Tools and Techniques for Managing Risk for Virginia Grain and Oilseed Producers

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TOOLS AND AIDS FOR THE DEVELOPMENT AND ADOPTION OF WRITTEN MARKETING PLANS FOR VIRGINIA SOYBEAN AND GRAIN PRODUCERS

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(ABSTRACT)

Two very important benchmarks in the development of a marketing strategy are the variable and fixed costs of production. Every farmer has costs of production that are unique to their particular farm. Accurately identifying the costs of production or break even costs for the various crop enterprises is important. Also important is the analysis of revenues and costs across the spectrum of various acreage allocations, yields, and market prices. A computer program in an EXCEL spreadsheet format has been developed to facilitate the identification of the costs of production and the financial impact of various yields, market prices and acreage allocations.

A second concern in the development of a marketing plan is the determination of reasonable price expectations given historical prices and current supply and demand estimates. Two devices used to analyze the situation today in a historical context are historical futures price distributions and the relationship between ending stocks versus season average price. Marrying these two devices together creates historic price distributions conditioned on estimated ending stocks. The conditional price distributions are significantly different from one another.

Producer attitudes and concerns in the area of pricing plans and price risk management are of interest to researchers and extension educators. A survey of Virginia grain and soybean producers explores pricing behavior, adoption of written pricing plans, attitudes towards risk management and risk management tools, and impediments to employing and executing a written marketing plan.

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CHAPTER ONE

INTRODUCTION

Introduction

The modern independent farmer often functions as a one man corporation. While other businesses might have multiple people and departments to handle the various aspects of the business, individual farmers are typically responsible for many or all of the various business aspects. They are responsible for a wide variety of tasks including: the production of the product (crop, livestock, vegetables, etc.), marketing the product, the maintenance of the facilities and equipment, compliance with local, state and federal regulations, stewardship of the land, the financial records and management, and probably several other tasks not to mention personal responsibilities. It is a very time intensive occupation that requires different sets of skills for each of the responsibilities mentioned above.

The number and variety of tasks that producers are responsible for performing require large amounts of information to be processed in order for the producer to make informed decisions. Tools and aids that can condense the available information into a simple and straightforward form will enable the producer to perform their tasks more quickly and efficiently. The aids and tools that are described in this thesis were constructed with the producer in mind as the end user. With helpfulness to producers as the primary goal, the development of the tools considered statistical significance while maintaining simplicity and ease of use.

This thesis will deal primarily with the marketing and financial record keeping responsibilities. It is not a traditional thesis in terms of the structure of this project and paper. This thesis is a combination of three separate but related projects that all fall under the same general heading of tools and aids for the development of marketing plans for Virginia soybean and grain producers. Each of the next three chapters represents a separate project. Those chapters will contain the literature review pertinent to that chapter and will be self contained units. The first and last chapters provide an overview of the general area of risk management and marketing plans and how these three projects fit into that general area.

Risk

Farming is an inherently risky business enterprise and as such, effective risk management becomes a very important aspect of operating a successful farm business today. For crop farmers, the nature of the business requires resources to be committed during the planting phase which effectively sinks some percentage of total costs. Returns are generally unknown until harvest some five to seven months after planting. Much can happen during this interim period between planting and harvest that can greatly affect the returns. At the time of planting, both the growing conditions and the market conditions for the upcoming season are uncertain. This uncertainty is generally known as risk. Risk can be defined as "uncertainty that affects an individual's welfare, and is often associated with adversity and loss." (Managing Risk in Farming: Concepts, Research and Analysis)

In 1996 with the passage of the FAIR (Federal Agricultural Improvement and Reform) Act the U.S. Agricultural policy landscape changed dramatically for the major grain and oilseed crops. The FAIR Act reduced the level of government intervention in the markets meaning farmers will face more risk than in the pre-FAIR days. Because of the increased risk present in this post-FAIR environment, it is more important than ever that farmers be aware of the risks and the tools available to manage the risk. The chapters that follow explore farmers attitudes towards risk, marketing plans, and tools for the management of price risk.

Types of Risk

There are many types of risk that the farmer faces every day that will directly affect the financial wellbeing of the farm and by extension, the welfare of the farmer and his family. One type of risk, institutional risk, is concerned with changes in governmental policies and regulations relating to agriculture. The FAIR act mentioned above is a prime example of institutional risk. The two risks that are of the most concern to grain and crop producers are price risk and yield risk according to a 1996 Agricultural Resource Management Study (ARMS) conducted by the USDA. Price and yield risks arise from the stochastic behavior of commodity prices and yields over time. The stochastic behavior can be thought of as price and yield uncertainty and it is this uncertainty that is considered risk. Figures 1.1 through 1.4 illustrate the variability in prices and yields for corn and soybeans from 1980 to 1997.

Figure 1.1 King William Corn Yield 1965-1996

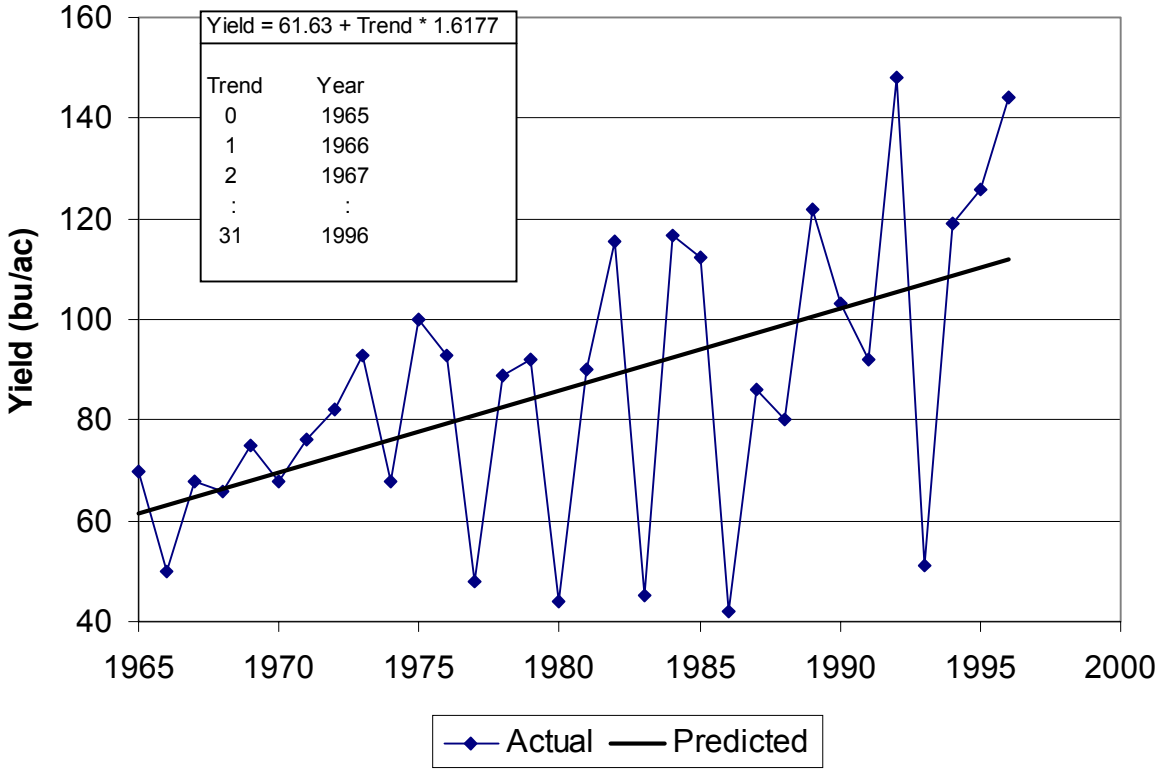


Figure 1.2 King William Soybean Yield 1965-1996

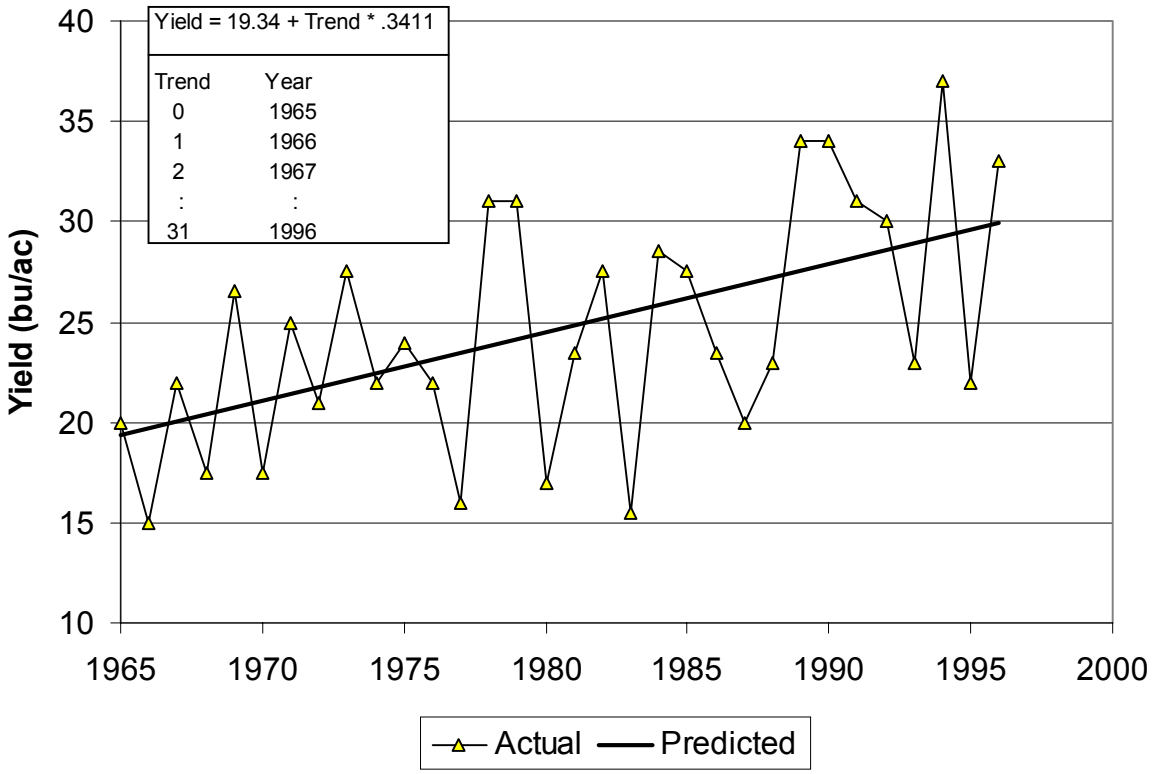


Figure 1.3 CBOT Near Month Corn Futures Prices 1990-2001

Figure 1.4 CBOT Near Month Soybean Futures Prices 1990-2001

In the spring, the farmer makes planting decisions and commits his acreage into various crop enterprises. Once this decision has occurred, the farmer has committed some of the variable costs of production as well as the fixed costs. Total costs are fairly well established at this point while the total returns are unknown and subject to variation. Total returns or revenue is the product of price and yield. Since both price and yield are uncertain at planting and throughout much of the production season, total revenue is also uncertain. This revenue uncertainty is due to price and yield variability resulting in possible outcomes for the farmer that vary from very profitable seasons to those of heavy debt acquisition. The farmer has tools available to manage price and yield risk and he does have the ability to a certain extent to control where his revenue will fall along the profit - debt continuum. The farmer's marketing skills help determine the price

received for a crop while his production skills will help to determine yield. The two combined determine revenue.

Research Objectives

There are three general objectives that are the object of this research with the goal of providing Virginia grain and oilseed producers tools and aids that assist in the development of grain marketing plans. The first objective is to develop a computerized spreadsheet program that will allow the user to evaluate the impact of various price, yield and acreage allocation combinations or scenarios on gross farm returns. The spreadsheet that was developed uses the costs of production budgets for grains and oilseeds grown in the grain region of Virginia (corn, wheat, soybeans, cotton, barley, sorghum, and peanuts). The program is called the "Break-Even Cost Program for Virginia Soybean and Grain Producers" and is discussed in detail in chapter two. The program is flexible so that each user can tailor the cost of production budgets to reflect the expenses incurred on any particular farm. The costs of production (both fixed and variable) for the various crop enterprises are very important benchmarks for pricing strategies. The producer must cover the variable costs of production every year and both the fixed and variable costs of production over the long run in order to remain in business.

The cost of production benchmarks take on added significance in the post FAIR Act era. The government has eliminated its target pricing program for wheat, corn and cotton which means that the price support safety net for producers has been dramatically lowered. There is still a price support at the loan rate. In 1995, the last year before the FAIR Act was passed, the target price for corn was $2.75 per bushel and the loan rate was $1.89. The December corn futures price has been trading below the 1995 target price level for contract years 1998 and 1999. Farmers that had been enrolled in the target price support programs are experiencing the additional price risk in the new regime of lower levels of government involvement in grains.

The second objective of this research involves developing tools that allow producers to form pricing expectations. Two different techniques are explored with one technique examining conditional distributions of historic futures prices and the other the development of a statistical model of futures prices. Just as the break-even cost program helps to establish a set of benchmark prices that correspond with marketing goals, the second part allows producers to assess the probability of the market offering prices that match the benchmarks that they have developed by using historical supply and demand data and historical futures prices for corn and

soybeans. Two approaches are explored that seek to enable the producer to assess the likelihood of the market offering a particular price. Viewed a different way, these tools suggest a range of prices likely to be offered by the market given the information set today.

Approach one uses histograms to graphically represent the distribution of harvest time futures prices based only on historical price data. Conditioning on various factors such as ending stocks, time to harvest, last years harvest, etc. allow histograms to be constructed that reflect the information set available today. This technique allows the producer to examine the prices offered when conditions in the past are similar to current conditions. The second approach involves the development of a statistical model that explains the variation in harvest time futures prices for corn and soybeans. The coefficients of the independent variables (ending stocks, time to harvest, last years harvest, etc) provide estimates of how much futures prices will change when the independent variables change. Both approaches use the same data set and are alternative ways of viewing the same problem, namely: "What are the odds that the market will offer me 'x' dollars a bushel or better?"

The third objective of this research is to examine factors relating to the use of written marketing plans. A survey of producer attitudes and concerns in the area of developing pricing plans and price risk management strategies was conducted. The survey participants are Virginia soybean and grain producers. The survey explores pricing behavior, the adoption of written marketing plans, and attitudes towards risk management and risk management tools. A secondary objective of the survey is to identify those areas of marketing that are of the greatest concern to producers. By learning the attitudes and opinions of producers, educational programs can be developed to address the areas that are of the greatest concern. The survey is also used as a means of comparing and contrasting attitudes and concerns between Virginia and Midwestern producers.

CHAPTER TWO

Break-Even Costs Program for Virginia Soybean and Grain Producers

Introduction

This program has been developed to serve as an aid to Virginia grain, soybean, cotton and peanut producers in making well informed marketing decisions. The program allows a producer to quickly examine how total farm revenue and returns are affected by different possible price and yield outcomes. The user can project costs and revenues across a range of acreage allocations, yields, and market prices. Analyzing a variety of situations should facilitate the development of a marketing strategy by illustrating best case, worst case and most likely scenarios and how the bottom line (profit/loss) for the whole farm is affected in each case.

The program is designed around costs of production. An accurate estimate of the total cost of production for the whole farm and each crop is needed to provide a benchmark so that an appropriate marketing plan can be developed. Costs are limited to cash operating expenses (both variable and fixed). Costs for depreciation expenses on equipment, buildings, etc., or the opportunity costs of equity capital or labor are not included. Knowledge of the total cost of production for each crop is an essential benchmark value in a marketing plan because in the long run, average market price must cover the average cost of production to remain in business.

The variable costs of production are generally very well known for the various crops. There are fixed costs associated with owning and operating a farm that are not easily attributed to any specific crop. A percentage of the fixed costs must be assigned to each crop. How this percentage is determined is discussed in a later section. The sum of the fixed and variable costs is the total cost of production for that crop. The total cost of production divided by the acreage and yield determines the price necessary to cover variable costs, fixed costs, debt and family living expenses.

Main Menu

The worksheet entitled "Main Menu" is the primary page for analyzing scenarios. The gray cells may be changed by the user but the rest of the cells are protected to prevent formulas used in various computations from being changed. The scenario is created in the top box by entering acreage, yield, and price for some combination of enterprises. This program includes most of the major grain and oilseed crops that are produced in Eastern and Southeastern Virginia; corn, soybeans (full season and double-cropped), wheat, barley, sorghum, cotton and peanuts. The program does not include any livestock enterprises. The program computes the costs, revenue, breakeven price and profit for the entire farm and by individual enterprise. The 'acres in production' column can be used to explore farm profit from various acreage allocations. The 'acres in production' column can also be used to help identify those crops which are more profitable at current market prices.

Varying the yield in the second column helps to determine the financial impact of yield risk. An accompanying EXCEL file called 'Yield Variability in Eastern and Southeastern Virginia' shows county average yields from 1965-1997 for corn, wheat, and soybeans and 1990-1997 cotton yields. This file shows the yield variability that is encountered by Virginia producers. For example, a corn producer in Southampton County might expect an average yield of 110 bushels per acre. A better than average yield may be 120 bushels per acre while a below average yield may be 75 bushels per acre. The program quickly computes the impact of these yields on the breakeven price of corn and on total farm profits.

The third column 'expected net price' allows the examination of price risk. The value entered in this column should reflect the current expected net price after adjusting for local basis and grade premiums and discounts. Another EXCEL file called 'Historical Futures Price Distributions' contains futures price data for corn, wheat, soybeans, and cotton since 1980. The historical price distribution indicates the probabilities that futures prices will be within certain price ranges.

Enterprise Budgets

There are eight different crop enterprises included in this program. Each enterprise has its own worksheet. The enterprise budgets were developed by Extension and Farm Management

Agents in conjunction with the Virginia Cooperative Extension Service. The budgets represent a "typical" or "average" production operation in 1997. Producers are strongly encouraged to modify these budgets to give a more accurate representation of their particular operation. Clicking the tab at the bottom of the screen accesses the worksheet. Each budget has two columns entitled "price" and "quantity" that are colored gray. These gray cells are initially set for the "typical" farm but may be changed to reflect the actual costs incurred by a particular operation. The price and quantity values that go into the gray cells determine the per-acre cost for the expense represented by that row. For example, the first expense listed is generally seed. One bag of seed corn may seed four acres and cost $80.00 per bag. This needs to be converted to a per-acre basis. The conversion is made by entering $80 in the price column and 0.25 in the quantity column. The third column of numbers is the cost/acre for that item. The last column represents the total cost for that item (seed) for the entire acreage planted in that crop. All the variable production costs are listed in the first column and any cost not explicitly stated should be entered as "other costs". The break-even price is computed in dollars per bushel or cents per pound depending on the crop. It is computed by calculating the total cost per acre and dividing by the expected yield per acre.

Each budget has a couple of rows for pre-harvest and harvest labor expenses. These expenses refer to hired labor and not owner labor. If no outside labor is hired, then there should be no entry in these rows. Owner labor is accounted for in the fixed expense section under 'Family Living' expenses. The enterprise budgets only take into account cash operating expenses. Interest expense assumes a loan term of 6 months since the operating loan is drawn upon in varying amounts throughout the production year.

Fixed Expenses

The fixed expense worksheet describes those expenses of owning a farm operation that are not related to the level of production in the short run. The fixed expenses are sunk regardless of the choice of enterprise or the level of production. These expenses are again cash operating expenses. Depreciation expense and opportunity costs of equity and labor are not included. If payments are made on a debt financed piece of land or machinery, then the amount of the annual payment should be entered in the appropriate row. If all land and equipment is owned and paid for, then a zero may be entered in that row.

Frequently, the fixed expenses such as machinery, buildings, family living, etc cannot be matched to any specific crop. Each crop must carry some percentage of the total fixed expenses.

The percentage of fixed expense that each crop must carry is determined by taking the total variable costs of each crop and dividing by the sum of the variable expenses across all crops. For example, if the variable costs of corn are $100,000 and the total variable costs for the farm (all crops) is $500,000 then corn is responsible for 20% of the fixed costs. This method of allocating the fixed costs was selected because the prices of the inputs tend to remain stable across time.

Alternative methods of allocating the fixed costs have some problems. One alternative is to allocate the fixed expense to a crop based on its contribution to gross revenue, but this method is very sensitive to changes in crop prices. The price level of the output varies a great deal both within a production year and even more across years. The ideal way to allocate the fixed costs is to record the hourly usage of machinery, labor, buildings, etc. for each crop. This method requires a large amount of record keeping and not many farmers have this data.

Cotton and peanuts each require specialized machinery that is specific to those crops. This specialized equipment expense is carried by the specific crop and not spread across the entire farm enterprise.

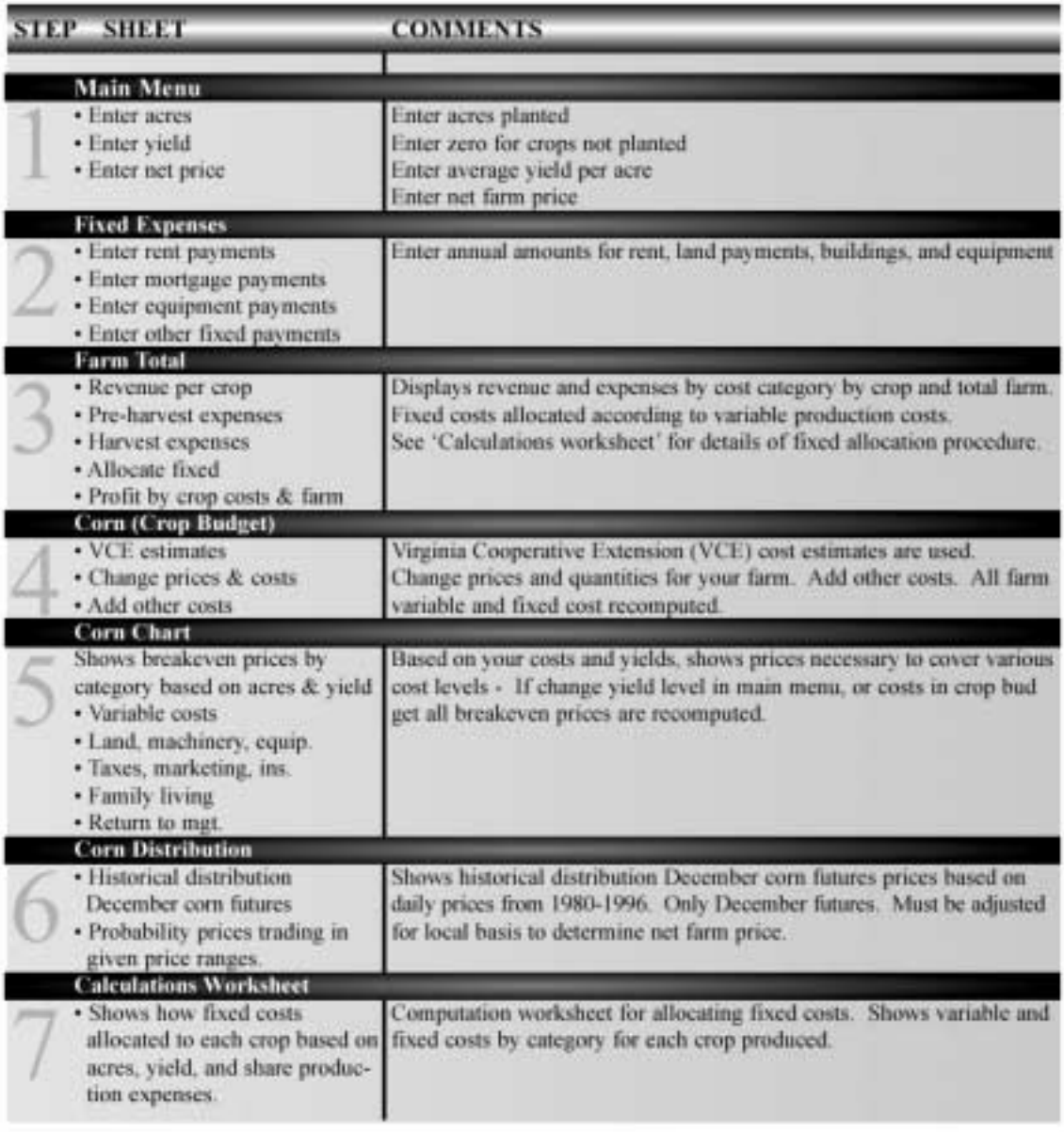
The 'Family Living Expense' row represents the farm's contribution to the household budget. If the yearly household expenses are $45,000 a year and off farm income is $20,000 a year, then the farm is expected to account for the remaining $25,000 a year.

