	6.1	7.4	7.4	
Pinto Beans	2.3	3.5	3.4	
Navy Beans	1.5	1.4	1.1	
Kidney Beans	0.4	0.6	0.5	
Black Beans	0.03	0.32	0.56	

*2. **Demand Transformation**:* Another aspect of the future change in demand is demand transformation. That is, increasing quality consciousness of the consumers will lead to an increase demand for upscale and trendy dry bean products. This increase in demand for quality beans will probably lead to a niche demand for quality dry beans. To what extent is there likely to be a niche demand for different market-classes? That is, what percentage of production is likely to be sold in the niche markets? Please give an estimate for your answer.

	Average Production 2000-2002(Mn CWT)	***% of Production for Niche Market over the period 2003 to - 2012***
Pinto Beans	10,800	
Black Beans	1,750	
Kidney Beans	1,750	
Navy Beans	4,100	

*3. **Increase in dry bean production in Canada***: Dry bean production in Canada has increased significantly in the 1990s because of increasing production in Manitoba. Also, there are ongoing research efforts to develop plant varieties to increase the dry bean production in Saskatchewan. With the success of the ongoing efforts, to what extent is the dry bean production in Canada likely to increase? Please give an estimate for your answer.

Table 3: Canada: Dry Bean Production

Year	Harvested Area ('000 Acres)	Production ('000 tonnes)
1991	222	136
1992	158	73
1993	200	131
1994	198	171
1995	260	203
1996	208	133
1997	222	164
1998	237	189
1999	381	294
2000	400	268
2001	432	255
2002	541	414
2003	371	270
Average	**294**	**207**

Table 4: Dry Bean Production by Region ('000 Tonnes)

	1998	1999	2000	2001	2002
Manitoba	72	122	147	160	231
Ontario	57	106	56	57	126
Alberta	46	43	44	60	32
Quebec	10	14	14	12	18
Saskatchewan	4	9	7	3	n/a
Total	189	294	268	292	407

Table 5: Production by Market-Class ('000) Tonnes

	1998	1999	2000	2001	2002	***Dry Bean Production by 2013***
Navy	65 (35%)	143 (48%)	110 (41%)	115 (39%)	202 (50%)	
Pinto	38 (20%)	42 (14%)	60 (22%)	68 (23%)	66 (16%)	
Black	18 (9%)	22 (8%)	18 (15%)	24 (8%)	47 (12%)	
Kidney	17 (8%)	21 (8%)	18 (15%)	18 (8%)	26 (6%)	
Other	51 (26%)	66 (22%)	62 (23%)	67 (23%)	66 (16%)	
Total	189	294	268	292	407	

4. Impact of Globalization *

There have been significant changes in the dry bean trade from the U.S. over the past decade. Exports of beans are declining, as the U.S. loses market-share to Canada. On the other hand, imports of beans into the U.S. are increasing. These changes in trade for all the major market classes are shown below. In future, with increasing globalization, the trade in dry beans can change significantly from the current trends. To what extent is the trade likely be different from the current trends? In the space provided below the graphs, please provide an estimate for different market-classes.

*Notes regarding collecting data on exports and imports: i) The break in time period was to see the impact of the change in trade when Mexico eliminates all tariffs on dry beans in 2008. However, discussions with the group revealed that increase in competition from Canada after 2008 will likely be offset by increase in imports from Mexico. Thus, the estimates are for a continuous trend over the period 2004-2013.
ii) The analysis requires aggregate data on dry bean exports and imports. However, it was easier for the scenario team to provide input for each market-class individually. Hence the data was collected by market-class and then aggregated for the analysis.