Charts

Each crop enterprise has a chart that shows breakeven prices necessary to cover various levels of expense. The charts are accessed by clicking on the tabs along the bottom of the screen. It may be necessary to click on the arrow pointing right in the lower left corner of the screen to see the chart tabs. The first column in the chart shows the price necessary to cover the pre-harvest and harvest variable costs only. The second column shows the price necessary to cover the total variable costs as well as the fixed expenses for land, machinery, and building repairs. Column three includes the expenses from the first two columns plus taxes, marketing and insurance. Columns four and five include family living and return to management expenses respectively.

The flowchart in figure 2.1 highlights the different components included in the program. It also acts as a guide on how to use the program and offers a step by step guide through the various features of the program.

Figure 2.1 Flow Chart for the "Break-Even Cost Program"



STEP	SHEET	COMMENTS
	Main Menu	
1	• Enter acres • Enter yield • Enter net price	Enter acres planted Enter zero for crops not planted Enter average yield per acre Enter net farm price
	Fixed Expenses	
2	• Enter rent payments • Enter mortgage payments • Enter equipment payments • Enter other fixed payments	Enter annual amounts for rent, land payments, buildings, and equipment
	Farm Total	
3	• Revenue per crop • Pre-harvest expenses • Harvest expenses • Allocate fixed • Profit by crop costs & farm	Displays revenue and expenses by cost category by crop and total farm. Fixed costs allocated according to variable production costs. See 'Calculations worksheet' for details of fixed allocation procedure.
	Corn (Crop Budget)	
4	• VCE estimates • Change prices & costs • Add other costs	Virginia Cooperative Extension (VCE) cost estimates are used. Change prices and quantities for your farm. Add other costs. All farm variable and fixed cost recomputed.
	Corn Chart	
5	Shows breakeven prices by category based on acres & yield • Variable costs • Land, machinery, equip. • Taxes, marketing, ins. • Family living • Return to mgt.	Based on your costs and yields, shows prices necessary to cover various cost levels - If change yield level in main menu, or costs in crop bud get all breakeven prices are recomputed.
	Corn Distribution	
6	• Historical distribution December corn futures • Probability prices trading in given price ranges.	Shows historical distribution December corn futures prices based on daily prices from 1980-1996. Only December futures. Must be adjusted for local basis to determine net farm price.
	Calculations Worksheet	
7	• Shows how fixed costs allocated to each crop based on acres, yield, and share production expenses.	Computation worksheet for allocating fixed costs. Shows variable and fixed costs by category for each crop produced.

Summary

This program is meant to serve as a tool for Virginia producers for the development of an overall marketing plan. There are a number of steps involved in developing a marketing plan. Several of these steps are incorporated into the program but there are several that are not and require additional analysis. The first step is to decide on some pricing objectives for your particular farm. Examples of objectives may include pricing in the top third of historical prices, pricing when the market is covering costs, or perhaps marketing so the odds of getting a good price are on your side. A clearly defined pricing objective is important because the subsequent steps in developing

the marketing plan are concentrated on reaching that objective. The next step in the development of a marketing plan is identifying the costs of production. This program breaks down the cash operating expenses down into individual components. The individual components may then be adjusted from the 'typical farm' default settings to the actual expenses incurred on a particular farm. Once the user has adjusted the costs to represent his particular farm, then he may project those costs and returns across a range of acreage allocations, yields, and market prices. The probabilities of realizing a particular yield or market price can be assessed by examining some historical data in accompanying files. Assessing those probabilities represents another step in developing a marketing plan. The next step is to examine the market outlook from both a fundamental and technical perspective. The fundamentals should indicate a price range where the market should trade. The fundamental analysis along with your pricing objectives in mind should help to identify a target forward price level. Technical analysis may be used to help time the execution of the pricing plan. The last step is to have the discipline and resolve to stick with the plan in a volatile market.

CHAPTER THREE

Corn and Soybean Statistical Models and Histograms

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Introduction

Chapter 2 discusses the importance of identifying the costs of production or break even prices for various crop enterprises and provides the producer a tool for identifying the break even prices specifically for his farm operation. The break-even price is a very important benchmark in the development of pricing objectives. A producer may have multiple pricing objectives. Once a producer has pricing objectives, the next step is to assess the probability of the market offering a price that meets those objectives. The producer could benefit not only from knowing the probability of meeting a marketing objective but also knowing the likelihood of encountering financially adverse price conditions. Two approaches are considered in assessing the distribution of prices that are likely to be offered by the market. One approach involves the decomposition of the marginal distribution of futures prices into conditional distributions with conditioning on such variables as time to harvest, ending stocks and other related variables. This approach employs histograms as graphical tools that describe the different distributions. This method conveys a good deal of information with only a casual visual examination of the plots.

The other approach involves the development of a statistical pricing model. The statistical pricing model attempts to explain variations in harvest time futures prices for corn and soybeans. The coefficients of the independent variables (ending stocks, time to harvest, the previous years harvest, production of substitutes, etc.) will provide estimates of how much the futures price might change when an independent variable changes. Good estimates of the coefficients can be useful in analyzing various scenarios.

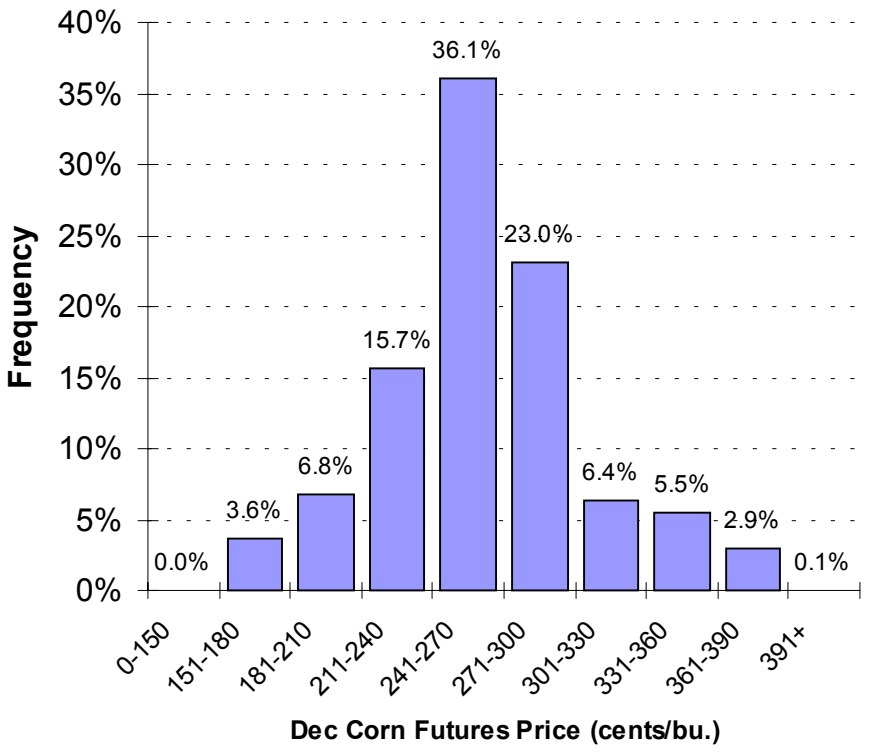
Literature Review

New research doesn't begin in a vacuum. It extends from and builds upon previous research. Several pieces of research act as the primary points of departure for this research. One is the publication Historical Futures Price Distributions for Corn, Soybeans, Wheat, Cotton, Soybean Meal, Feeder Cattle, Live Cattle, and Hogs by Amanda Wilson and David

Kenyon. Wilson and Kenyon collected daily closing futures prices for December corn and November soybeans for each trading day for the contract years 1980 to 1996. The information is presented graphically in the form of a histogram with a set of price ranges along the X axis and the frequency of the closing price falling in a particular range measured along the Y axis. The historical futures price distributions for corn and soybeans provide some useful but limited information on the likelihood of certain prices being offered by the market. Figure 3.1 shows the histogram of December corn futures and the analogous November soybean futures histogram is in the appendix.

The distributions of Wilson and Kenyon are useful for answering some questions but not others. For example, suppose a farmer is producing corn and his costs of production are $2.45 a bushel. The Wilson and Kenyon distribution might suggest that over the next 10 years, the futures market will offer this farmer a price of $2.45 or better 66% of the time. If this farmer wants to know the likelihood of making $2.45 or better for the corn crop he is producing in 1999, then the Wilson and Kenyon distribution is ill equipped to deal with this question. The distribution needs to be broken down or decomposed in order to extract more information.

Figure 3.1 Price Distribution of December Corn Futures 1980 - 1997



The sixteen year time span that makes up the Wilson and Kenyon futures price distributions covers a wide range of economic conditions. In any given year, however, those economic conditions assume specific values. A different set of distributions is needed that takes into account the various values that the economic conditions might take. The research presented in this chapter builds upon the previous research in this regard.

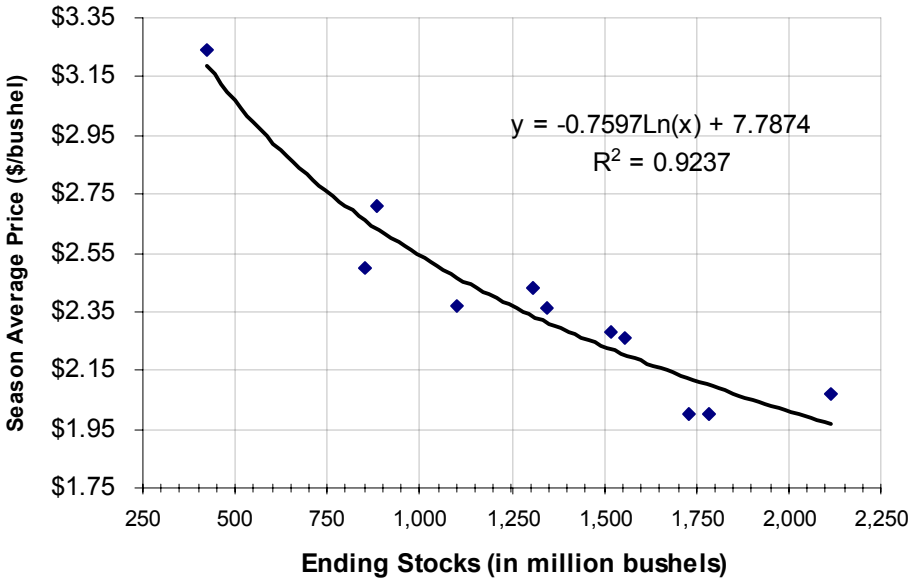
O'Brian, Hayenga, and Babcock (1996) developed a method of providing price probability distribution estimates rather than point estimates. They estimated an annual model of harvest time corn futures prices using OLS. Then, using the variance covariance matrix of the independent variables, they use monte carlo simulation to generate an estimated probability distribution. The distribution that they generate reflects the harvest time average futures price of corn. The variance covariance matrix that O'Brian, Hayenga, and Babcock generate provides an estimation or approximation of the joint distribution between the dependent and independent variables which allows conditional distributions to be generated. It is the conditional distribution that is of interest to a producer faced with marketing the crop that is currently in production. The current economic conditions need to be taken into consideration. O'Brian, Hayenga, and Babcock do take the current information set into account (production, use and export estimates), but their method of generating distributions is somewhat complex and may be too complicated for use in extension marketing programs for producers.

The current research builds upon the models developed in the Corn Pricing Guide and the Soybean Pricing Guide by Kenyon and Lucas. In each of these, a price forecasting model is constructed with the season average price as the dependent variable and ending stocks as the independent variable. These simple models serve as points of departure for the futures price explanatory statistical model presented in this chapter. The Kenyon and Lucas models use only one set of observations or data points for each year. The dependent variable (season average price) is composed of farm level prices collected by the National Agricultural Statistics Service from locations around the country throughout the marketing year, so it is an average price weighted by both location and time. The independent variable represents the final revised estimate of ending stocks for the given marketing year as reported in the *World Agricultural Supply and Demand Estimates* (WASDE) published monthly by the USDA. The WASDE report estimates ending stocks for the current marketing

year every month beginning 7 to 8 months before harvest. In contrast to the WASDE monthly estimates, the futures markets offer prices for corn and soybeans on a daily basis.

One shortcoming of the models presented in the pricing guide is the use of only one set of observations per year. The season average price is composed of many observations collected throughout the year. Each of those price observations is a function of fundamental supply and demand factors as well as expected values of those fundamental supply and demand factors. The fundamental supply and demand factors include: beginning stocks, production, imports, domestic use, exports, and ending stocks. The models in the pricing guides do a good job in explaining the variation in season average prices across years for corn and soybeans. Figure 3.2 shows the log linear regression of ending stocks on the season average price accounting for approximately 92% of the variation in the season average price of corn.

Figure 3.2 Scatter-Plot of Season Average Price *vs.* Ending Stocks
Corn 1989-1999



USDA's Economic Research Service recently published a report entitled Price Determination for Corn and Wheat: The Role of Market Factors and Government Programs. In this report, Westcott and Huffman develop an annual model for corn and wheat prices for the 1975 to 1996 period. Their model builds upon the basic inverse log relationship between price and stocks used by Kenyon and Lucas by adding variables to capture the effects of government programs during the 1975-1996 period. Westcott and Huffman used a dummy

variable to represent the 1978 to 1985 period when the loan rate was high and a variable that represents government owned stocks. Both of these variables had a positive effect on price.

There is a sizable body of literature that examines the forecast accuracy of futures prices. Kenyon, Jones and McGuirk (1993) showed that November soybean and December corn futures prices are poor predictors of harvest prices when the forecast horizon is greater than one or two months. When the forecasting horizon is around six months extending from spring planting to harvest, the accuracy of the futures price as a forecast of harvest price is very poor. Just and Rausser (1981) conducted a similar study which compared and analyzed the forecasts of commercial consulting firms against futures prices as forecasts. These firms used large-scale econometric models to generate their forecasts , but they generally performed just as poorly as the futures prices as forecasts. Kenyon also conducted a study of producer ability to forecast harvest corn and soybean prices. The producers fared no better at forecasting harvest prices in the spring than the futures prices or the econometric models. Basically, *a priori* there is no accurate means of predicting the harvest price of corn or soybeans.

There is a sizable body of research on hedging strategies and optimal hedge ratios. Although the research presented here does not offer any specific hedging strategy, examination of these hedging strategies help identify what others consider key price determinants. Wisner, Blue and Baldwin (1997) contend that the market behaves differently in years following a short crop compared with a year following a normal crop. A short crop is defined as one in which the current year's production is less that the previous year's total utilization. Different hedging strategies are recommended depending on the classification of the previous year as normal or short. Beckman and Kenyon present a similar type of opportunity driven hedging strategy. They developed a hedging strategy in which three years of production is hedged when trigger prices based on historic price distributions are reached.

Lence, Kimmle and Hayenga have shown that mean net returns are not very sensitive to changes in the hedge ratio when a fixed hedging strategy is employed every year but that the variance of the net returns can be decreased. Opportunities to increase net returns sometimes do present themselves. Wisner, *et al.* and Beckman and Kenyon have shown, however, that it is important to know where the market is in a fundamental and

historical context because these opportunities do sometimes become available. It is important to be able to recognize these opportunities and take advantage of them when they present themselves.

Data for the Statistical Models and Histograms

There are six sets of futures price data that are examined in this chapter. All of the sets are time series. The futures price, like most prices, is the market mechanism that adjusts to bring supply and demand towards equilibrium. The December corn and November soybean futures contracts are examined because these contracts are the ones most often used in forward pricing and risk management strategies by corn and soybean producers. These contracts begin trading a full 2 years or more before contract expiration and the daily closing price is collected for both of these harvest contracts. Four of the six sets of data are daily price series that consists of daily futures closing prices of the harvest contracts for corn and soybeans, two sets for corn and two for soybeans. The two series for corn are divided by the time to harvest. Prices from before the release of the May WASDE are labeled as **Daily Old Crop** and prices on and after the May WASDE are labeled as **Daily WASDE** for both corn and for soybeans.

The other two time series are monthly averages of the Daily WASDE time series for corn and soybeans, though calendar months are straddled. The averaging begins with the closing price on the day a report is issued and ends with the closing price the day before the next report is issued or the contract expires. These two data sets are labeled **Monthly Corn** and **Monthly Soybeans**. The USDA publishes the *World Agricultural Supply and Demand Estimates* (WASDE) report approximately once a month. The first estimates for the new crop are published in the May report which comes out on approximately the 10^{th,} six to seven months prior to harvest and seven to eight months before the expiration of the harvest futures contracts.

The crop balance sheets in the WASDE reports are the primary source of fundamental supply and demand information. The balance sheets contain price determinants on both the supply and demand sides of the market. The determinants of demand or usage differ slightly for corn and soybeans. Soybean demand include seed, feed and residual (~5%), exports (~33%) and crush (~60%). Crush is the conversion of a raw

soybean into soybean meal and oil. The numbers in parentheses represent the proportion of total use. Corn demand consists of animal feed (~60%), exports (~18%) and food, seed and residual (~17%). The supply determinants for both corn and soybeans consist of three components: beginning stocks, production and imports. Beginning stocks for the current year is an equivalent term for ending stocks from the previous year. Ending stocks is measured and defined as the residual difference between the total quantity supplied in a given year and the total usage for that same year.

Ending stocks is an important measure of the net effects of the fundamental supply and demand determinants. It has the advantage of summarizing the net effects of changes in supply and demand with one number, but the disadvantage of not identifying the cause of that change. When ending stocks increase, prices tend to decrease and conversely, when stocks decrease, prices rise. Since production, use and stocks have all been positively trending by varying degrees over the time period considered here (1980-1997), the ending stocks is measured relative to the total use in this study

Historical Price Distribution Histograms

The distributions developed by Kenyon and Wilson serve as a point of departure for the futures price distributions developed in this thesis. One question examined here is whether the price distributions vary with the time to expiration. That is, are the price distributions different at three months to contract expiration compared with twelve or more months to expiration? The distribution of prices at three month is expected to be different than at twelve months to contract expiration. The acreage and yield uncertainty is much greater at twelve months than three months. At twelve months, the best estimator of yield is the historic average because there is no reliable information available this far from harvest, or even planting. The 12 month distribution would therefore be expected to have a much tighter distribution or a smaller variance around the long term historic average price. As the time to harvest decreases, more and more information becomes available and is incorporated into the prices and the price distribution becomes larger.

A Student's T test statistic is used to compare the means of the Daily Old Crop and the Daily WASDE price series for corn and soybeans to determine whether the two are statistically different from one another. The null hypothesis for the test of equality of means

for both corn and soybeans is shown in Equation 1. The null hypothesis is the same for both corn and soybeans. The null hypothesis used to compare the variances of the two distributions is given in Equation 3. An F test as shown in Equation 4 is used to compare the variances of the different distributions.

Equation 1.

$$H_{\varnothing}: \overline{x}_{\text{old crop}} = \overline{x}_{\text{wasde}}$$

Equation 2.

$$t = \frac{\overline{x}_{wasde} - \overline{x}_{oldcrop}}{\left\{\left[\frac{s^2_{wasde}}{n_{wasde}} + \frac{s^2_{oldcrop}}{n_{oldcrop}}\right]\right\}^{1/2}}$$

Equation 3.

$$H_{\varnothing}: s^2_{\text{old crop}} \leq s^2_{\text{wasde}}$$

Equation 4.

$$f = \frac{s^2_{wasde}}{s^2_{oldcrop}}$$

The F and T test results are presented in Table 3.1.

Table 3.1 CORN T-Test: Two-Sample Assuming Unequal Variances

Statistics	WASDE since 80	Old crop since 80
Mean	261.658	263.006
Variance	2557.484	1470.502
Observations	2889.000	4174.000
Hypothesized Mean Difference	0.000	
Df	5087.000	
t Stat	-1.212	
P(T<=t) one-tail	0.113	
t Critical one-tail	1.645	
P(T<=t) two-tail	0.226	
t Critical two-tail	1.960	

Table 3.2 CORN F-Test Two-Sample for Variances

Statistics	WASDE since 80	Old crop since 80
Mean	261.658	263.006
Variance	2557.484	1470.502
Observations	2889.000	4174.000
Df	2888.000	4173.000
F	1.739	
P(F<=f) one-tail	0.000	
F Critical one-tail	1.058	

Table 3.3 SOYBEANS T-Test: Two-Sample Assuming Unequal Variances

Statistics	WASDE since 80	Old crop since 80
Mean	641.30	638.04
Variance	11252.33	6051.59
Observations	2474.00	4010.00
Hypothesized Mean Difference	0.00	
Df	4107.00	
t Stat	1.325	
P(T<=t) one-tail	0.093	
t Critical one-tail	1.645	
P(T<=t) two-tail	0.185	
t Critical two-tail	1.961	

Table 3.4 SOYBEANS F-Test Two-Sample for Variances

Statistics	WASDE since 80	Old crop since 80
Mean	641.30	638.04
Variance	11252.33	6051.59
Observations	2474	4010
Df	2473	4009
F	1.859	
P(F<=f) one-tail	0.000	
F Critical one-tail	1.061	

The T-Test results for the two tailed test in Tables 3.1 and 3.3 indicate that the Daily Old Crop and Daily WASDE price distributions have means that are not statistically different for both corn and soybeans. The high p-value of the T-tests (0.226 and 0.185) for corn and soybeans respectively indicates strong support for the null hypothesis. This result is as expected because both corn and soybeans and other storable commodities are generally considered to be mean reverting. Had the Old Crop mean been statistically greater or less

than the WASDE mean, then the mean would drift over time exhibiting normal backwardation or contango respectively.

The variances of the Daily Old Crop and Daily WASDE price distributions do appear to be statistically different from one another. The F-test results and the corresponding low p-values indicate that the Daily Old Crop distributions for both corn and soybeans have much less price variation about the mean compared with the Daily WASDE distributions. This result intuitively makes sense because at eight to twelve or more months from harvest, there is a lack of information with which to estimate supply other than trendlines and historic means. As a result, the Daily Old Crop price series are more tightly centered about the mean. The Daily WASDE price series reflects all of the uncertainty due to weather and other factors during the actual production time period and has a much greater variance as a result.

Figures 3.3 and 3.4 show the cumulative distribution functions for corn and soybeans. The CDF of the Daily Old Crop price series is plotted against the Daily WASDE price series. The two functions intersect at the mean (~$2.62 for corn and ~$6.40 for soybeans). The soybean functions actually intersect twice and the midpoint between the intersections is the mean. The two functions have very different shapes. The CDF of the Daily Old Crop stays relatively flat for the first 15% to 20% of the observations, then becomes relatively steep until reaching 85% to 90% of the observations and then flattening out again. The Daily WASDE CDF becomes steeper more quickly than the Daily Old Crop CDF and flattens out more quickly as well. The plots of the Daily Old Crop CDF and Daily WASDE CDF shows that extreme prices (both high and low) are offered more frequently during the WASDE time period. This point can also be seen in examining the histograms of the two time periods (Figures 3.5 - 3.8).

Figure 3.3 CDF of Daily Old Crop vs. Daily WASDE Price Series

December Corn Futures Prices 1980-1997

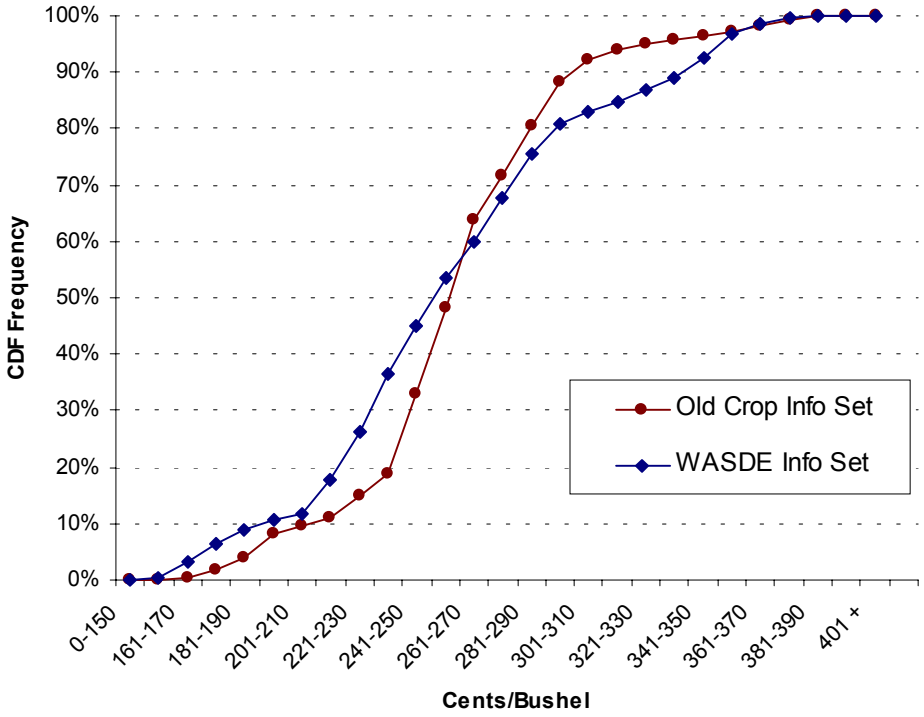


Figure 3.4 CDF of Daily OldCrop vs. Daily WASDE Price Series

Nov. Soybean Futures Prices 1980-1997

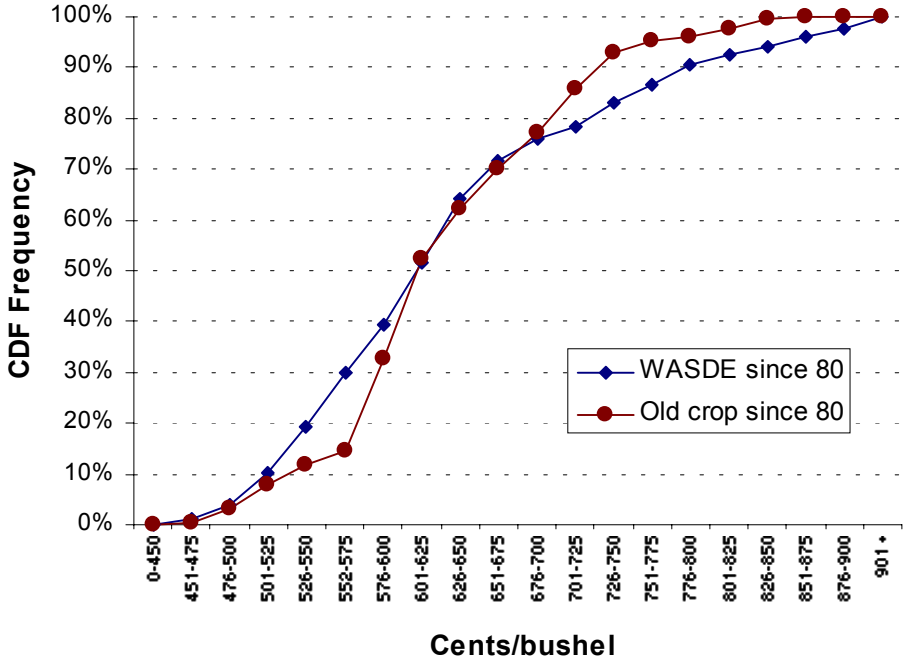


Figure 3.5 Histogram of Dec. Corn Futures Prices 1980 - 1998 Old Crop Info Set

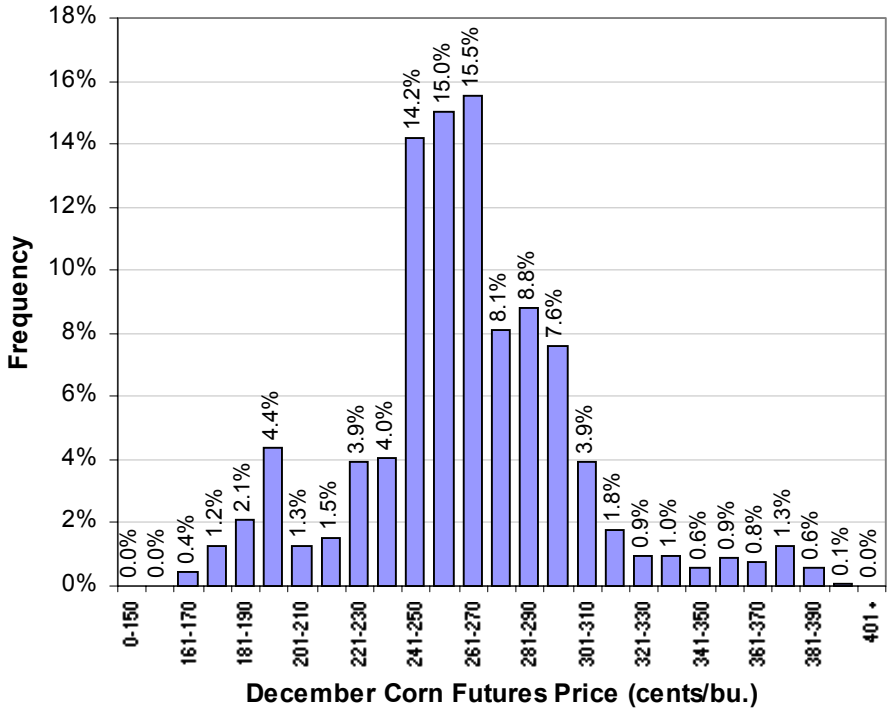


Figure 3.6 Histogram of Dec. Corn Futures Prices 1980 - 1998 WASDE Info Set

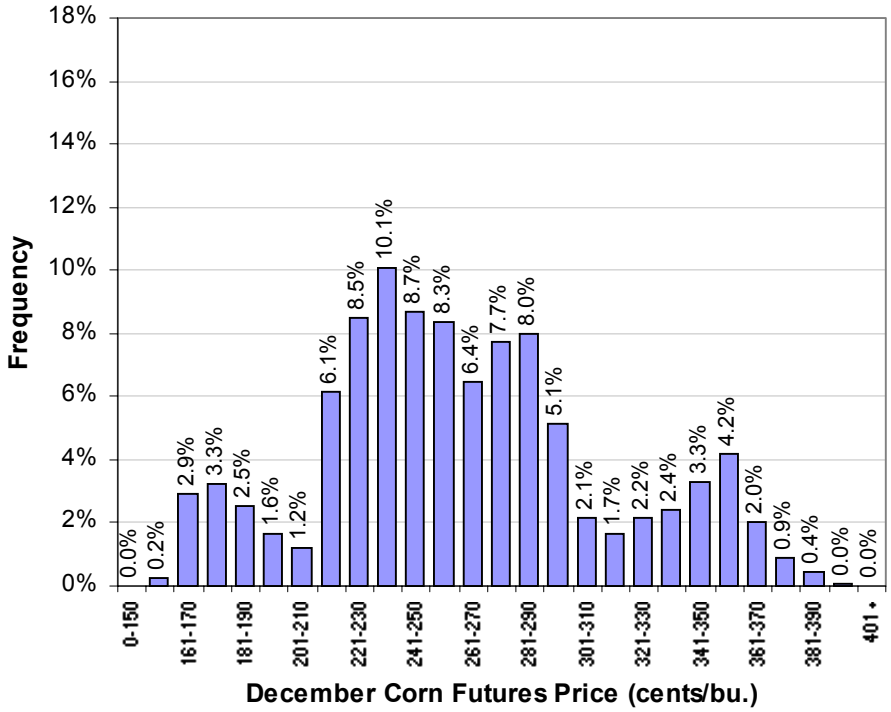


Figure 3.7 Histogram of Nov. Soybean Futures Prices Old Crop Info Set 1980-1997

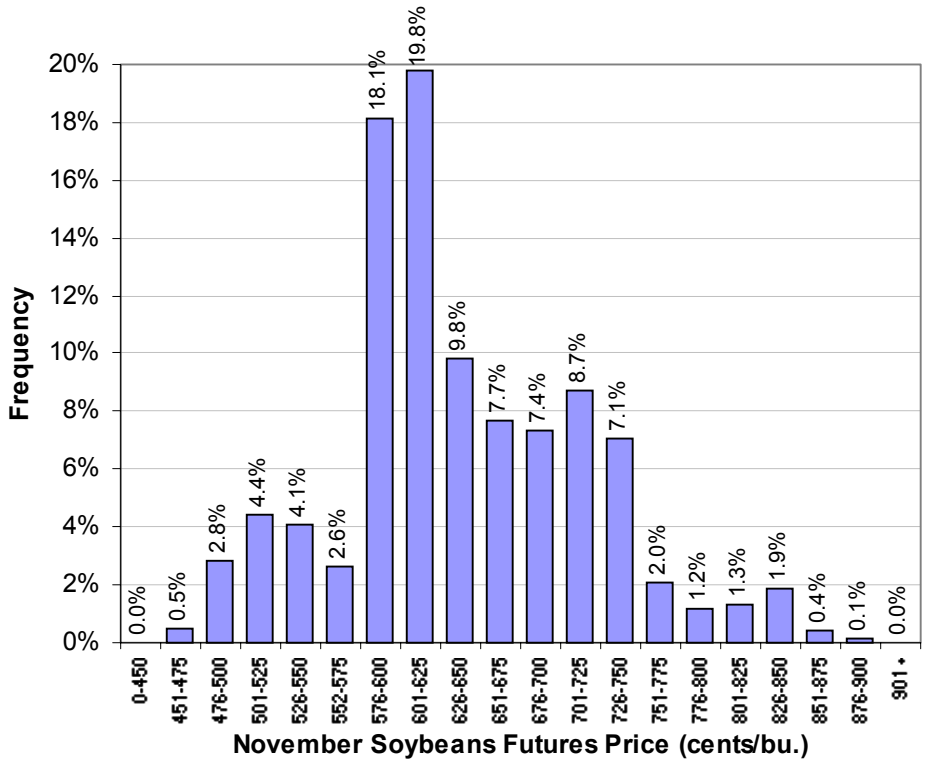
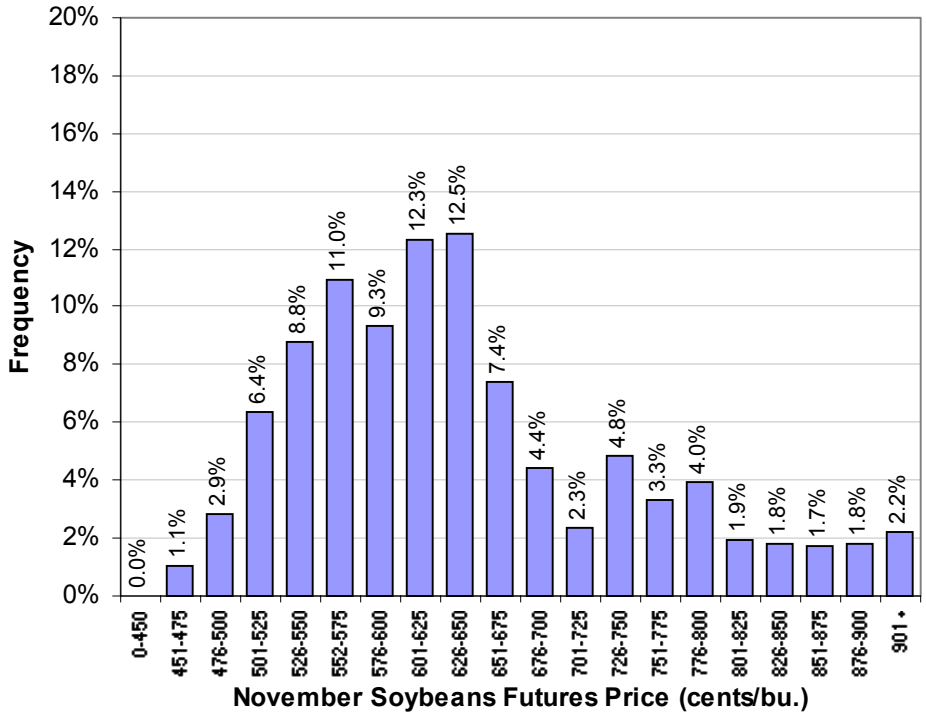


Figure 3.8 Histogram of Nov. Soybean Futures Prices WASDE Info Set 1980-1997



Ending stocks as a percentage of total use acts as a key determinant for the conditioning of the futures prices of corn and soybeans. Figures 3.9 an 3.10 show scatter-plots of ending stocks as a percentage of total use and the Monthly WASDE price series (the average price of December Corn Futures and November Soybean Futures between releases of WASDE reports). The points in these figures cover a wide range of prices on the left side of the plot, but as you move right, the points cover a smaller and smaller range of prices. The price point range grows narrower and takes smaller and smaller values as you move right. It is important to remember that each point on the plot represents the average futures price over the approximately 22 trading days between WASDE releases.

Figure 3.9

Average Monthly Dec. Corn Futures Price *vs.* Ending Stocks as Percentage Total Use 1980 - 1997

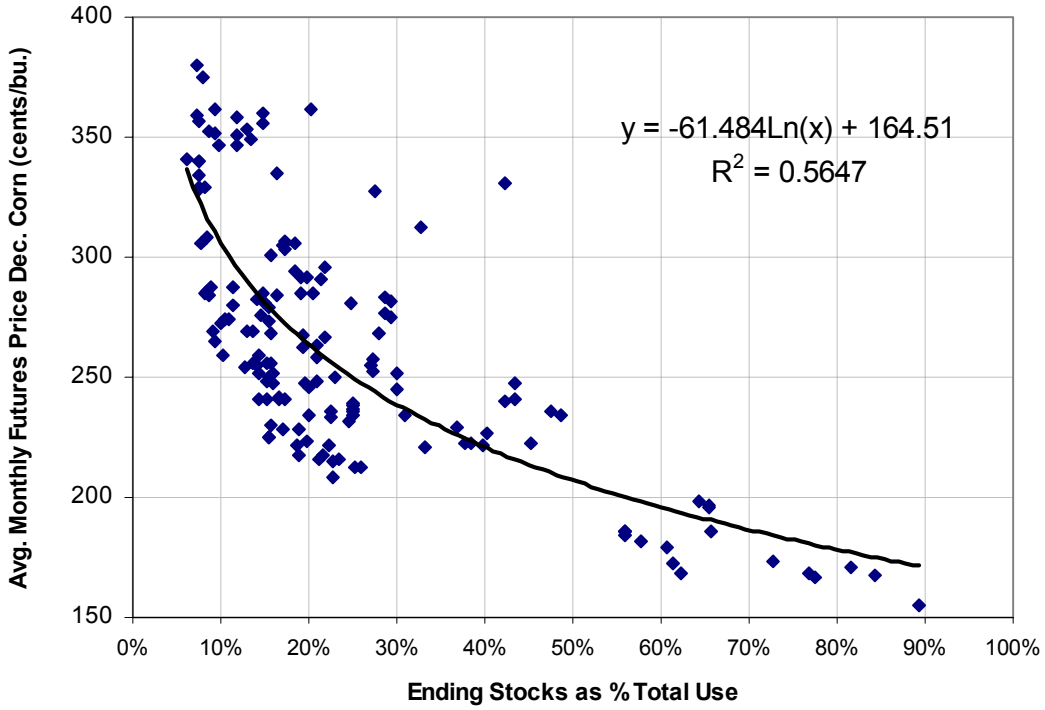
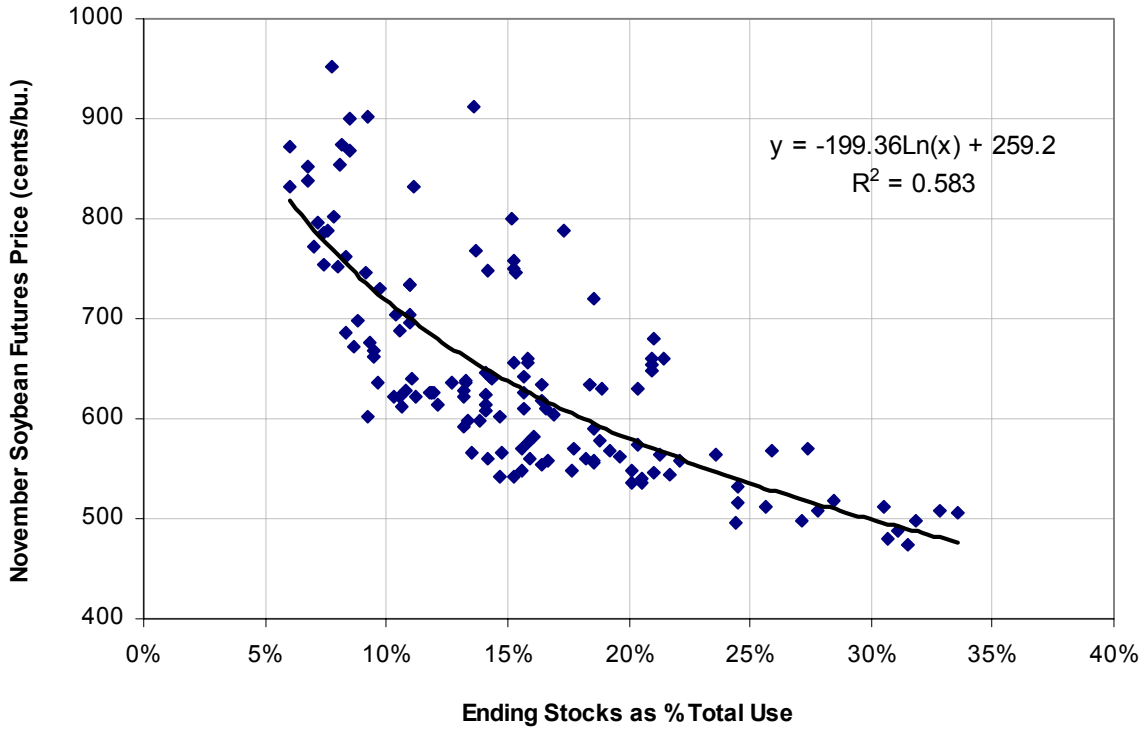


Figure 3.10

Average Monthly Nov. Soybean Futures Price *vs.* Ending Stocks as Percent Total Use 1980 - 1997



The scatter-plots shown in Figure 3.9 and 3.10 show that the futures market offers a very different set of prices when the stocks to use ratio is less than 10% versus when the stocks to use ratio is greater than 25%. This result is very intuitive. The market offers a higher price, perhaps even a premium when the ratio is low to insure a steady supply and to ration usage to those market participants with relatively inelastic demand. The high prices exhibited when the stocks to use ratio is low signals producers to increase the supply. A simple linear regression of the natural log of the stocks to use ratio onto price is represented as a curved line in figures 3.9 and 3.10. The stocks to use values in all of this research have values less than one and the natural log of any number less than one yields a negative value. As a result, the X-coefficient (Ending Stocks as % Total Use) is negative. It is important to quantify how the distribution of futures prices changes for varying levels of ending stocks as a percentage of total use. This was done by examining the marginal distributions of the futures prices conditioned over a range of stocks to use ratios. These marginal distributions can be represented graphically via histograms and quantified and

tested through their moments. The hypotheses to be tested are that the means and variances of the futures price distributions will be significantly lower as the stocks to use ratios increase.

Several considerations were taken into account in selecting and defining the range of values that the stocks to use ratio takes in decomposing the joint distribution. One approach was to subjectively select ratio values that highlight or emphasize the distributional differences between the adjacent ratio ranges. This approach might be important in identifying critical stocks thresholds but was ultimately rejected in favor of a more intuitive, rule of thumb type method for defining the ending stocks to use ranges. The corn scatter-plot from figure 3.9 was separated into 4 segments based on ending stocks as a percent total use (ES % Use): less than 15%, between 15% and 30%, between 30% and 50% and greater than 50%. The soybean scatter-plot from figure 3.10 was separated into five different segments using ending stocks as a percent total use (ES % Use): less than 10%, between 10% - 15%, between 15% - 20%, between 20% - 25%, and greater than 25%. The plots of the aforementioned histograms as well as some other representations of these distributions are contained in appendix 1 at the end of this document. Every daily closing futures price between the release of the first new crop estimates by WASDE and contract expiration is represented in the appropriate histogram. Each point in the figure 3.9 and 3.10 scatter-plots represent the average price between report releases (approximately 22 prices) so there are many more observations that create the histograms than figures 3.10 and 3.11 might suggest.

Tables 3.5 to 3.10 present descriptive statistics of the distributions and the results of the hypothesis testing. The descriptive statistics for the conditional distributions are presented in tables 3.5 and 3.8. Several matrices of t and F tests were constructed that compared the means and variances of the ending stocks conditional distributions. All of the possible combinations were evaluated. P-values are reported in tables 3.6, 3.7, 3.9 and 3.10. The diagonal of these matrices have p-values equal to one because identical distributions are being tested. The lower left portion of the t and F test matrices are blank, their p-values omitted because the lower left of the matrix is a mirror image of the upper right portion. The null hypotheses for the corn tests are given in equations 5 and 6. The soybean null hypotheses are identical to those for corn, except that the ending stocks to use ratios have different bin sizes.