Figure 3

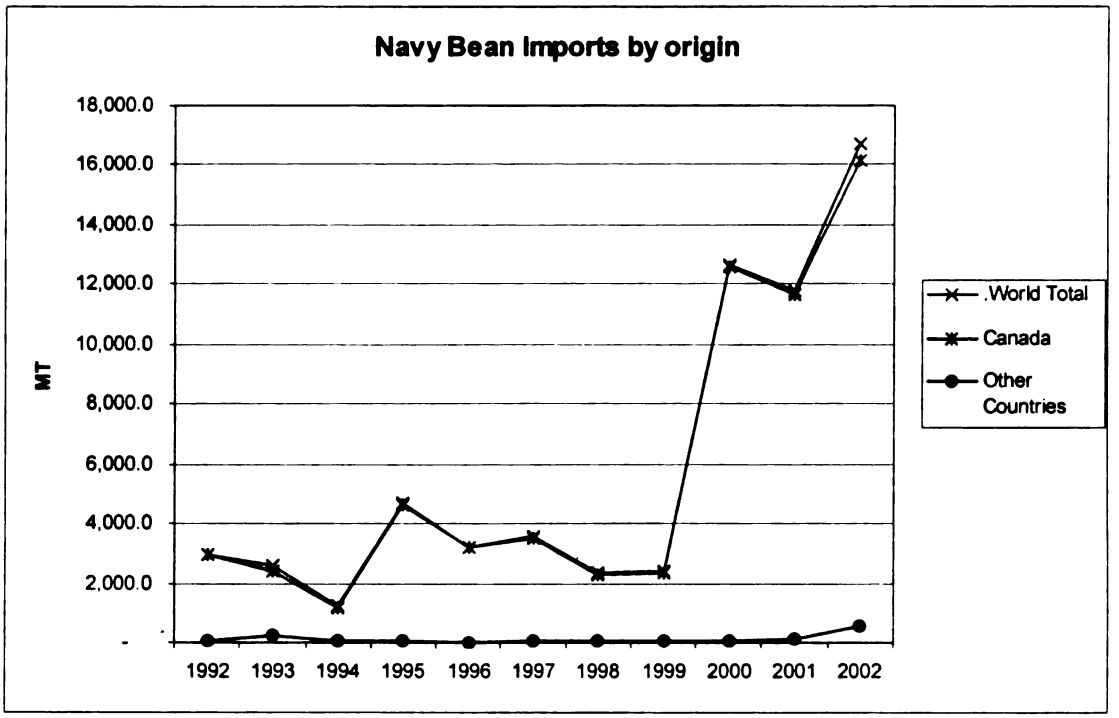