Equation 5:

$$H_{\varnothing}: \bar{X}_{ES < 10\%} = \bar{X}_{ES\ 10 - 15\%} = \bar{X}_{ES\ 15 - 20\%} = \bar{X}_{ES\ 20 - 25\%} = \bar{X}_{ES\ 25\% +}$$

Equation 6:

$$H_{\varnothing}: \sigma^2_{ES < 10\%} = \sigma^2_{ES\ 10 - 15\%} = \sigma^2_{ES\ 15 - 20\%} = \sigma^2_{ES\ 20 - 25\%} = \sigma^2_{ES\ 25\% +}$$

Table 3.5 Descriptive Statistics of December Corn Futures Prices 1980-1997 Conditioned on Ending Stocks as % Total Use WASDE Information Set

	ES < 15%	ES 15-30%	ES 30-50%	ES > 50%
Mean	305.93	256.64	244.98	178.85
Std. Dev.	40.80	32.51	36.58	12.40
Median	290.00	250.13	232.50	176.88
Maximum	393.75	371.00	362.75	214.75
Minimum	229.25	205.00	214.00	151.25
Observations	868.00	1422.00	277.00	322.00

Table 3.6 Students T Test of Equality of Means December Corn Futures (p-Values)

	ES < 15%	**ES 15-30%**	**ES 30-50%**	**ES > 50%**
ES < 15%	1	0	0	0
ES 15-30%		1	0	0
ES 30-50%			1	0
ES > 50%				1

Table 3.7 F Test of Equal Variances December Corn Futures (p-Values)

	ES < 15%	**ES 15-30%**	**ES 30-50%**	**ES > 50%**
ES < 15%	1	0	0.02977	0
ES 15-30%		1	0.00867	0
ES 30-50%			1	0
ES > 50%				1

Table 3.8 Descriptive Statistics of November Soybean Futures Prices 1980-1997 Conditioned on Ending Stocks as % Total Use WASDE Information Set

	ES < 10%	ES 10 - 15%	ES 15 - 20%	ES 20 - 25%	ES 25% +
Mean	775.5	648.6	621.6	576.0	511.9
Std. Dev.	94.7	75.3	74.9	59.2	31.3
Median	778.9	629.8	599.0	554.5	506.8
Maximum	1022.0	948.0	860.3	710.5	623.0
Minimum	575.8	529.0	518.8	482.8	468.3
Observations	454.0	788.0	681.0	333.0	253.0

Table 3.9 Students T Test of Equality of Means November Soybean Futures (p-Values)

	ES < 10%	ES 10 - 15%	ES 15 - 20%	ES 20 - 25%	ES 25% +
ES < 10%	1	0	0	0	0
ES 10 - 15%		1	0	0	0
ES 15 - 20%			1	0	0
ES 20 - 25%				1	0
ES 25% +					1

Table 3.10 F Test of Equal Variances November Soybean Futures (p-Values)

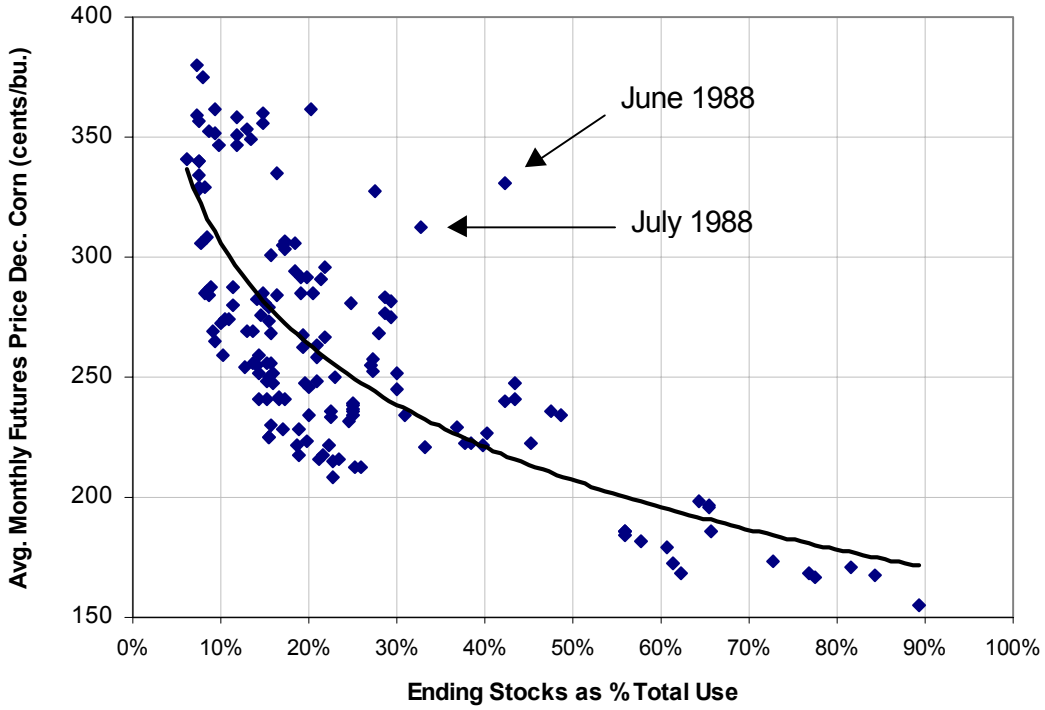
	ES < 10%	ES 10 - 15%	ES 15 - 20%	ES 20 - 25%	ES 25% +
ES < 10%	1	0	0	0	0
ES 10 - 15%		1	0.9017	0	0
ES 15 - 20%			1	0	0
ES 20 - 25%				1	0
ES 25% +					1

Tables 3.6 and 3.9 show that each distribution conditioned on ending stocks for both corn and soybeans has a statistically different mean using the Students T Test of equality of means (shown in *Equation 2*). Tables 3.7 and 3.10 show that the variances of the distributions are all significantly different except for the soybean distributions of 10% to 15% stocks to use and 15% to 20% stocks to use. The variability of prices in these two categories are not significantly different, although the average price received in the 15% - 20% bin is 30 cents per bushel lower than the 10% to 15% bin.

As discussed earlier and shown in the scatter-plots, the mean of the price distributions falls as the stocks to use level rises. This relationship holds for both corn and soybeans. The variance generally decreases as expected when the stocks to use level rises. The corn table shows an increase in the standard deviation of the distribution comparing stock levels between 15 - 30% of use with 30 - 50% levels. The larger variance associated with the 30-50% ending stocks is caused by a pair of observations in the summer of 1988 and one in 1983. This discrepancy can be explained in large part by considering these observations to be outliers, highlighted in figure 3.11. There was a large discrepancy between the market's expectations of the ending stocks levels and the estimates published by WASDE in the1988 June and July reports. The market clearly anticipated a short crop year and was pricing corn above $3.00 a bushel well before the published stocks to use ratio fell. It took until the August 1988 WASDE report for the

projections of stocks to use and price to get realigned and exhibit their historic relationship. There are 45 daily prices associated with the 1988 June and July WASDE reports. If the projected stocks to use ratio was less than 30% in June and July and those 45 prices were not included in the 30% to 50% bin, then the 30% to 50% bin would have had a standard deviation of 10.17 instead of 36.58.

Figure 3.11 Corn Price Outliers:
Average Monthly Dec. Corn Futures Price *vs.* Ending Stocks as Percentage Total Use 1980 - 1997



The purpose of developing these price distributions and histograms is to provide an aid for making informed marketing decisions to corn and soybean producers. The histograms specifically address the question of 'what sort of prices did the market offer the last time we were in this situation.' By collecting the prices offered during the production months of the past seventeen years, a great variety of economic conditions become incorporated into the price distribution. Segregating this distribution into several parts based on varying levels of stocks to use is just one way of answering the question posed above.

The stocks to use parameter is just one of many parameters that may be used to measure the current economic condition of corn and soybeans. It is perhaps the most

significant measure and that is why it was used as the conditioning element in deriving the histograms. The next section takes many parameters of economic conditions into account in an attempt to explain the variability of futures prices.

Statistical Model of Corn and Soybean Futures Prices

The statistical models developed here stem primarily from the annual pricing models developed in the Kenyon and Lucas pricing guides, but also draw from much of the other research cited in this chapter. There are many different price series that might be selected to serve as the dependent variable. These could be spot cash prices, an average of spot cash prices, an index of many spot prices across location, across time, across location and time, a futures price, an average of futures prices, etc. Prices are generally an easily available data series, but the same cannot always be said for the independent variables that are expected to be price determinants.

Much of the previous research has involved the development of annual pricing models. These models typically use only one set of observations per year, and the observations are generally *ex ante* measures reflecting final revisions of production and use estimates and season average prices. Other research (Just and Rausser) examines the forecast accuracy of econometric models in predicting harvest time prices. The focus of this research departs from these previous studies of forecasting the season average prices and harvest time prices of corn and soybeans. This study attempts to identify the determinants of the November soybean and December corn futures prices.

There are two major differences in the research presented here and previous research. First, the structure of the models is similar to that of the annual pricing models except that more than one set of observations per year are included. There is data availability such that monthly observations might be used. There is the question as to whether the ending stocks - price relationship holds when there are monthly observations as opposed to yearly observations. The second difference is in the choice of the dependent variable. Many models use the harvest time price of commodities as the dependent variable, while the research here uses the futures prices as the dependent variables.

While the futures price is itself a forecast of the harvest price, it is also a forward price available to producers. The futures price therefore is serving a dual purpose. First, it is the

market's best expectation of the price of a bushel of corn or soybeans at contract expiration in a specific location. All of the information currently available has been incorporated into that price. If the information set doesn't change, then it is reasonable to expect the futures price to remain constant with a small white noise fluctuation. New information is constantly becoming available and incorporated into the futures price. This new information represents the independent random variables upon which the model is built.

The second purpose of the futures price is that of a risk transference mechanism. A farmer commits his resources in the spring when he plants while his returns are unknown until harvest. The farmer's costs of production are fairly constant, but the returns can be quite variable. Returns or revenue is the product of price and yield, both of which are highly variable from year to year. (see figs. 1.1-1.4 in chpt. 1) The futures market allows the producer to transfer the price risk to another party, thus reducing the variability in price.

It is this second aspect, futures prices as effective forward prices, that makes this research of practical relevance for both the producers and users of corn and soybeans. By capturing the stochastic nature of the futures price through a statistical model, we can begin to decompose the big joint distribution into the various component conditional distributions. Knowing the effect of the independent variables on the dependent variable (futures price) will allow us to generate possible futures price distributions for given dependent variables. Knowing the approximate distribution of futures prices for a given set of dependent variables will put today's posted futures price into a context that the producer can use to make informed decisions, whether they be pricing decisions or resource allocation decisions or something else.

Independent Variables

Observational data for the independent variables comes from the WASDE reports issued by the USDA. Beginning on approximately May 10th of each year, the USDA publishes a WASDE report that forecasts the supply and demand fundamentals for the crop currently in the ground, being produced that year. The reports are subsequently updated on about the tenth of each month throughout the marketing year. The USDA began issuing the WASDE report in September 1973 and the first crop forecasts were for the corn and soybeans produced in 1974. The issue dates of these reports varied over the next five years before settling into a regular pattern for the 1980-1981 marketing year. The data set used to

develop the following models therefore begins in 1980 and includes an observation for each month from May until November for soybeans and from May until December for corn. The data spans the period from 1980 to 1997. This results in 135 observations for soybeans and 154 observations for corn.

Wisner, Blue and Baldwin (1997) argue that the marketing years for corn and soybeans can be categorized according to the size of U.S. production relative to total usage. They divided the marketing year into three categories defined in the following manner. A short year is one in which expected production is less than the previous year's total use. A normal year is one in which the current year's expected production is greater than or equal to the previous year's total use. A year following a short year is just as it sounds, a year in which the previous year's total utilization exceeded the previous year's total production. Short crop and normal crop years cannot be differentiated *ex ante* with certainty, but estimates can be made as the production season progresses whether the crop will be normal or short.

The monthly release of updated corn and soybean supply and demand information reflects an information set that is free and public. There are other private sources of information available, but it is not known how many of the market participants are basing their expectations on these other sources of information. Since the WASDE information set is only updated once a month, only monthly prices could be used.

Dependent Variable

Prices are discovered and updated every day as the market incorporates all new information as it becomes available. For this model, daily closing futures prices are collected from the date the WASDE report is issued until the day prior to the next report release date. These daily prices are then averaged together and this average monthly price between report releases acts as the dependent variable. The price series used in the statistical models are monthly averages and are labeled **Monthly Corn** and **Monthly Soybeans** and were discussed earlier in this chapter in the section entitled Data for the Statistical Models and Histograms Some ideas of possible alternative dependent variables that might be explored in future research are presented in the conclusions.

Model Specification

The probabilistic reduction method is used in the formulation of the statistical models that seek to explain the stochastic nature of the monthly corn and monthly soybean futures price series. The probabilistic reduction method calls for the initial specification of the statistical model to include all the variables that economic theory and experience suggest might be important. The following tables describe the variables that were considered and evaluated as determinants of futures prices.

Table 3.11 Corn Variables (expected coefficient signs in last column)

CornFut (Dependent Var)	Average futures price of December Corn for the period beginning with the WASDE report release date and ending the day prior to the next report release. (cents per bushel)	positive
ES%TotUse	Estimated ending stocks divided by estimated total utilization as reported in WASDE.	negative
Short	A binary dummy variable taking a value of one when estimated production for year n is less than total utilization for year n-1.	positive
YAShort	A binary dummy variable taking a value of one when the year n-1 satisfies the conditions for a Short year.	positive
YearTrend	Denotes the year in which the crop is being produced.	uncertain
ES-less15%	A binary dummy variable that acts as an intercept shifter when ES%TotUse is less than 15%	positive
SS<15%	A dummy variable that is the product of ES-less15% and ES%TotUse that acts as a slope shifter.	negative
ES 15-30%	A binary dummy variable that acts as an intercept shifter when ES%TotUse is between 15 and 30%	uncertain
SS 15-30%	A dummy variable that is the product of ES15-30% and ES%TotUse that acts as a slope shifter.	uncertain
ES 30-50%	A binary dummy variable that acts as an intercept shifter when ES%TotUse is between 15 and 30%	uncertain
SS 30-50%	A dummy variable that is the product of ES15-30% and ES%TotUse that acts as a slope shifter.	uncertain
ES greater50%	A binary dummy variable that acts as an intercept shifter when ES%TotUse is greater than 50%	uncertain
SS greater50%	A dummy variable that is the product of ES greater 50% and ES%TotUse that acts as a slope shifter.	positive
ES%Use PrevYr	Ending Stocks relative to total use for the crop harvested the previous year.	negative

Table 3.12 Soybean Variables

SoybeanFut (Dependent Var)	Average futures price of November soybeans for the period beginning with the WASDE report release date and ending the day prior to the next report release. (cents per bushel)	positive
ES%TotUse	Estimated ending stocks divided by estimated total utilization as reported in WASDE.	negative
Short	A binary dummy variable taking a value of one when estimated production for year n is less than total utilization for year n-1.	positive
YAShort	A binary dummy variable taking a value of one when the year n-1 satisfies the conditions for a Short year.	positive
YearTrend	Denotes the year in which the crop is being produced.	negative
S.A. Prod	Production of the South American Soybean crop for the current year measured in millions of bushels.	negative
Less 10%	A binary dummy variable that acts as an intercept shifter when ES%TotUse is less than 10%	positive
SS < 10%	A dummy variable that is the product of ESless10% and ES%TotUse that acts as a slope shifter.	negative
ES 10-15%	A binary dummy variable that acts as an intercept shifter when ES%TotUse is greater than or equal to 10% and less than 15%.	uncertain
SS 10-15%	A dummy variable that is the product of ES 10-15% and ES%TotUse that acts as a slope shifter.	uncertain
ES 15-20%	A binary dummy variable that acts as an intercept shifter when ES%TotUse is greater than or equal to 15% and less than 20%.	uncertain
SS 15-20%	A dummy variable that is the product of ES 10-15% and ES%TotUse that acts as a slope shifter.	uncertain
ES 20-25%	A binary dummy variable that acts as an intercept shifter when ES%TotUse is greater than or equal to 20% and less than 25%.	uncertain
SS 20-25%	A dummy variable that is the product of ES 20-25% and ES%TotUse that acts as a slope shifter.	uncertain
ES greater 25%	A binary dummy variable that acts as an intercept shifter when ES%TotUse is greater than 25%	uncertain
SS greater 25%	A dummy variable that is the product of ES greater 25% and ES%TotUse that acts as a slope shifter.	uncertain

Many various combinations of the independent variables described above were included or specified in the statistical model. Several problems were encountered in specifying the models. One problem encountered was positive autocorrelation, which meant that the residual or error term contained systematic information relating to the dependent variable. The autocorrelation was detected with the Durbin Watson test statistic. A common fix for autocorrelation is the inclusion of a lagged dependent variable in the model specification. When this fix is undertaken, the lagged futures price dominates all other independent variables with the exception of ending stocks relative to total use. At this point, a choice is made to develop a statistical model that helps to expose the interaction between

the independent variables mentioned above and the futures price rather than the development of a model the meets the rigorous definition of strict statistical adequacy. Ideally both of these conditions could be met but such was not the case in this instance. The model specifications outlined next do not meet the definitions for statistical adequacy, but they do cast light on the interactions between the dependent and independent variables.

The models specified and described in equations 7 and 8 performed reasonably well at describing the stochastic mechanism generating these futures price series. The following regression equations were estimated using ordinary least squares (OLS).

Equation 7.

$$\text{CornFut}_t = B_0 + B_1\text{ES\%TotUse}_t + B_2\text{Short}_t + B_3\text{YAShort}_t + B_4\text{YearTrend}_t + B_5\text{ES} < 15\%_t + B_6\text{SS} < 15\%_t + B_7\text{ES} > 50\%_t + u_t$$

Equation 8

$$\text{SoybeanFut}_t = B_0 + B_1\text{ES\%TotUse}_t + B_2\text{Short}_t + B_3\text{YAShort}_t + B_4\text{S.A.Prod.}_t + B_5 < 10\%_t + B_6\text{SS} < 10\%_t + u_t$$

Equation 9

$$\begin{aligned}\text{CornFut}_t = {} & \underset{(738.45)}{9378.5} \underset{(28.25)}{-87.921}\ \text{ES\%TotUse}_t + \underset{(4.279)}{12.777}\ \text{Short}_t + \underset{(4.477)}{15.101}\ \text{YAShort}_t \underset{(0.371)}{-4.587}\ \text{YearTrend}_t \\ & + \underset{(15.151)}{136.819}\ \text{ES} < 15\%_t \underset{(122.582)}{-758.681}\ \text{SS} < 15\%_t \underset{(13.031)}{-33.60}\ \text{ES} > 50\%_t\end{aligned}$$

Durbin Watson (DW) = 0.894
Coefficient of Determination (R-sq) = 0.825
Adjusted R-sq =0.816
Standard Error of Regression (SER) = 22.00

Equation 10

$$\begin{aligned}\text{SoybeanFut}_t = {} & \underset{(32.330)}{904.30} \underset{(105.658)}{-1028.67}\ \text{ES\%TotUse}_t + \underset{(12.344)}{24.891}\ \text{Short}_t + \underset{(12.244)}{22.941}\ \text{YAShort}_t \\ & \underset{(0.0177)}{-0.1227}\ \text{S.A.Prod.}_t + \underset{(93.429)}{199.945} < 10\%_t \underset{(1101.01)}{-1587.41}\ \text{SS} < 10\%_t\end{aligned}$$

Durbin Watson (DW) = 0.741
Coefficient of Determination (R-sq) = 0.733
Adjusted R-sq = 0.721
Standard Error of regression (SER) = 56.07

The coefficients of determination (R-squared values) for the corn and soybean models in equations 9 and 10 indicate that 82% and 73% of the variation futures prices can be explained by the models presented above. This is much better that the 55% to 60% explanatory power of the simple model of futures price as a function of the natural log of ending stocks as a percentage of total use (scatter-plot figures 3.9 and 3.10). The Durbin Watson statistics indicate that the error terms in these equations are positively serially correlated which means that the error terms are not independent and that some systematic information is still contained in the error terms. This can be seen in figures 3.12-B and 3.13-B, plots of the actual futures prices against the predicted futures prices. In the 1980 and 1981 seasons for instance, the model consistently underestimates the futures price, while in 1990 and 1992, the models consistently overestimate the actual futures prices. The inclusion of a lagged futures price in the models might have helped the predicted futures prices close in on the actual price. Another method that could be used to work around the autocorrelated errors problem is a transformation of all the variables into first differences.

The models specified in equations 9 and 10 do not meet the requirements for strict statistical adequacy. However, some of the fixes for statistical adequacy result in models that are much more complicated where the variables are transformed (as in first differencing or log linear form) and the coefficients lose their intuitive meanings. Additional fixes include the use of the lagged dependent variable as an independent variable. These fixes must be viewed in the context for which this thesis is intended which is to provide Virginia producers of corn and soybeans intuitive, simple models that might assist in making informed marketing decisions. For this reason, the models above represent the best fits achieved that maintained their simplicity.