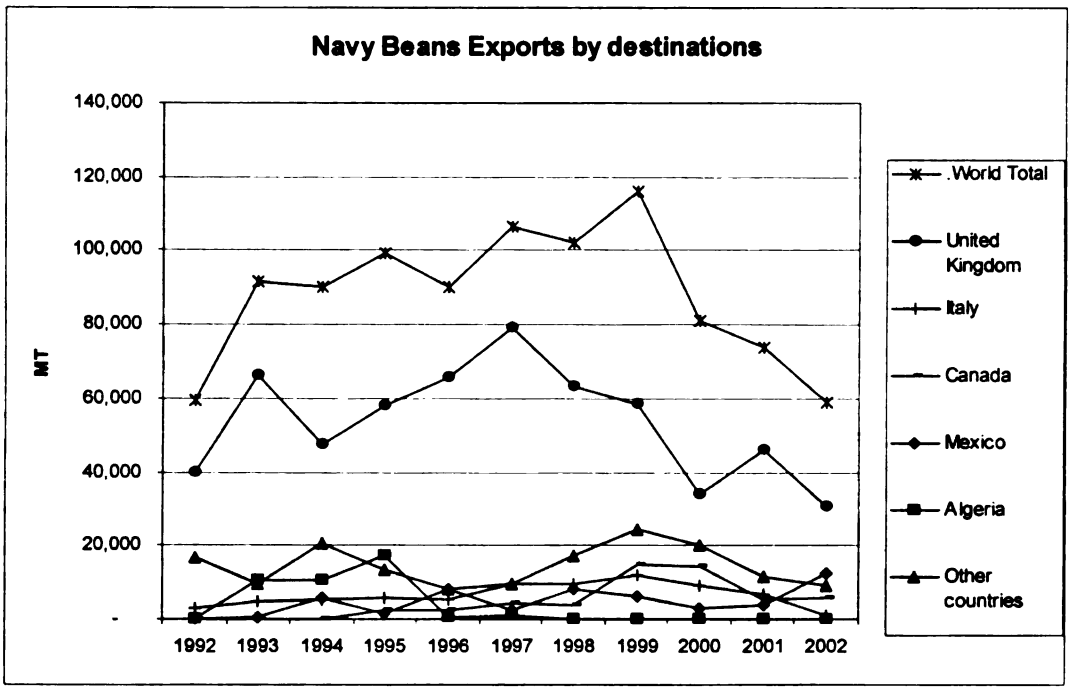