Figure 3.12-A Plot of Actual vs. Predicted Values of Average Monthly December Corn Futures Price

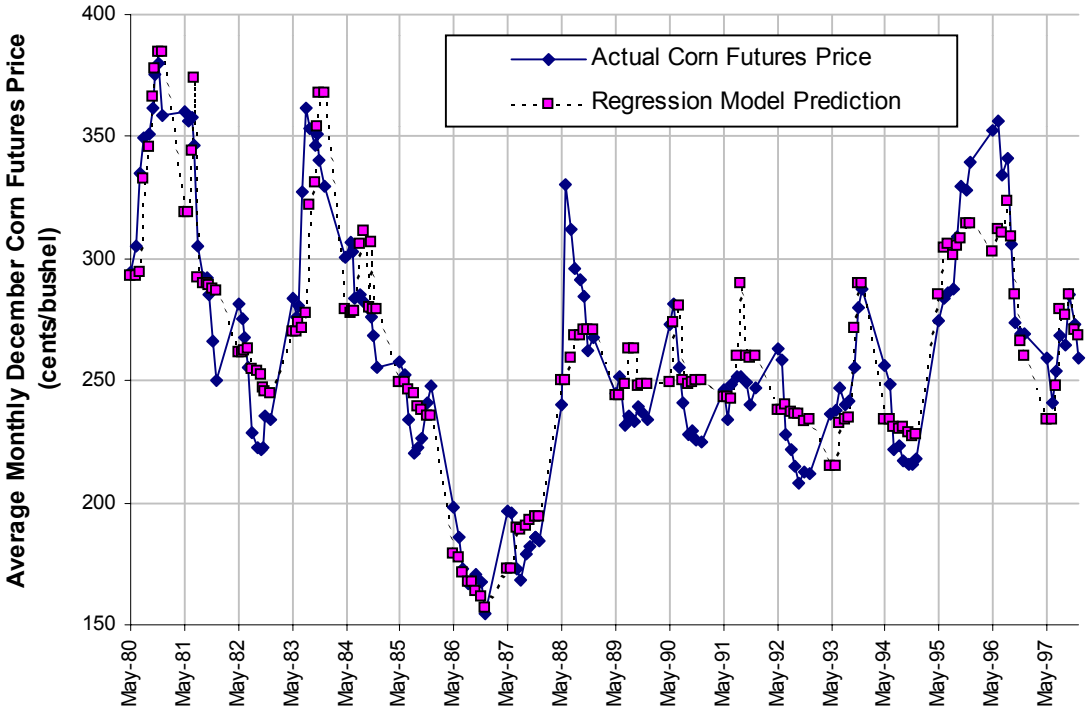


Figure 3.12- B Forecast Error Corn Futures Price Statistical Model

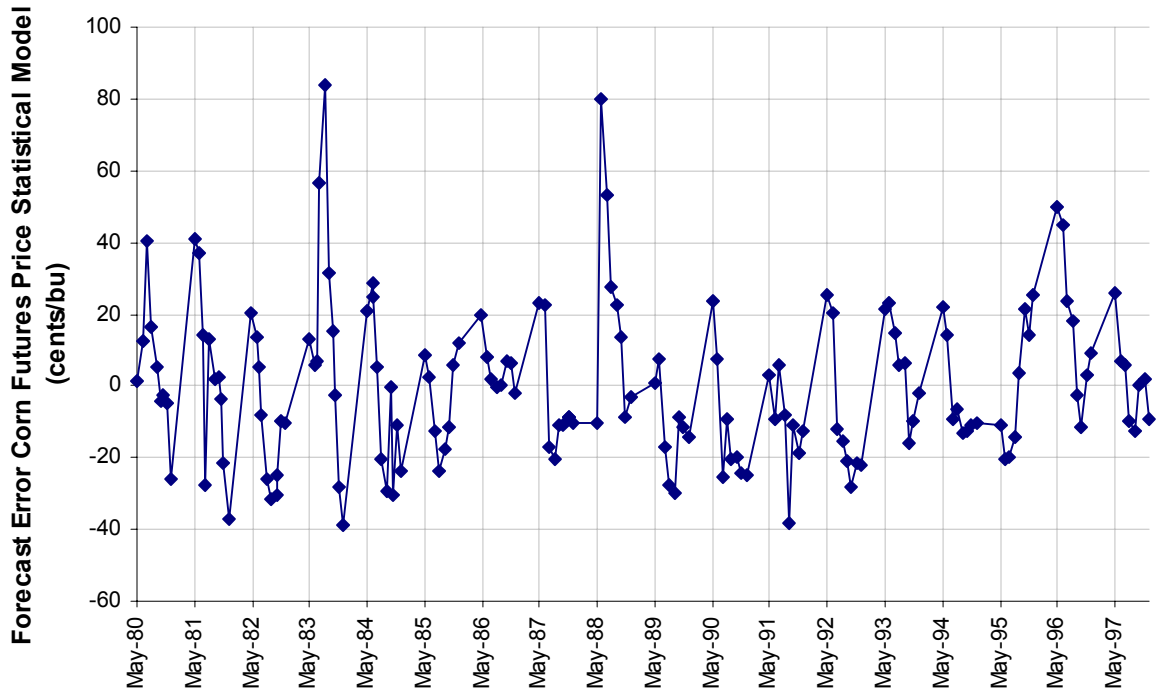


Figure 3.13-A Plot of Actual vs. Predicted Values of Nov. Soybean Futures Prices for 1980-1997

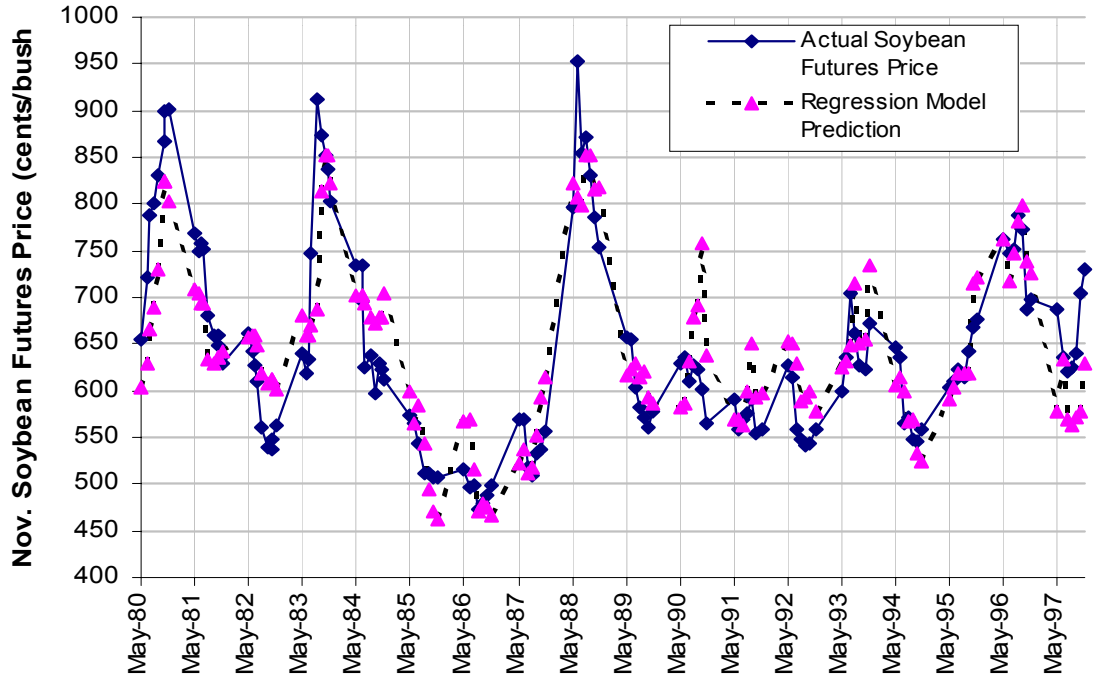
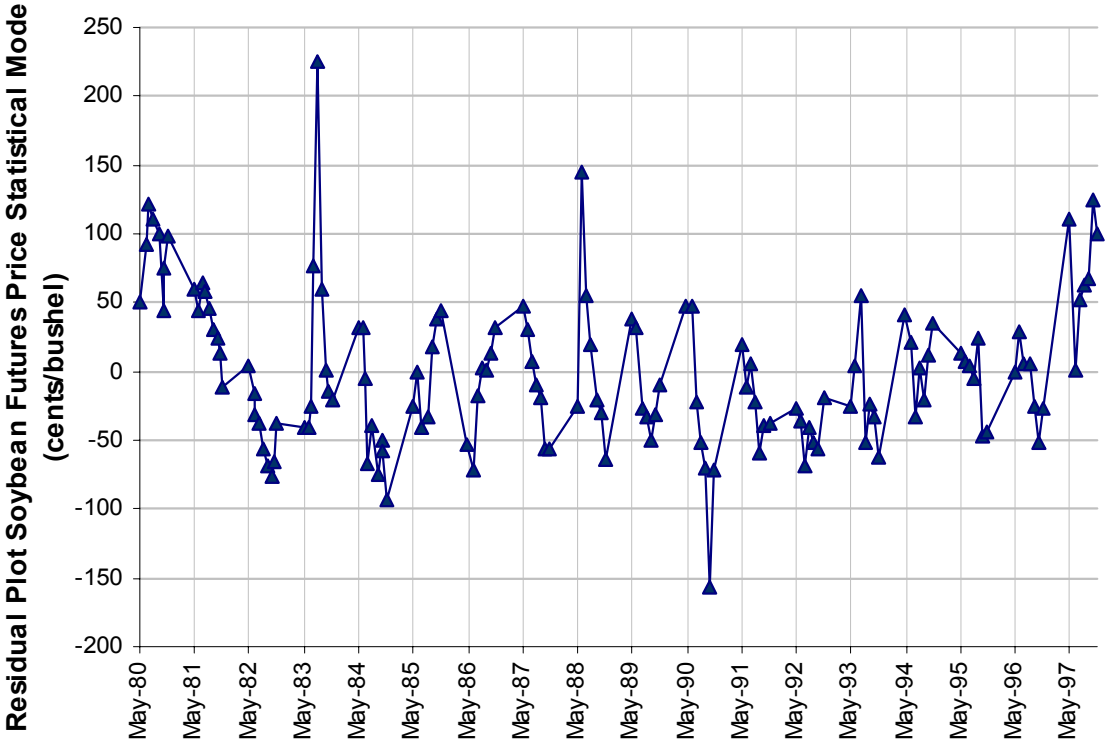


Figure 3.13-B Forecast Error Soybean Futures Price Statistical Model



The coefficients and their standard errors for the two models indicate that ending stocks relative to total use is indeed significant for both corn and soybeans. An increase of one percent in the stocks to use parameter would result in a 0.879 cent decrease in the estimated corn futures price and a 10.29 cent decrease in the estimated soybean futures price. If the forecast is for a short crop year, the models estimate higher prices by 12.8 cents for corn and 24.9 cents for soybeans. In the year following a short year, estimated prices are higher by 15.1 cents for corn and 22.9 cents for soybeans. Each year, the corn price tends to drop by 4.6 cents. A similar behavior might also exist with the price of soybeans, but the yearly trend variable is not included in the soybean model because of a multicollinearity interaction with the South American production. When various specifications of the soybean model are estimated, the South American production and yearly trend coefficients vary substantially including sign changes.

Figures 3.14 and 3.15 graphically illustrate several characteristics of the statistical models that were developed. One is the effects of the dummy variables (slope shifters and intercept shifters) that are based on ending stocks relative to total use on the predicted futures price. This is represented as a bold line across the scatter-plot. The bold line is calculated using the parameters associated with ending stocks relative to use from the statistical models while other independent variables are represented using their average values. Another feature of the figures are the scatter-plots of the predicted values of furtures prices from the statistical models. There is less variability in the predicted values of the futures prices than the actual futures prices. This is to say that the models tend to underestimate the highest prices and to overestimate the lowest prices.

Figure 3.14 Average Monthly Dec. Corn Futures Price vs. Ending Stocks as Percentage Total Use Including Intercept and Slope Shifters: 1980-1997

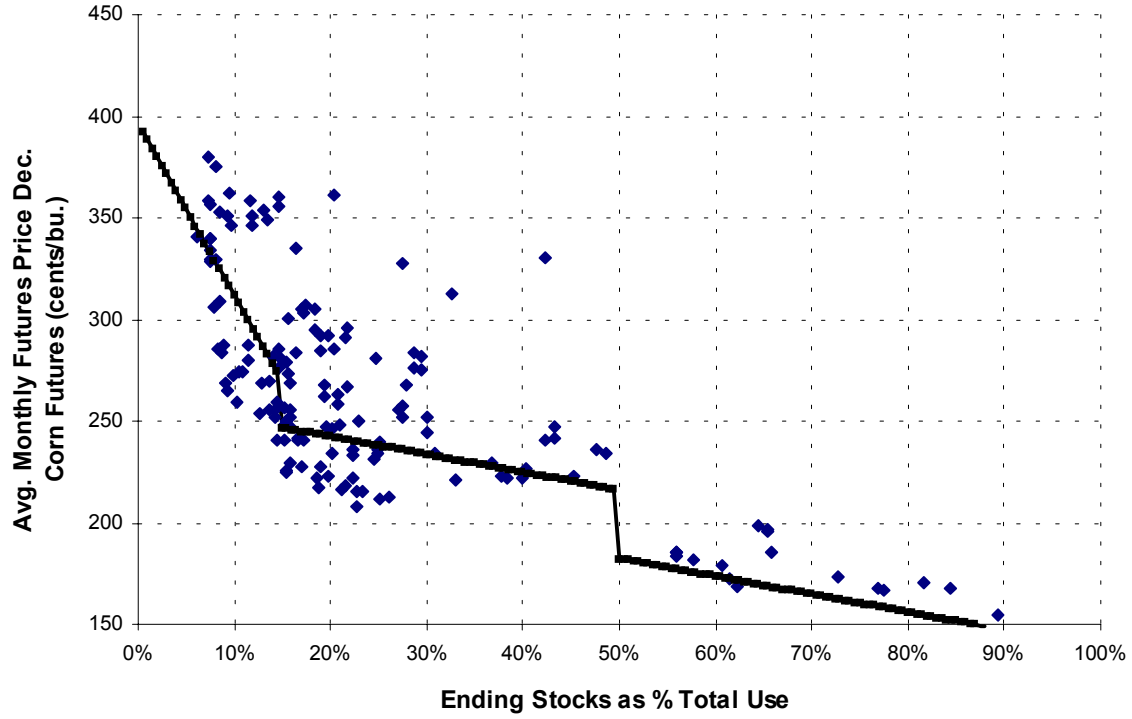
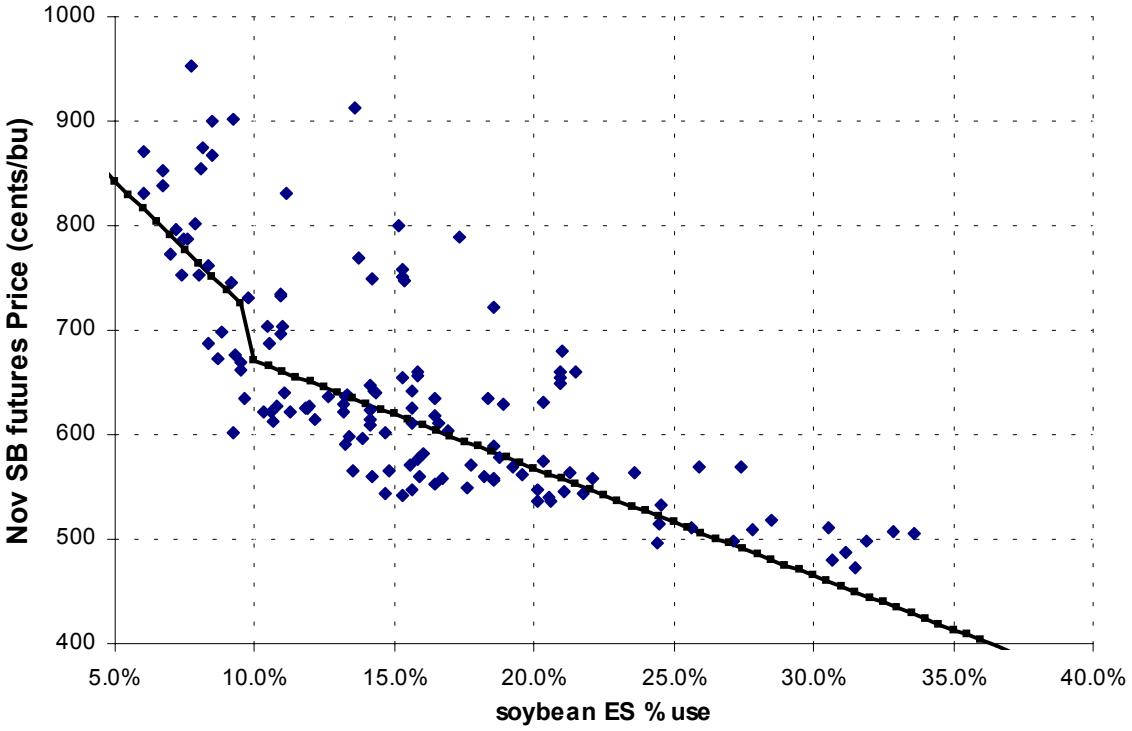


Figure 3.15 Average Monthly Nov. Soybean Futures Price vs. Ending Stocks as Percent Total Use Including Intercept and Slope Shifters: 1980 to 1997



The question remains as to whether the model provides any new useful information for making informed marketing decisions. It depends on the definition of useful but a broad definition of useful will do. If a producer has never paid much attention to the supply and demand fundamentals that underpin the market, then the material presented here is almost certainly useful. On the other hand, a producer who is also an astute marketer probably already has a good understanding of the relationships between the futures prices and the supply and demand fundamentals. It is probably still useful to have these relationships that are intuitively held to be measured quantitatively. The major point of the statistical model is to have some parameter estimates of the fundamentals.

Tables 3.13 and 3.14 demonstrate some of the variability that can be found in the futures prices based on different levels of information. The tables indicate that the more information that is taken into account, the greater the certainty in our price expectations , or stated differently, the lower the uncertainty in our pricing expectations. The table summarizes the major findings of this chapter. The futures prices exhibit a relatively tight distribution about the mean price when the time to contract expiration is seven or eight months in the future. The variability in the futures prices increases as the crops enter the planting and production stages. Production (yield) risks from such factors as the weather, insects, etc. are at their highest during the summer months and into the fall. The production estimates from WASDE take these uncertainties into account as well as demand uncertainties. The net effect of these uncertainties can be measured in the ending stocks estimate, compared relative to total use to standardize the comparison across the 17 year time frame.

Table 3.13 Informational Effects on the Certainty of Corn Futures Prices

Information Set	Mean	Standard Deviation
No Information (all prices 1980-1997)	262.3	41.3
Old Crop Information (time to harvest > 8 months to contract expiration)	263.0	38.3
WASDE Information Set (less than 8 months to contract expiration)	261.7	50.8
Statistical Model (Equation 9)	263.2	22.0
Conditioned on Ending Stocks to Total Use		
Histograms - Ending Stocks to Total Use less than 15%	305.9	40.8
Statistical Model - Ending Stocks to Total Use less than 15%	308.7	21.8
Histograms - Ending Stocks to Total Use 15% to 30%	256.6	32.5
Statistical Model - Ending Stocks to Total Use 15% to 30%	256.7	21.0
Histograms - Ending Stocks to Total Use 30% to 50%	245.0	36.6
Statistical Model - Ending Stocks to Total Use 30% to 50%	246.2	29.6
Histograms - Ending Stocks to Total Use 50% or more	178.9	12.4
Statistical Model - Ending Stocks to Total Use 50% or more	178.5	13.2

Table 3.14 Informational Effects on the Certainty of Soybean Futures Prices

Information Set	Mean	Standard Deviation
No Information (all prices 1980-1997)	639	87.94
Old Crop Information (time to harvest > 7 months to contract expiration)	638	77.8
WASDE Information Set (less than 7 months to contract expiration)	641	106
Statistical Model (Equation 10)	644.7	56.1
Conditioned on Ending Stocks to Total Use		
Histograms - Ending Stocks to Total Use less than 10%	775.5	94.7
Statistical Model - Ending Stocks to Total Use less than 10%	776.3	61.5
Histograms - Ending Stocks to Total Use 10% to 15%	648.6	75.3
Statistical Model - Ending Stocks to Total Use 10% to 15%	647.9	66.4
Histograms - Ending Stocks to Total Use 15% to 20%	621.6	74.9
Statistical Model - Ending Stocks to Total Use 15% to 20%	618	48.9
Histograms - Ending Stocks to Total Use 20% to 25%	576	59.2
Statistical Model - Ending Stocks to Total Use 20% to 25%	595	42.5
Histograms - Ending Stocks to Total Use 25% or more	512	31.3
Statistical Model - Ending Stocks to Total Use 25% or more	498	24.7

The ending stocks to total use estimate is an important piece of information when it comes to futures price expectations. Given that the stocks to use ratio is less than 10%, the futures prices are expected to have a higher mean and more price variability and conversely, when the stocks to use ratio is greater than 35%, the mean futures price is expected to be lower with less variability. This relationship holds for both corn and soybeans.

Not all of the information is captured in the ending stocks measure though. Other factors such as short crop years, the year following a short year, yearly trends, South American production, and manipulation of the ending stocks to use number can provide valuable information for the formation of price expectations. The models for corn and soybeans both exhibited smaller standard errors than the variability in prices associated with the histograms. For example, the corn model had a standard error of 22 cents per bushel compared with 55 cents for the entire WASDE distribution. The 22 cent standard error for the corn model is lower than that of all the distributions conditioned on ending stocks except for the greater than 50% level when prices are at the very bottom and stop moving (st.dev. 12.4 cents). Comparisons between standard errors of the histograms and the statistical models both conditioned on ending stocks relative to total use supports the argument that the models contain additional information helpful in forming price expectations that the histograms do not hold.

Summary and Conclusions

There are several points that should be taken from the analysis of futures prices and the determinants of those futures prices that were discussed in this chapter. There are many factors that can affect the futures price of corn and soybeans. Some, such as forecasts of acreage and yield have an obvious effect while others, such as the balance of trade between nations, or exchange rates have a less obvious effect, while still others such as sun spot activity can border on the incredulous. The point is that many factors are taken into account in the determination of price and the market is a very efficient mechanism for taking all of these various factors into account in determining what the price of soybeans will be in November and corn in December. This chapter sought to identify some of the major determinants of the futures prices and to quantify their effects.

The ending stocks relative to total use was the most important determinant from an explanatory power perspective that was examined in this chapter. As Kenyon and Lucas show in their Corn Pricing Guide and Soybean Pricing Guide, approximately 90% of the variation in the season average cash price can be explained by the ending stocks relative to total use information. The information as used in the pricing guides was only available *ex post* and thus not as helpful in making marketing decisions for the new crop as *ex ante*

information would be. The main aim of the research presented here was to build upon this previous research and to develop tools that facilitate informed decision making *ex ante* by examining the relationship between the available information at a given time with the prices available at that time.

The histogram analysis showed that for smaller values of ending stocks relative to use, the distributions of prices offered had higher means and higher variances. The histograms developed in this chapter are a good graphical technique for illustrating the effects of different stocks to use levels on futures prices. The strength of the histogram is in the simplistic way that it demonstrates how differing stock to use levels have different futures price distributions. The statistical models go a step farther than the histograms by quantifying the effects of determinants other than ending stocks on futures prices. If the new crop is forecast as short, or if the previous year's crop can be classified as short, then prices tend to be significantly higher for both corn and soybeans, and South American production has a significant negative effect on the price of soybeans. By quantifying the effect of these various conditions on futures prices, the producer is better equipped to form his price expectations and is in a better position to make well informed marketing decisions. That, after all, is the is the purpose of this research, to help the producer develop price expectations that can be used in making well informed marketing decisions.

CHAPTER FOUR

Marketing Practices and Adoption of Marketing Strategies of Virginia Corn and Soybean Producers

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Introduction

The third area of this thesis explores various producer concerns in the development of marketing strategies, particularly the attitudes and perceptions relating to different methods of managing price risk and the effectiveness of the various tools and methods. Producers who attended the three day Price Risk Management Workshops in January and February of 1998 were asked to complete a questionnaire that examined their marketing and pricing strategies for the 1998 crop year. Part of the workshop included the development of written marketing plans. The questionnaire was designed to explore the extent to which the marketing plan presented by the Extension marketing specialists was put into practice. Alternative marketing strategies were also elicited and examined through the questionnaire, which was designed to explore not only the marketing strategy employed in 1998, but also the reasoning behind the selection of a particular marketing plan. The questionnaire also examined producer attitudes and perceptions of the effectiveness of different pricing tools in reducing risk and/or enhancing income.

The 1996 Farm Bill (Federal Agricultural Improvement and Reform Act) marks a shift towards a more market oriented U.S. farm policy. Acreage restrictions are being phased out and target price support programs have been eliminated, replaced with a diminishing (theoretically) schedule of transition payments as the old programs are phased out. A major consequence of this change in U.S. farm policy is the possibility of greater commodity price variability and income variability in the years ahead. The soybean and grain producer certainly has various tools available with which to manage the commodity price risk and the accompanying income variability in this new arena of U.S. farm policy.

Literature Review

As extension economists, it is important to have an idea and understanding of producer concerns in the area of price risk management. Anderson and Mapp stipulate that the major task of the extension economists " is to take complex situations, convert them into simple, explainable subjects, and then teach decision makers how to reach their goals." A natural starting point is the examination of producer behavior in the area of marketing and

more specifically, pricing decisions. There is a large body of research on the marketing activities of grain producers in the United States. Some of this research suggests that extension and research economists have different opinions regarding hedging strategies, risk management and the effectiveness of price forecasting (Parcell, Schroeder, Kastens, and Dhuyvetter). Popular lore suggests that the number of opinions or theories on an economy (more specifically, the workings of the market mechanism) increases exponentially with the number of economists present, so it is not surprising that research economists and extension economists have some different views on marketing. Ultimately, it is farmers' views on the effectiveness of the different marketing and risk management techniques that are important.

Farmers in general or grain producers more specifically are not a homogenous group. There is a great deal of variety in the individual characteristics of a producer and his farming operation. Much research has been conducted in analyzing the correlation between various farm and farmer characteristics and their marketing practices (Sartwell, O'Brien, Tierney, Eggers, Wisner, Lawrence, and Baker). Patrick, Musser, and Eckman have been conducting surveys of producer marketing practices during Purdue University Top Farmer Workshops and have analyzed the responses in the 1993-1995 surveys. The questionnaire from those workshops acted as the template for the questionnaire given to Virginia producers in the course of this research. There are a number of studies which research the information sources used by grain producers and the usefulness of that information in helping with marketing decisions (Ortmann, Patrick, Musser, and Doster ; Ford and Babb ; Patrick and Ullerich). Shapiro and Brorsen conducted research that examined the factors affecting hedging decisions. They conducted surveys and with the data collected, used a tobit regression model to explain the 5 year average percentage of acres that were hedged. The independent variables included self assessed levels of risk aversion measured with questions on a likert scale, personal descriptive characteristics, marketing objectives, and the financial status of the farming operation.

The USDA recently published a report entitled Managing Risk in Farming: Concepts, Research and Analysis, which explores the wide range of risks faced by farmers today, from price and yield risk to enterprise diversification to management structure. One important element in the discussion of risk is that "because farmers vary in their attitudes towards risk, risk management cannot be viewed within a 'one size fits all' approach." This aspect makes

the development of tools and strategies for managing risk all the more challenging. Each producer must determine his own level of risk aversion and select the tools and strategies that are best suited to his unique situation in a risk-reward context. "Understanding risk helps farmers and others develop strategies for mitigating the possibility of adverse events, and aids in circumventing extreme outcomes, such as bankrupcy." (*iv, v* USDA)

Background

The research presented in this chapter draws in large part from the studies cited above. The research here closely follows much of the previous research for two reasons. First, all of the research cited here focuses on the topic of producer marketing behavior and producer characteristics. There are only so many ways that these characteristics can be measured. The second reason the studies are similar is to provide a basis of comparison across different regions of the country. This can be done with greater accuracy when a standard set of questions is used. That this research is similar to previously conducted research does not mean that this research only covers ground previously covered by others. On the contrary, the body of previous research provides a basis for comparison while addressing the question of how producers form their pricing decisions in a new approach. Eckman, Patrick and Musser modeled the adoption of written marketing plans, and while this approach is similar, there are important differences.

All the participants of the marketing workshops conducted by Virginia Tech in early 1998 developed written marketing plans as part of a learning exercise. Each participant left the workshop with a written marketing plan based on historic price distributions as well as current market conditions. The subject of this research is to examine how the participants chose to implement their marketing decisions and why they chose their particular methods given a standard information set. The goal of this research is to better understand areas of producer concern in risk management and the difficulties they encountered in implementing their pricing strategy. As producer concerns are identified through their marketing activities and their comments, extension researchers and educators will gain a better understanding of their audience and will be able to construct programs and tools that will address the needs of the producers.

Description of Data

The data used in this research was collected through a questionnaire that was mailed to producers in February 1999, presumably after the grain produced in 1998 had been marketed. The producers receiving the questionnaire had attended one of two Price Risk Management Workshops that were sponsored by Virginia Cooperative Extension services and conducted in January and February of 1998. In these three-day workshops, producers were given instruction in various hedging tools available to them and exercises and examples of their use were covered. The hedging tools covered in the workshop included cash forward contracts, basis contracts, minimum price contracts, futures contracts and options on futures contracts. A cash forward contract is an agreement between the buyer and seller for the delivery of a specific quantity and quality of a commodity at a specified price on a specified date. A basis contract is a forward contract that sets a fixed difference (basis) to a specified futures contract. The minimum price contract is an agreement between an elevator and the producer that provides the seller with price protection below a specified minimum level. Futures and options contracts are exchange traded products that allow the producer to forward price using standardized contract specifications. The option contract gives the holder the right, but not the obligation to buy or sell the underlying futures contract. During the first two days of the workshop, examples and exercises in the construction of hedges were covered and worked through as a group. The hedging mechanism was examined using various pricing tools and evaluated under a variety of market conditions and the strengths and weaknesses of the tools were discussed.

The third day of the workshop concentrated on developing a pre-harvest pricing plan for the 1998 corn and soybean crop. The instruction included a discussion of marketing objectives and risk. The "Breakeven Program" discussed in chapter two was used to illustrate yield, price and financial risk. Then a market price outlook was presented using fundamental and technical analyses. A process for developing price objectives based on all the information above was presented. Tables 4.1 and 4.2 summarize the written marketing plans that were developed in the workshop.

Table 4.1 Corn Pricing Strategy

Level	* Price 25% of expected production with **forward** cash contracts @	$2.83
	* Price another 25% of expected production with Dec. **futures** contracts @	$2.90
	* Price the remaining 50% of expected production with Dec. **options** @	$3.00
Timing	* Cash contract whenever target is met	
	* Use options up to July 15 for all pricing over 50% expected production	
	* Price 50% of expected production by July 15	
	* Remove futures hedges if expected yields decrease and price increases after July 15	

Table 4.2 Soybean Pricing Strategy

Level	* Price 20% of expected production with **forward** cash contracts @	$6.27
	* Price another 30% of expected production with Nov. **futures** contracts @	$6.52
	* Price the remaining 50% of expected production with Nov. **options** @	$6.52
Timing	* price 20% in Jan. 1998 at the current price	
	* price another 30 % when futures reach the $6.52 Nov. soybean target	
	* use options up to July 15 for all pricing over 50% expected production	
	* price 50% of expected production by July 15	
	* remove futures hedges if expected yields decrease and price increases after July 15	

There were approximately 75 people in attendance in the two workshops combined. Fifteen of the attendees identified themselves as extension agents, farm lending agents and bankers during the workshops and were not included in the survey population. Surveys were sent to the remaining pool of 60 attendees, and 7 more attendees were identified as non-producers. Of the 53 producers that received the questionnaire, 25 responded by completing the form and returning it. (Some responded vocally in a negative fashion during a follow-up phone request for responses.) Two of the respondents left large segments of the questionnaire incomplete and were not useable, so the sample size for the analysis was 23, representing a usable response rate of 43%. The results of the questionnaire are summarized in Tables 4.3 and 4.5. (A complete copy of the questionnaire is included in the appendix.)

The questionnaire respondents represented 14 different Virginia counties and cities in Southeastern Virginia and the Northern Neck region. Essex, Caroline, Isle of Wight and Suffolk had the most respondents with three apiece. The average respondent had 1000

acres of total cropland. The questionnaire focused primarily on corn, wheat and soybeans which producers allocated over approximately equal acreages. The average age of the person responsible for making the marketing decisions was 47 1/2 and this person reported an average of 20 years experience in making marketing decisions. The 1997 Census of Virginia Agriculture estimated the average farmer to be nearly 10 years older at 56.4 years of age. The average age of the respondent in the Eckman, Patrick and Musser survey of Midwestern grain producers was 38.1 years of age while the age of the average Indiana farmer is 51.3 years. We can draw the general conclusion that these types of workshops attract producers in the younger end of the age spectrum.

All respondents reported participation in marketing workshops, to be expected since the 1998 workshop participants represented the population of the survey. Twenty-one percent had participated in marketing clubs while 40% had attended commodity conferences. The average respondent had some college education and responses ranged from some high school education to postgraduate university studies. Over one third of the respondents (38%) had futures accounts with commodity brokers while less than 10% had arrangements with their bankers to cover margin calls.

Table 4.3 Descriptive Statistics of Questionnaire Respondents

		Acreage	Yields
Q 2	Corn	304.8	105
Q 2	Wheat	325	55
Q 2	Soybeans (Full Crop)	189	30
Q 2	Soybeans (Double Crop)	359	26
Q 2	Total Cropland	997	
Q 3	Age of the Pricing (Marketing) Decision Maker	47.5	
Q 4	Years Experience Making Pricing (Marketing) Decisions	19.7	
Q 7	Education Level of the Pricing (Marketing) Decision Maker	Some college	
Q 13	Respondents with a commodity broker	38%	
Q 14	Respondents with an arrangement to cover margin calls with a banker/lender	8%	
Q 15	Respondents that use a professional marketing consultant	9%	
Q 5	Participation rate in grain marketing clubs	21.7%	

		December Corn	November Soybeans
Q 17	Minimum futures price that puts you in the top 1/3 of historic prices	$2.74	$6.30
Q 18	Percentage of crop you would price prior to harvest given a price in the top 1/3 of historic prices.	56%	59%

Question 6	**The Use of Various Pricing Tools**	
Pricing Tool	**Corn**	**Soybeans**
Cash forward contracts	90.5 %	95.7 %
Futures contracts	33.3 %	34.8 %
Options contracts (buy puts)	23.8 %	26.1 %
Minimum price contracts	9.5 %	17.4 %
Basis contracts	42.9 %	47.8 %
Complex method	19.0 %	30.4 %
Selective hedging	14.3 %	17.4 %
Write options (sell puts and calls)	14.3 %	17.4 %
Other	14.3 %	13.0 %

Question 8 and 9	0=not used 1=very ineffective ←----------→ 5=very effective	
	Rank Pricing Tools According to Price Enhancement avg response	Rank pricing tools according to price risk protection avg response
Cash forward contracts	3.91	3.82
Minimum price contracts	3.00	3.71
Futures contracts	2.75	2.75
Options contracts (buy puts)	3.33	3.71
Deferred pricing	3.29	2.00
Basis contracts	3.38	2.54
Selective hedging	2.67	2.67

Question 10	**Concerns with Futures Markets**
1=strongly agree <=> 5=strongly disagree	**Avg. Rating**
a) I am encouraged by my lender to market using futures	3.35
b) I am hesitant to take a position in the futures market because of the possibility of margin calls.	2.52
c) Credit for margin calls on futures positions is readily available	3.22
d) I am hesitant to take a position in futures because of the variability in the weather	3.09
e) I have a good understanding of how to use the futures market to hedge my production.	3.09
f) I have sufficient knowledge of options to use them should the opportunity arise.	3.13

Question 11	**Pricing Objectives by Importance**
5=very important <=> 1=not important	**Average**
a) Selling in the top 1/3 of the price range.	4.65
b) Reducing the possibility of receiving a low price.	4.39
c) Managing my income for tax purposes.	2.70
d) Providing for my cash flow needs.	4.35
e) Selling some grain at a price higher than my neighbor.	1.26
f) Getting a price which provides a margin above my cost of production.	4.83

The cash forward contract was by far the most popular pricing tool, used by over 90% of the respondents. The basis contract was the next most commonly used pricing tool,

used by 45% of the respondents. Futures contracts were employed by 34% of those surveyed and options were used by 25%. The remaining pricing tools (writing options, minimum price contracts, selective hedging and other) were used by less than 20% of those responding. By contrast, 73% of the Midwestern grain producers in the Patrick and Eckman studies reported using futures or options as part of their marketing activities.

Questions 8 and 9 ask the survey participant to rank the effectiveness of the various pricing tools using a scale of zero to five where five means the tool is very effective and one means the tool is very ineffective and zero means the tool was not used. The cash forward contract was perceived as the most effective tool at both price risk reduction and price enhancement. Minimum price contracts and options contracts (buying puts) ranked just below the cash forward contract in terms of price risk protection. The remaining tools (futures, deferred pricing, basis contracts and selective hedging) rank in the ineffective half of the scale for providing price risk protection.

Figure 4.1 plots the average responses to questions 8 and 9 and indicates that there is little difference between the perceived effectiveness for risk reduction or price enhancement in the cash forwards, futures, and selective hedging pricing tools. There does seem to be some perceived differences in the minimum price, deferred pricing and basis contracts. Table 4.4 presents the p-values of a paired t-test comparing the effectiveness in price enhancement against the effectiveness of price risk reduction for the various tools and the p-values of a two-tailed T test against a hypothesized mean of three. The null hypotheses are given in equations one and three, and the test statistics are given in equations two and four.

Equation 1.

$$H_{\varnothing}: \ \overline{x}_{\text{price enhancement - Q8}} = \overline{x}_{\text{price risk reduction - Q9}}$$

Equation 2.

$$t = \frac{\overline{x} - \overline{y}}{\left\{\left[\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}\right]\right\}^{1/2}}$$

Equation 3.

$$H_{\varnothing}: \ \overline{x}_{\text{price enhancement - Q8}} = \overline{x}_{\text{price risk reduction - Q9}} = 3$$

Equation 4.

$$T_{n-1} = \frac{\overline{X} - 3}{S / \sqrt{n}}$$

Figure 4.1 Producer Perceptions of the Effectiveness of Various Pricing Tools

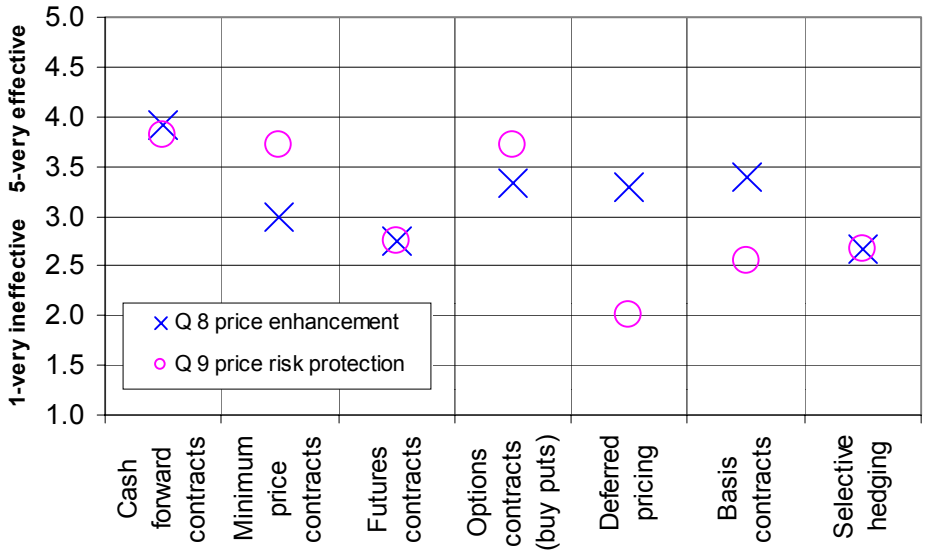


Table 4.4 Paired T-Test comparing Effectiveness of Price Enhancement v. Price Risk Reduction

	Paired T Test Q8 *vs* Q9	Z Test mean <> 3 Question 8	Z Test mean <> 3 Question 9
Pricing tool	p-values	p-values	p-values
Cash forward contracts	0.540	0.00	0.001
Minimum price contracts	0.135	1.00	0.02
Futures contracts	1	0.30	0.40
Options contracts (buy puts)	0.056	0.15	0.22
Deferred pricing	0.104	0.18	0.003
Basis contracts	0.024	0.20	0.09
Selective hedging	1	0.4	1.00

There doesn't appear to be strong feeling on the part of the producers that the pricing tools are effective or not for price enhancement other than for the cash forward contract. The options, basis and deferred pricing tools are rated slightly effective, the minimum price contract falls in the middle and the selective hedging and futures tool fall towards the

ineffective end of the scale. There appears to be a stronger sentiment for the effectiveness of the tools for providing price risk protection. The cash forward and minimum price contracts rank in the high threes for effectiveness, while the basis contract rates in the ineffective end of the scale as theory would suggest. The remaining tools rank in the middle of the scale.

The development of a written marketing plan was a major theme of the price risk management workshops conducted in early 1998. The workshop focused extensively on market price analysis and the costs of production that should be examined in producing a marketing plan. A written marketing plan for corn and soybeans was developed as a group exercise as part of the workshop. As Table 4.5 indicates, 96% of the participants wrote down the suggested pricing strategies that were developed in the workshop. Only 23% of the respondents indicated that they had a written marketing plan for the 1998 corn and soybean crops, but 61% of the respondents indicated that they made an effort to implement the suggested pricing strategies. The Eckman, Patrick and Musser study indicated that 45% of Midwestern producers used written marketing plans in their farming operations.

Those producers who tried to implement the pricing strategy developed during the workshop were asked to answer question 24, which sought to identify difficulties that may have been experienced in implementing the suggested pricing plan. Yield risk was the largest difficulty the producers had in implementing a pricing activity. It would have been interesting to have a question to examine the extent to which crop insurance was employed to guard against yield risk. Producers were concerned about not being able to fulfil their contractual obligation with either physical delivery in the case of cash forward contracts or futures losses from hedging activities.

Table 4.5 Producer Responses to Written Marketing Plan Questions

	Yes
Q 19 Did you have a written pricing plan for Corn and Soybeans to be harvested in 1998?	23%
Q 20 Did you write down the suggested pricing strategies presented in the workshop?	96%
Q 21 Did you make an effort to implement the pricing strategies during 1998?	61%
Question 24 Difficulties in implementing the suggested pricing plan	
	Average
1= very difficult <=> 5= no difficulty	
a) I didn't have easy access to daily futures prices	4.54
b) I was hesitant to price at the target levels because I was concerned prices were going higher.	3.43
c) I was concerned about poor yields and being unable to fill contracts.	2.43
d) I didn't have an account with a futures broker.	3.38
e) My banker was concerned about trading futures and options.	4.08
f) Prices were not high enough to satisfy me.	2.50
g) Option premiums were too high to justify their purchase.	2.69
Question 26 Reasons why you didn't attempt to implement the suggested pricing strategy	
1= strongly agree <=> 5= strongly disagree	average
a) I chose to develop and follow my own pricing plan	2.57
b) I am not comfortable trading futures and options.	1.63
c) I didn't have a futures trading account, nor did I want the hassle of setting one up.	1.75
d) I didn't want to explain the use of futures and options for hedging to my banker.	2.86
e) My expectations were that higher prices were yet to come and that I would benefit more by waiting.	3.00
f) Getting daily market information and finding what is pertinent to my situation takes too much time.	3.63
Question 27 Producer opinions about pricing	
1= strongly agree <=> 5= strongly disagree	average
I believe that pricing using futures and options will increase my returns in general.	2.00
I believe that pricing using futures and options will reduce my risk (lower the variability of my total returns over the long run).	2.00
I would rather give up some opportunities at higher prices to protect against receiving lower prices.	2.14
I believe that my time and effort is better spent on production concerns so I spend more time concentrating on production than on pricing.	3.57
I am more likely to use pricing tools to manage price risk during periods of above average prices.	3.05
Profits and losses are inevitable so my risk is managed effectively by maintaining a high level of equity.	3.18

Another difficulty voiced by the producers was committing to the marketing strategy and pricing some percentage of the crop at the current market price. There may seem to be some disparity between the answers given for questions 24b and 24f, but the disparity is not necessarily there. Question 24b indicates that producers are willing to give up some upside potential that higher prices offer to remove the downside risk of lower prices. Question 24f indicates that producers are acutely aware that the profit margins for most field crops are

frequently razor thin to non-existent, as evidenced by the pricing tool from chapter two. The range of prices at which producers make a profit represents a small area of the historical price distribution. Producers are aware that they are doing well when they cover all of their expenses for the year and make a small profit. Question 24f indicates that they would be more satisfied if prices were higher according to the fundamental law of economics that more is better, while 24b indicates that they are not banking on prices going higher, but will forsake that potential to remove the downside risk. Question 24g indicates that producers were also concerned that option premiums were too high to justify their purchase.

The respondents seemed to experience very little to no difficulty in gaining access to good market information. This is not at all surprising in this new information age. There is so much information available via the internet that producers might experience greater difficulty in filtering and sorting through the data that is pertinent to their particular situation than in finding the data. Asking whether the internet is used to access market information and prices and the most popular sites used would make an interesting survey question for the future.

Producers who did not attempt to implement the pricing strategy developed during the workshop (47%) were asked to answer question 26, which explores reasons for not attempting to implement the plan. The main reason given was a lack of comfort and confidence in trading futures and options. There is a natural reluctance and hesitation to use a tool that is new and unfamiliar. Trading futures or options would also require an extra administrative duty in both setting up an account with a brokerage and the additional administrative duties that come with maintaining an account. The other responses, explaining margin calls to the banker, developing a different pricing plan, and waiting for higher prices did not evoke strong responses either positively or negatively from the group that didn't try to implement the plan. These reasons may have had some effect but they were not the major reason the plan was not attempted. The major reason for not attempting to implement the workshop pricing strategy was a general reluctance to use futures or options experienced by some producers.

The survey participants were asked to share their opinions about making pricing and marketing decisions in question 27. The producers participating in this survey seem to hold the belief that using futures and options will increase their returns in general and will decrease the variability in total returns over the long run. They also seemed to acknowledge that marketing activities are as important a part of operating the farm business as the

production aspects. For the business to do well, it is important to have good production skills as well as good marketing skills. The equity level of the farm operation did not seem to play a role in the way risk is managed

All of the respondents to this questionnaire fall into one of two categories according to the response given to question 21. Everyone attending the marketing workshops participated in the development of a written marketing plan as part of a group exercise. 96% of the respondents reported that they wrote down the suggested plan. Only 61% of those responding indicated that they made a good faith effort in implementing the plan during the 1998 marketing year. The total sample population was divided into two subsets based on the response to question 21 (those who attempted to implement the developed pricing plan and those who did not) and these two population subsets were examined for both differences and similarities.

The two subsets exhibited no statistical difference in age, years experience in making marketing decisions, education level or in total cropland farmed. Table 4.6 summarizes the results of T-tests for differences in the means of the two population subsets. The test statistic is explained in the appendix of test statistics.