Figure 4



Navy Bean Exports by 2008: _____MT; and by 2013: _____MT

Navy Bean Imports by 2008 _____ MT; and by 2013:_____ MT

Figure 6

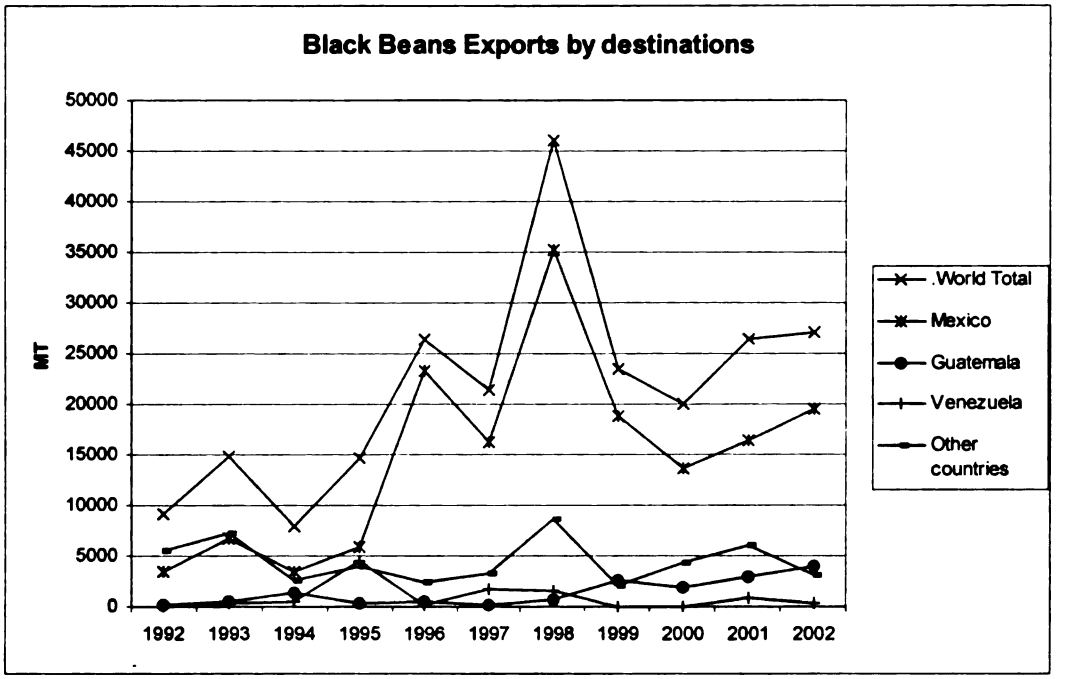
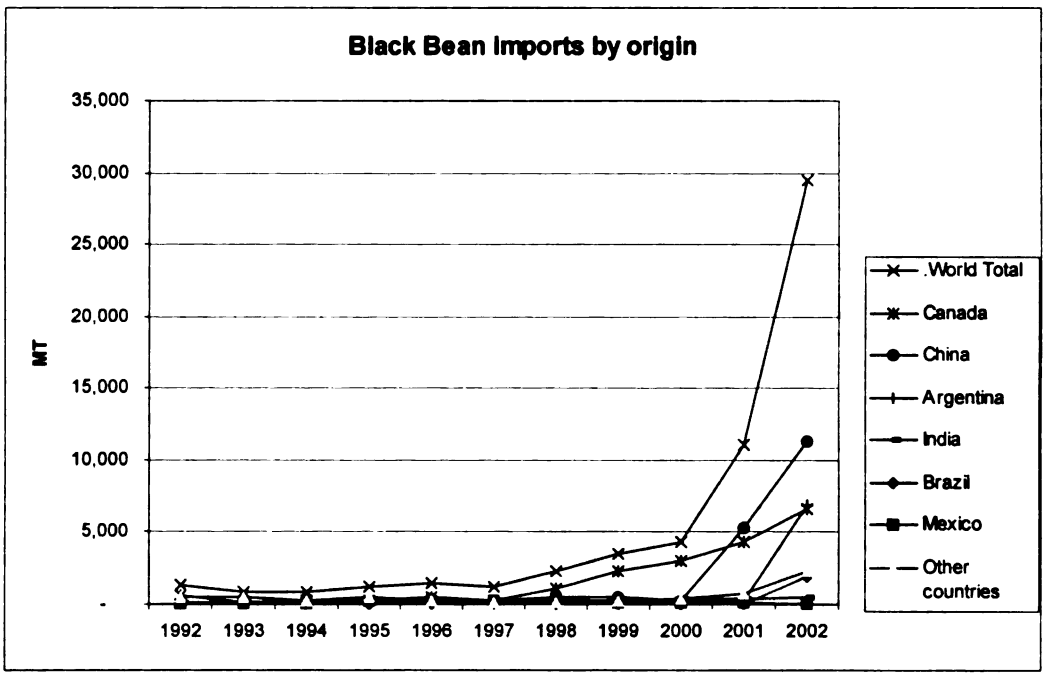