Table 4.6 Differences Between Questionnaire Responses Given Population Subsets

		Attempted to Implement Plan	Did Not Attempt to Implement Plan	P-value of T-Test for significant differences
Q 2	Total Cropland (acres)	1,036	1,037	0.857
Q 3	Age of the Pricing (Marketing) Decision Maker	45.2	51	0.342
Q 4	Years Experience Making Pricing (Marketing) Decisions	20.9	18.9	0.714
Q 7	Education Level of the Pricing (Marketing) Decision Maker	4.8[1]	4.5[1]	0.584
Q 17	Estimate of Minimum Corn Price in Top 1/3 Historic Distrib.	$2.74	$2.71	0.776
Q 17	Estimate of Min. Soybean Price in Top 1/3 Historic Distrib.	$6.43	$6.08	0.211
Q 18	Percentage of Corn willing to hedge given price in top 1/3	57.2%	53.1%	0.740
Q18	Percentage of Soybeans willing to hedge given price in top 1/3	62.5%	51.9%	0.168
Q 10	**Concerns with Futures Markets** 1=strongly agree <=> 5=strongly disagree	**Avg. Response**	**Avg. Response**	**P-Value**
A	I am encouraged by my lender to market using futures	3.2	3.78	0.207
B	I am hesitant to take a position in the futures market because of the possibility of margin calls	2.53	2.44	0.865
C	Credit for margin calls on futures positions is readily available	3.00	3.44	0.287
D	I am hesitant to take a position in futures because of the variability in the weather	3.40	2.50	0.029
E	I have a good understanding of how to use the futures market to hedge my production.	2.67	3.89	0.017
F	I have sufficient knowledge of options to use them should the opportunity arise.	2.60	4.11	0.001

[1] Average score in education level 4.8 and 4.5 mean some post high school education (trade/vocational school or some college experience)

Q 11	**Question 11 Pricing Objectives by Importance** 1=not important ← - - → 5=very important	**Attempted to Implement Plan**	**Did Not Attempt to Implement Plan**	**P-value of T-Test for significant differences**
A	Selling in the top 1/3 of the price range.	4.93	4.22	0.089
B	Reducing the possibility of receiving a low price.	4.47	4.33	0.716
C	Managing my income for tax purposes.	2.73	2.78	0.940
D	Providing for my cash flow needs.	4.20	4.44	0.484
E	Selling some grain at a price higher than my neighbor.	1.27	1.22	0.862
F	Getting a price which provides a margin above my cost of production.	4.73	5.00	0.104
Q 6	**Question 6 The Use of Pricing Tools**	**Attempted to Implement Plan**	**Did Not Attempt to Implement Plan**	
	Cash forward contracts	92%	89%	
	Minimum price contracts	54%	0%	
	Futures contracts	38%	0%	
	Options contracts (buy puts)	15%	0%	
	Deferred pricing	46%	44%	
	Basis contracts	23%	11%	
	Selective hedging	23%	0%	
	Other	0%	33%	

As the p-values indicate, the group that did not attempt to implement the plan was more concerned about the weather variability and the associated yield risk than the group that tried to implement the plan. The group that attempted the plan was significantly more confident in their understanding of futures and options and in constructing hedges using these tools than the group not implementing the plan. Perhaps this group was less concerned with weather variability and yield risk because they might also be hedging this risk as well with crop insurance. It would have been useful to have included a question that explored the use of crop insurance as a tool for mitigating yield risk in the questionnaire.

Question 11 yielded some inconsistent differences between the two populations. Selling in the top third of the price distribution was statistically more important to the group that tried to implement the plan indicated than it was to those not trying to implement the plan. The responses to question 11f indicate that getting a price above the costs of production was more important to the group not implementing the plan. Both pricing objectives are obviously important to both groups as evidenced by average responses of 4.2 or greater. These statistically significant differences are more a function of the measurement scale used to quantify the answers than actual differences in pricing objectives between the two groups. The responses appear different because there was very little or no variation in the responses by one group or the other in these two questions and the resulting small

variances resulted in small standard errors which in turn yielded large test statistics and small p-values. If the populations were larger, more variation might be detected and the differences in pricing objectives would not be significant.

The most important difference between the group that attempted to implement the plan and the group that did not can be seen in the use of the various pricing tools. As Table 4.6 indicates, the producers who did not attempt to implement the plan had never used futures or option contracts or minimum price contracts. Nearly every producer has used cash forward contracts and nearly half of each group has used basis contracts. Every pricing tool in table 4.6 was used by someone in the group that tried to implement the suggested pricing plan except for the "other" category. The group that did not attempt to implement the plan used only the cash forward and basis contracts and the one response in the complex method is the result of a loose definition of "complex method" as the use of two or more pricing tools. (i.e. cash forward and basis contract) Those who answered "other" failed to provide any additional details.

Another big difference between the groups that tried and did not try to implement the pricing plan can be seen in the percentage of their crop they were willing to hedge prior to harvest. Figures 4.2 and 4.3 illustrate the timing and percentage of the crop hedged for corn and soybeans. The percentage of the crop hedged is a straight average for all producers in each group who answered this question. As these figures illustrate, the group that attempted to implement the suggested marketing plan priced a much higher percentage of their crops than the group the didn't try to implement the plan. The group attempting to implement the plan have very similar activities for both corn and soybeans in terms of the timing of the pricing and the percentage of the crop hedged.

Figure 4.2 Soybeans
Timing of Marketing Decisions for Those Who Tried to Implement Developed Marketing Plan vs. Those Who Made No Effort

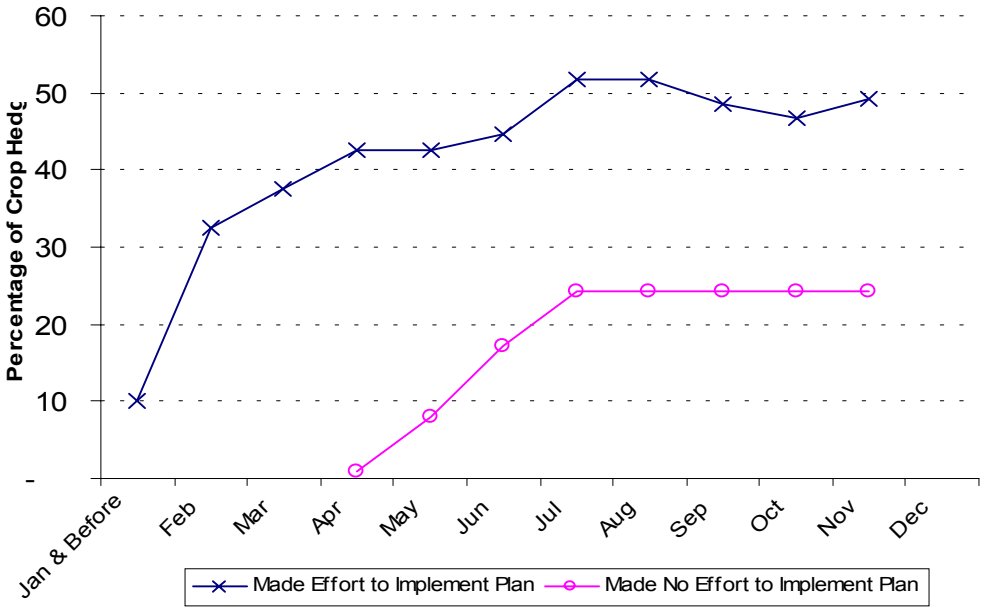
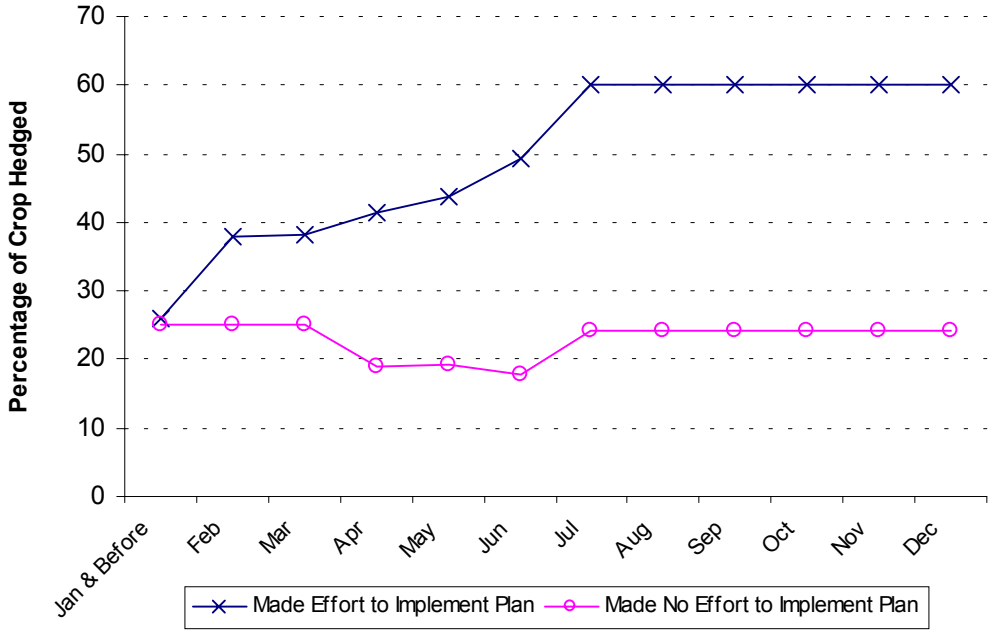


Figure 4.3 Corn
Timing of Marketing Decisions for Those Who Tried to Implement Developed Marketing Plan vs. Those Who Made No Effort



The group that did not try to implement the plan showed similar behaviors across the two crops in terms of percentage of crop hedged. Only 25% of the crop appears to have been priced prior to harvest. Corn was hedged well before the crop was planted but soybeans were not priced by this group prior to May. The questions upon which figures 4.2 and 4.3 are based asks the participants to "Please describe your pricing activities for 1998 crop corn [and soybeans] during the period January 1, 1998 until harvest." (questions 22 and 23 see appendix for the complete questionnaire) Cash market sales at harvest did not appear on any of the questionnaire responses from either group. While not explicitly expressed in the questionnaire results, the unhedged crop might be marketed as spot cash sales at harvest, unhedged storage, or for use as feed or seed on the farm. The group of producers who did not attempt to implement the developed pricing plan faced a great deal of price uncertainty for a very large percentage of their crops. The group that chose to attempt the developed pricing strategy priced a much larger percentage of their crops prior to harvest and as a result, face much less price uncertainty and should experience much less revenue variability assuming of course expected yields are met and contracts can be fulfilled.

Conclusions

The producers who participated in this questionnaire exhibited a wide variety of marketing attitudes, activities, and concerns regarding pricing decisions in the face of uncertainty and risk. The variation in responses is not surprising for several reasons. First, there are several types of risk being faced by the producers, primarily price and yield risk, but also basis risk and institutional risk. Each of these types of risk can be effectively managed with the tools discussed in this chapter with the exception of institutional risk, which typically works in the favor of the producer in the form of government aid and assistance. Each of the risk mitigating tools (forwards, futures, basis contracts and yield insurance) is effective in reducing only one of the types of risk facing producers. Depending on the particular situation for any given farm, the producer may need to use tools to hedge against all three types of risk (price, yield and basis). Each risk mitigating tool has a cost associated with its use. Cash forwards and futures remove the downside risk by also removing the upside. Options and yield insurance require cash outlays in the form of

premiums to remove the downside risk while keeping the upside potential for higher prices. Basis contract will typically have a built in margin for the elevator that acts as a premium. Each individual producer must decide whether the price protection associated with a particular pricing tool is worth the cost. In early 1998, those producers who opted to price their crop early benefited from the higher prices offered by the market in 1998.

The producers that participated in this study represent a diverse group in terms of personal characteristics as well as the characteristics of their farming operations. Anderson and Mapp say of the clientele in Risk Management Programs in Extension "Research and extension programs must meet the needs of a broad audience. Each audience normally has a wide range of ages, financial positions and personal objectives. Each person has a different set of factors influencing his/her decision process."[2]
The responses in the questionnaire certainly lend support to that statement.

One of the most startling observations of the questionnaire results and perhaps the most significant finding is the disparity in the use of futures and options between the group that tried to implement the developed plan and the group that did not. Those that tried to implement the pricing plan had experience with in using a greater variety of pricing tools. The group that did not attempt to implement the plan had no experience in the use of futures or options contracts. As producers achieve a greater comfort level with the various pricing tools available, the number of pricing options increases resulting in greater flexibility and optionality in developing a marketing plan that is adaptable to a variety of market conditions. An understanding of the marketing tools available provides greater flexibility for the financial management of the farm.

There were no significant demographic differences between the group that attempted to implement the plan and the group that did not attempt to implement the plan. The average cropland between the two groups differed by only one acre (1,036 *vs.* 1,037 acres). There were no significant differences in age, years of marketing experience, education level, willingness to hedge or price expectations. The demographic of the survey participants are very similar to the characteristics of the Shapiro and Brorsen survey participants.

Another significant finding in this producer survey concerns the timing of the marketing decisions. The two groups of interest were those who attempted to develop the suggested plan and the group that did not. Those attempting to implement the plan hedged

a larger percentage of their corn and soybeans and marketed their soybeans earlier in the year. The general conclusion that can be drawn from these findings is that the group that attempted to implement the suggested pricing plan is better at marketing than the group that did not. The question that arises is how to help those who did not attempt to follow the marketing plan become better at marketing. This goal should be to increase their understanding and confidence in using marketing tools such as futures and options, as well as giving the activity of marketing a higher priority in the administration of the farm business.

The main reason for not using futures and options that was given by the group not attempting to implement the developed plan was a lack of knowledge and understanding in the use of futures and options. Extension has been providing educational materials and workshops and other outreach programs in an effort to educate producers about the use of futures and options as risk management tools and the features of these tools. While these techniques are good, one drawback is that the exposure to the material, managing risk, is short in duration and requires the producer to continue the learning process on his own time after the seminar or workshop is over. There are so many things competing for a producer's time that finding this extra time for learning about new risk management tools is difficult, particularly if the producer has little knowledge in the features and uses of these tools. The greater the producer's familiarity with the pricing tools, the greater the likelihood that the producer will incorporate them into their marketing activities. One of the key tasks of extension educators should be to increase the knowledge and level of understanding of the different tools for managing risk for all producers.

One approach for teaching and learning about risk management that was mentioned by several of the participants in the workshop is the formation of marketing clubs. These marketing clubs have been employed in other areas and give the participants a chance to get experience trading futures and options. Marketing clubs have the added advantage of shorter classes held over longer time periods. The marketing clubs could be conducted by local extension agents that specialize in farm business management who could be available to help answer questions and to implement the programs.

Another approach that could be beneficial in several ways would be to make marketing and risk management top priorities in the high school agricultural curricula, through vocational classes, 4-H clubs, or the Future Farmers of America. First, the equation

[2] "Risk Management Programs in Extension" Journal of Agricultural and Resource Economics 21 (1) p.35

for revenue is basically *Yield (Production) x Price (Marketing) = Revenue*. As the equation indicates, marketing represents one half of the equation. As such, the importance of marketing and risk management should be emphasized and stressed right from the beginning. As part of a high school curriculum, the material could be presented at a steady pace throughout the school year and across several years. Targeting a high school audience assures in effect a captive audience. Another advantage that the high school approach might offer is the diffusion of knowledge into farm households who would otherwise never attend the programs offered by the Cooperative Extension. For every producer who attends a program sponsored by extension, there are many more who do not attend. Those who attend these programs are by virtue of their attendance more proactive in increasing their knowledge and skills. The existing format of programs and seminars is already effective at reaching the group that will attend such programs. Reaching the group that does not otherwise attend these types of programs is a more difficult challenge. Targeting producers at their own dinner tables through their children could bring marketing and risk management to the forefront of their conscience. Parents may decide to attend an educational seminar because their appetite for the subject has been whetted. College education in the business side of farming is vital for a successful farm operation. College training in futures and options, risk management, price analysis and finance are just some of the tools that are going to be necessary to be a successful in pricing and marketing grain.

Advancements in technology will continue to create new alternatives for accessing information resources. The internet has the potential of extending the classroom to every home in the country. The price risk management workshops examined in this thesis might lend themselves to different presentational formats. The workshop could be broadcast over the internet with conference call tie ins to alleviate time and distance constraints on attendance. Further, since the internet makes distance largely irrelevant, there is the potential for regional or even national collaboration among the experts in the various subject areas to produce a set of seminars. Extension researchers could collaborate to produce a seminar series in which experts in grain production for instance cover the whole range of issues that concern the grain producer. One seminar could be on production techniques, another on marketing and risk management, another on government policy and programs for grain, legal issues relating to wetlands, taxes, estate conveyance and suburban encroachment, and the list could go on.

Chapter 5

Conclusions

This thesis is comprised of three separate but related projects designed to assist grain and oilseed producers in developing and evaluating market price expectations and conducting scenario analysis over a range of prices and yields. Producer feedback is sought and analyzed through a survey that examines the preferred pricing tools and price risk management strategies that were used in marketing the corn and soybean crops. Providing helpful information to producers is the primary goal of this project.

The "Break-Even Costs Program" is a useful tool that enables the Virginia grain and oilseed producer to evaluate the financial impacts of various price, yield and acreage scenarios. The research objective was to develop a spreadsheet program that is flexible so that each user can model the costs and acreage distributions representing his or her own farm. The user can play with the price and yield inputs and immediately see the impact different price, yield and acreages have on the gross and net farm returns. The program was made available to producers in late 1998 and has been well received in anecdotal evidence by producers, extension and private consultants.

The second part of the thesis examines price distributions of December corn and November soybean futures prices. The goal of this research was to provide a context from which to evaluate the likelihood of receiving prices above or below a particular level. Two different techniques are used to quantify the determinants of futures prices, histogram analysis and statistical models. Ending stocks as a percentage of total use is a key variable and conditional distributions based on the stocks to use ratio are constructed, evaluated, and presented in histogram form. It was hypothesized that the different corn and soybean price distributions would have significantly different means and variances. The means and variances were tested for equivalent means and variances and the null hypothesis was rejected. The distributions conditioned on lower stocks to use ratios had higher means and variances than the distributions conditioned on lower stocks to use ratios. Histograms were developed to illustrate these differences in distributions and they provide a quick and easy means of estimating the range of prices that are likely under different stocks to use ratios.

The development of corn and soybean statistical models was an approach that involved a more detailed examination of the factors that determine futures prices. The histograms examined the corn and soybean price distributions conditioned only on the ending stocks to use ratio while the statistical models incorporate several other explanatory variables to explain the variation in prices. The additional information from the extra explanatory variables in the statistical models was useful when the stocks to use ratios were towards the lower end of the scale. At the upper end of the stocks to use ratio scale, the additional explanatory variables in the statistical models did not provide any additional information beyond that conveyed in the conditional distribution histograms.

One potential extension of this research could be to include a pricing model such as the ones developed in chapter three into the Break-Even Costs Program (Chapter 2) or into a separate program that could be distributed to producers. Another extension of this research could involve automating the statistical model in a spreadsheet so that a new point estimate of price is generated whenever the values from an updated WASDE balance sheet are entered into the spreadsheet. This would enable price sensitivities to be analyzed over a range of supply and demand values from the WASDE balance sheets.

The third section of this thesis sought to find producer's thoughts and areas of concern with developing and implementing written marketing plans. A survey of producers participating in a three-day marketing seminar revealed that producers represent a diverse group in personal demographics, farm characteristics and marketing practices. The questionnaire focused heavily upon the use of written marketing plans and the pricing tools used market their production and the reasons behind the selection of a particular tool and marketing plan. The primary findings are that producers experience difficulty in using pricing tools such as futures and options when those tools haven't been used before. Producers who had used futures and options were much more likely to have used written marketing plans as a part of their pricing strategy.

Additional methods of making producers comfortable using futures and options need to be explored and tried. Some producers expressed an interest in marketing clubs as a means of becoming familiar and comfortable with using futures and options. The producers participating in the survey seemed to have a conceptual understanding of the risk management tools available, but the obstacle appears to be in putting these pricing tools into practice as part of a marketing strategy.

An interesting question to pose in future questionnaires might be one that examines how home computing and the use of the internet is used in facilitating the marketing and pricing decisions. .An interesting study might be to apply some traditional business school balance sheet analysis of representative Virginia grain farms and compare them other farms as well as with other small businesses that fall in a similar range of gross returns. Return on equity analysis could place the farms in context with other businesses and various financial management techniques among farms could be compared.

In summary, this thesis was undertaken with the premise of providing information and tools that a producer could use in managing his operation. When the three parts of this thesis are combined, the "Break-even Costs program" provides benchmark prices that are necessary to provide different levels of returns. The histograms and statistical models place those benchmark prices in a historical context in which the probability of receiving the benchmark price or better can be evaluated. The third part reviewed the use of written marketing plans and different pricing tools by producers. The goal was to aid producers in the marketing process by providing tools and analysis that are both simple to use and that provide useful information and analysis for making informed marketing decisions.

APPENDIX

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December Corn and November Soybean Futures Price Histograms

Histogram of Dec Corn Futures Prices 1980 - 1998
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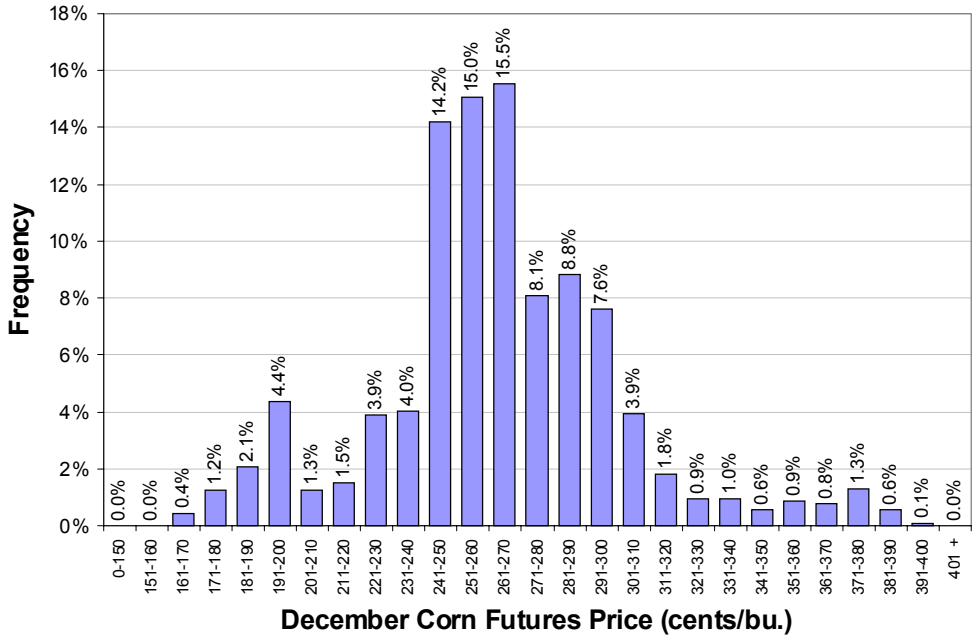

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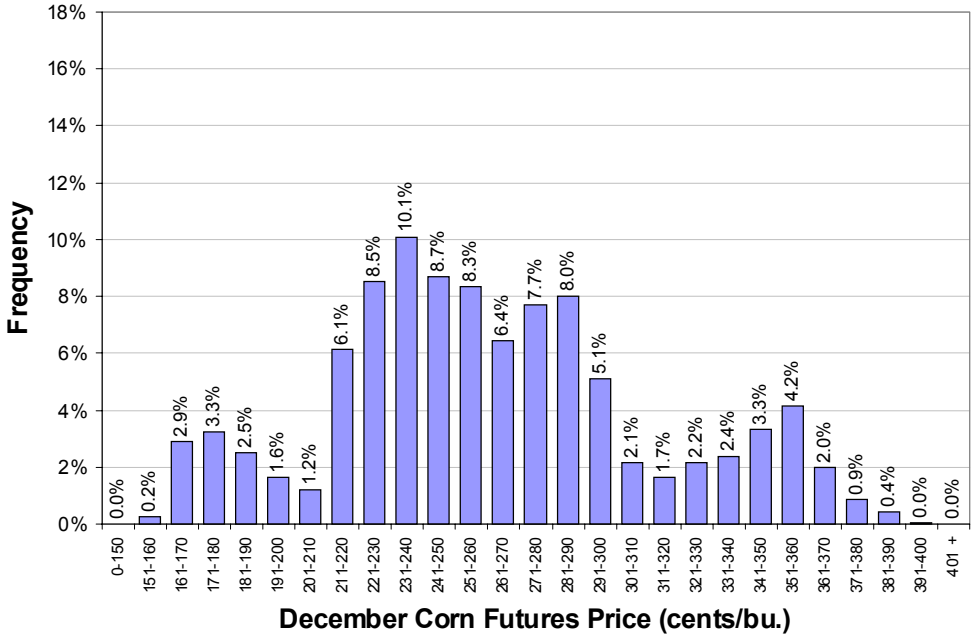

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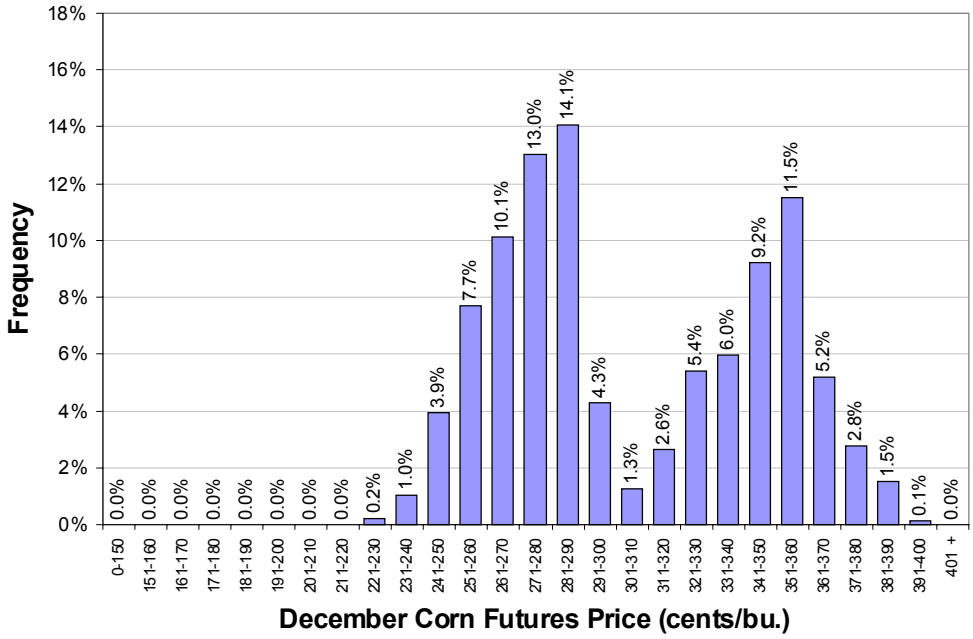

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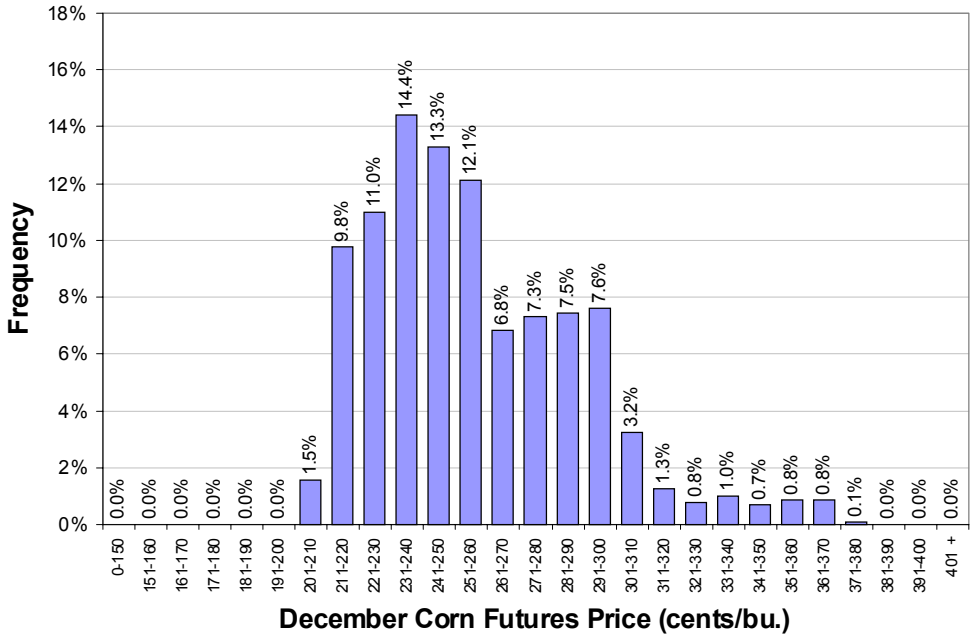

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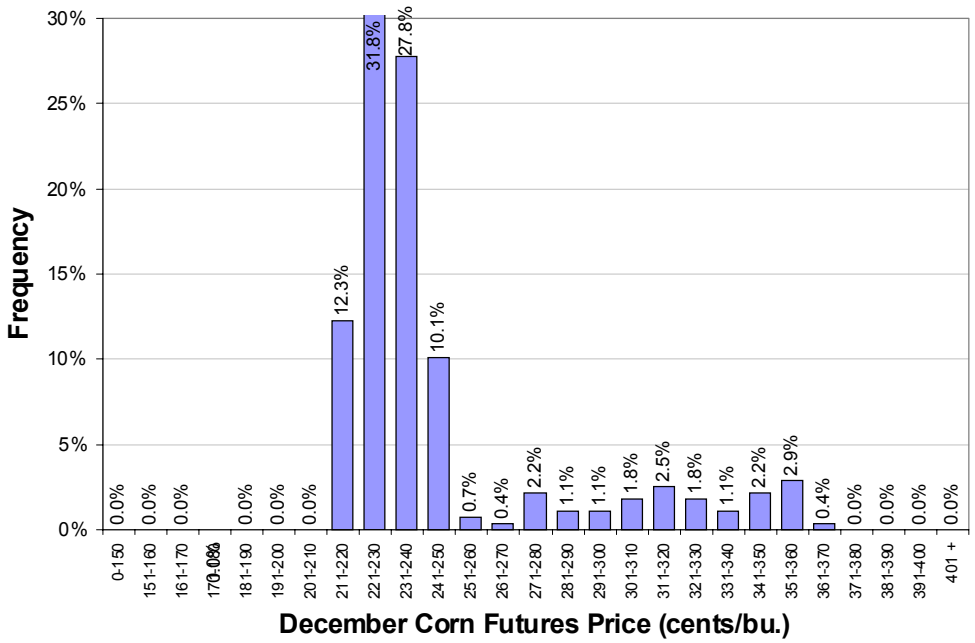

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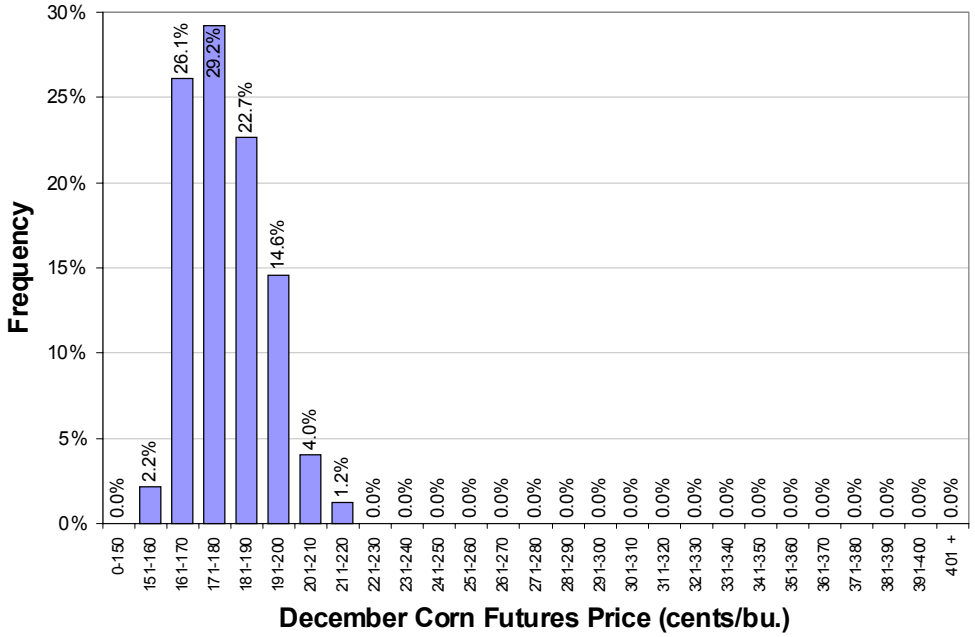

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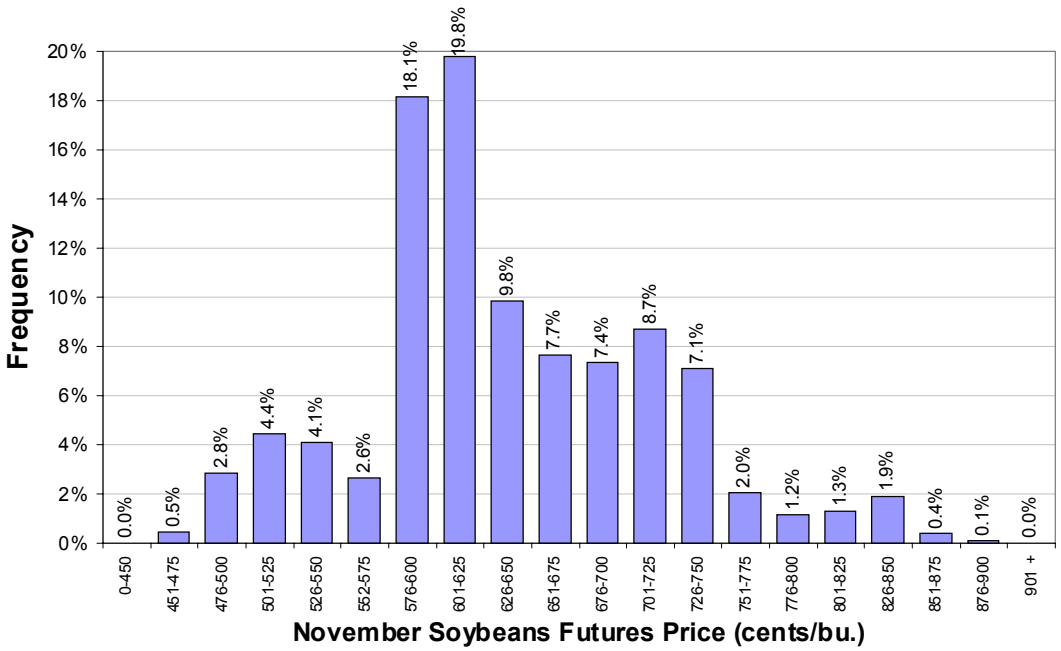

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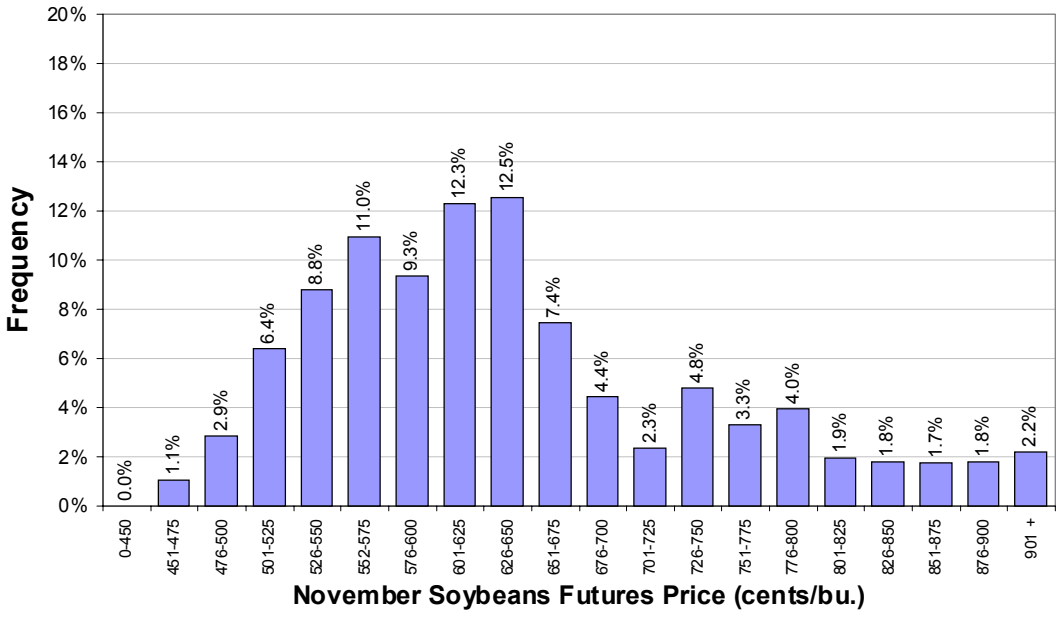

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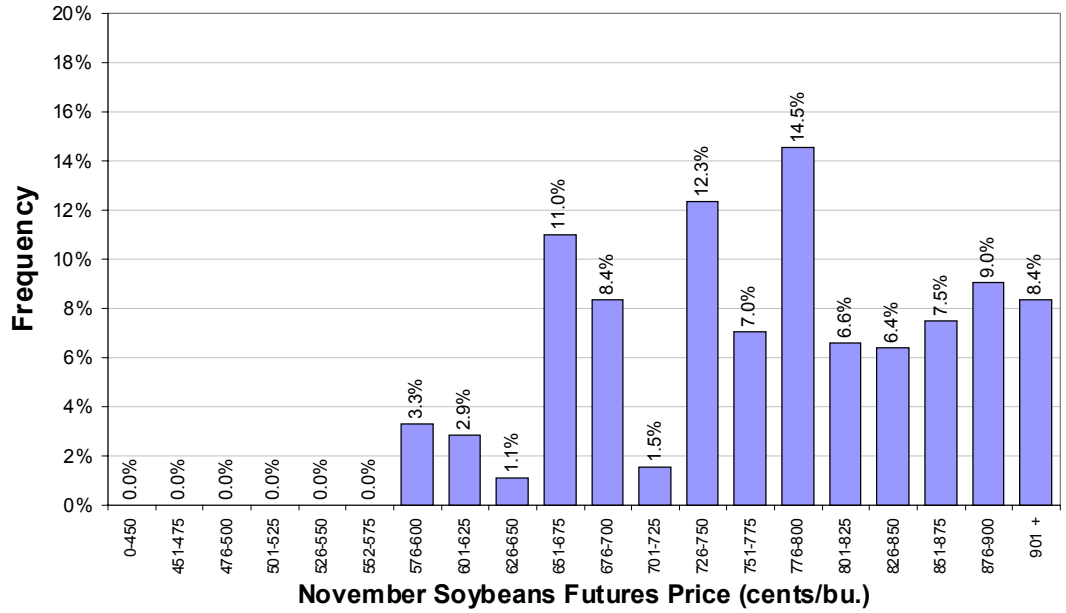

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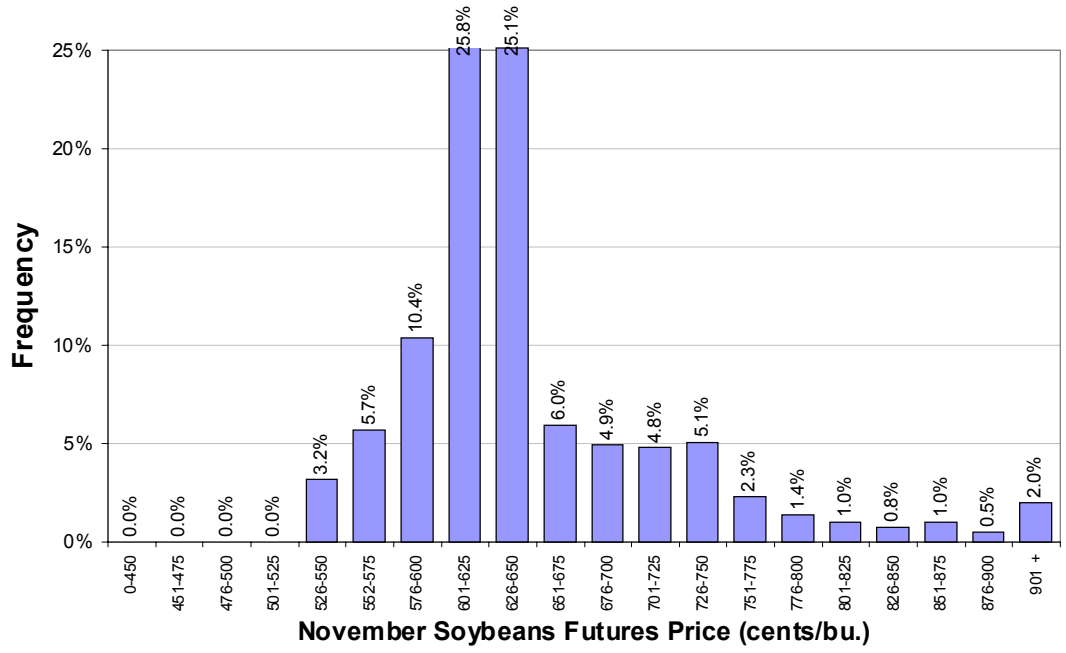

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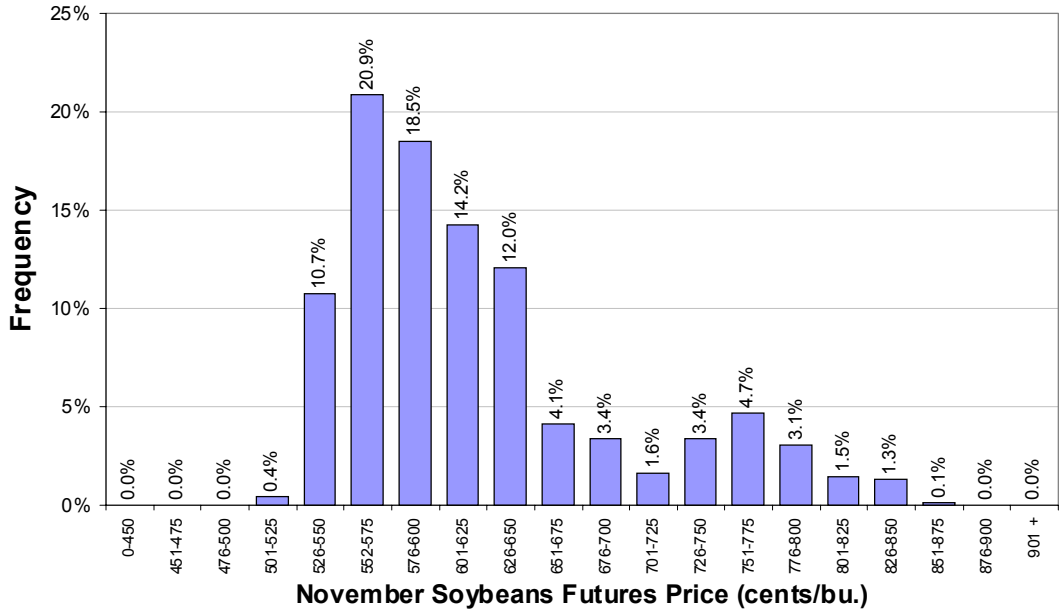

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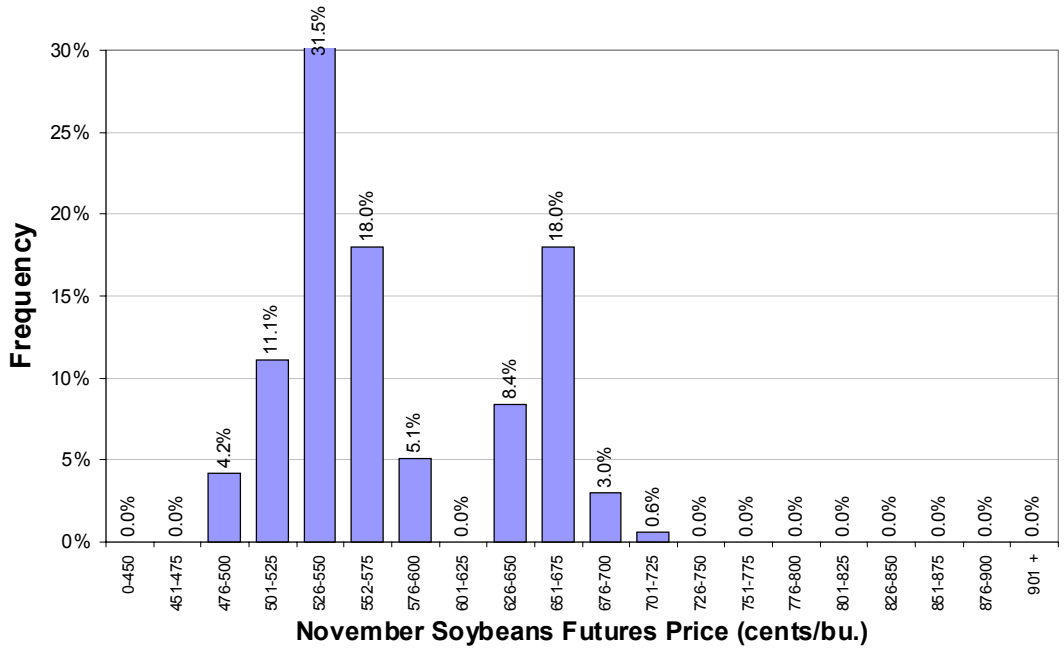

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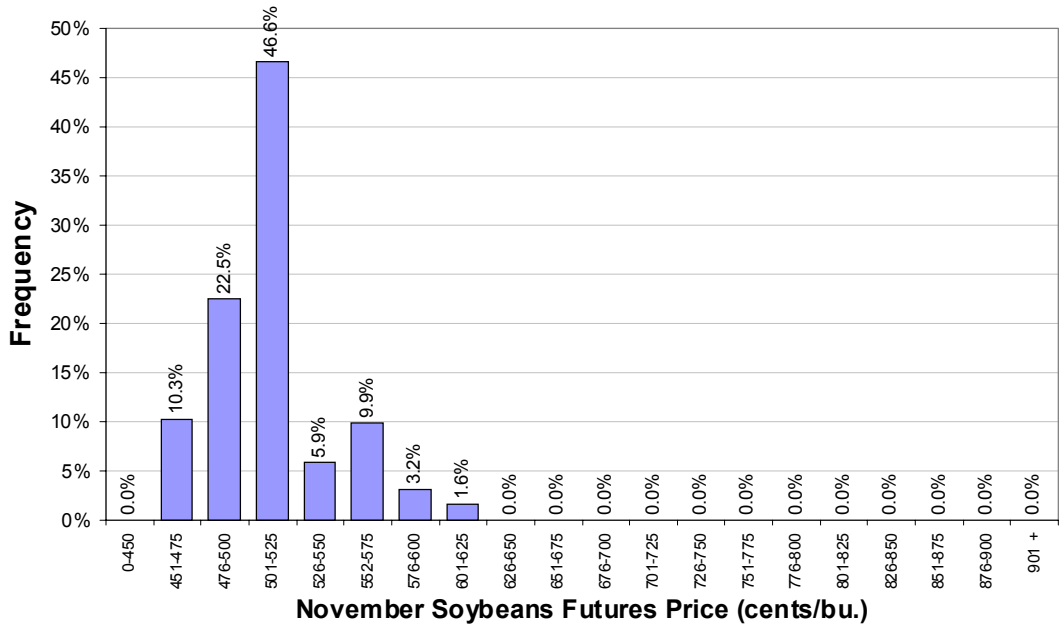

Corn and Soybean Pricing Survey for 1998 Crops