Figure 7



Black Bean Exports by 2008: _____MT and by 2013 _____ MT

Black Bean Imports by 2008: _____MT and by 2013_____ MT

Figure 8

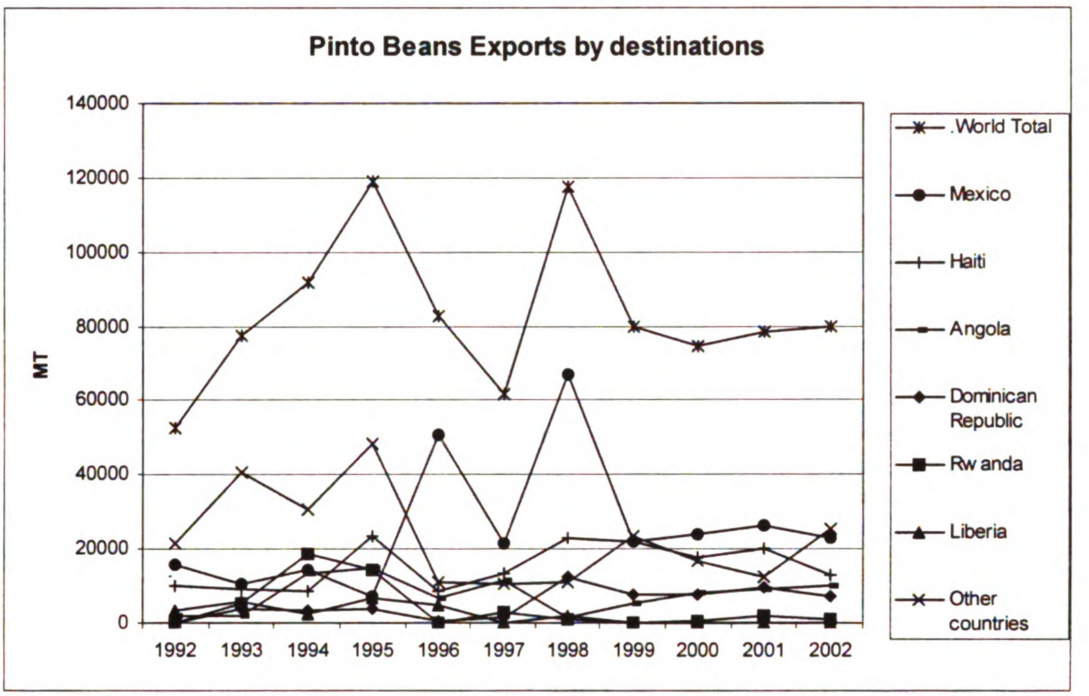
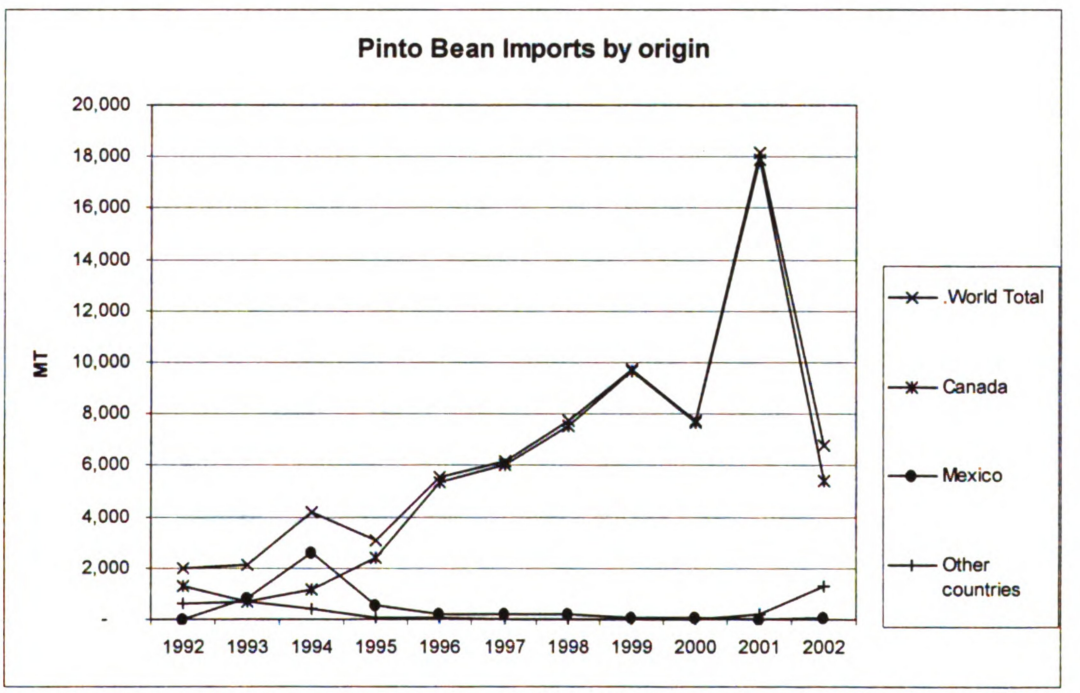


Figure 9



Pinto Bean Exports by 2008 _____MT and by 2013 : _____MT

Pinto Bean Imports by 2008 _____MT and by 2013: _____MT

Figure 10

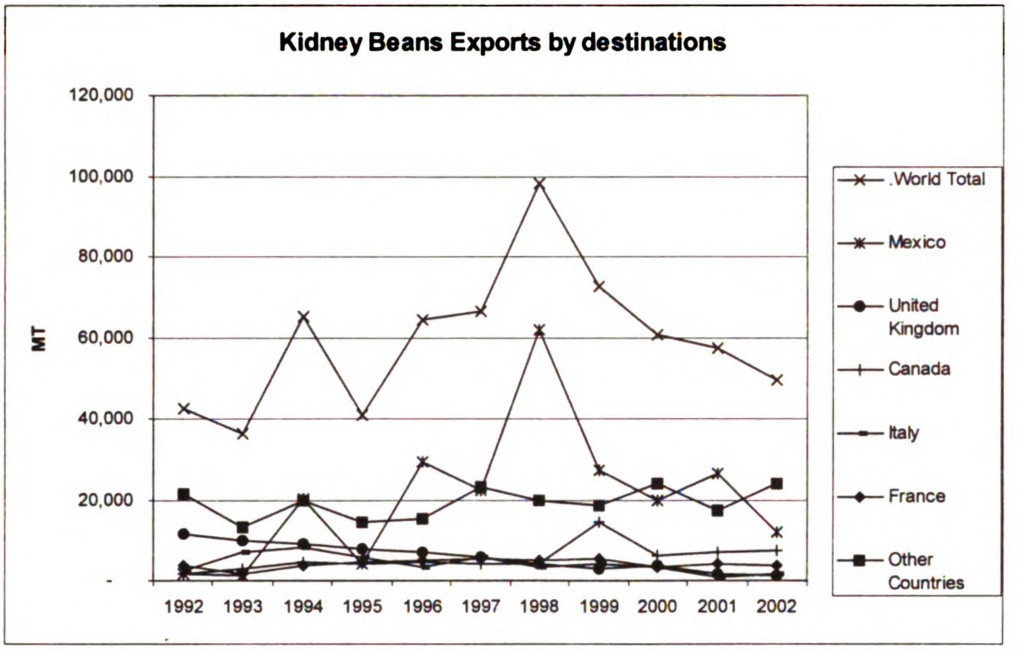
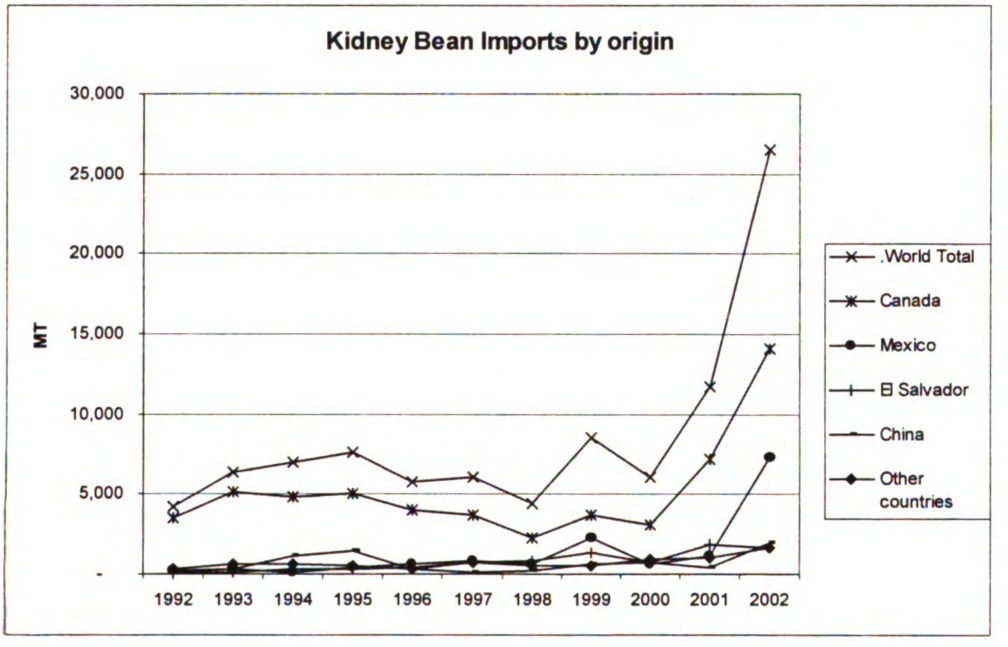


Figure 11



Kidney Bean Exports by 2008: _____ MT and by 2013: _____MT

Kidney Bean Imports by 2008: _____MT and by 2013: _____ MT

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