An Application of Risk Analysis: Localized Corn and Soybean Price Distributions

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The dilemma facing grain producers in the Midwest concerns the question of how to market grain under price and yield uncertainty. The advent of crop insurance and other means of protecting yields has addressed part of this dilemma. What remains in the further exploration and solution of the optimal marketing strategy under vastly different local price conditions. A number of authors have addressed this question. Purcell(1991); and others have investigated the optimal hedging strategies and the willingness of farmers to hedge under various conditions.

What remains the testing of marketing strategies under different conditions of price uncertainty. The author is involved in a multiyear study of localized price distributions in various regions of Minnesota. In a previous analysis for the 1998/99 year, results indicated that fitting of probability distributions to localized price data resulted in vastly different distributions. An update of these findings to the 1999/2000 years is incorporated in this paper. This paper extends this work by incorporating these price distributions in Excel spreadsheets to test their impact on marketing decisions.

Research on Localized Price Distributions

The behavior of futures prices has been studied in a thorough manner. Most of the research has concluded that futures prices fit a normalized distribution. The calculation of local grain prices involves knowledge of local basis which is not as well documented. Studies of local basis have been documented in several states(Dahl,1977;Quasmi, 1994 and Mastel et al, 2000). The integration of futures and local basis generated a local

price series which reflects quality of grain, transportation ,local supply and demand, competition for grain supplies and other factors. Purcell(1991, p.39) suggests that "location and related transportation costs are the primary reasons for basis levels in a particular market area. But there are other factors such as storage capacity, participation in government programs, weather at harvest, and the financial position of producers that will influence the level of cash-futures basis at a particular point in time in a particular market area" The author has chosen five regional sites to collect price data in Minnesota. These are Worthington(Southwest); Hutchinson(Central); Mankato(South Central), Crookston(Northwest); and Pine Island(Southeast). Observations were recorded by downloading local prices from electronic sites such as DTN and supplementing these with other information. This set of empirical data was fitted to standard distributions using BESTFIT by Palisade Co. The fitting of these distributions using 1999/2000 data is summarized in Table 1.

Table 1. Standardized Price Distributions

For Corn-Regional Locations In Minnesota

Location	Best Fit	Second Best Fit	Third Best Fit
Worthington	Uniform	Beta	Erlang
Hutchinson	Pareto	LogLogistic	Triangular
Mankato	Uniform	Beta	Extreme Value
Crookston	Uniform	Beta	Pearson VI
Pine Island	Uniform	Triangular	Beta

The price distributions were also estimated for soybeans during the same price period. The results of this fitting using BESTFIT are summarized in Table 2.

Table 2. Standardized Price Distributions for Soybeans - Regional Locations in Minnesota

Location	Best Fit	2nd Best Fit	Third Best Fit
Worthington	Extreme Value	Triangular	Beta
Hutchinson	Extreme Value	Beta	Triangular
Mankato	Extreme Value	Beta	Uniform
Crookston	Beta	Uniform	Extreme Value
Pine Island	Beta	Uniform	InvGaussian

The results of these distributions were expressed in specific parameters of each distribution. This form makes it possible to insert into Excel spreadsheets and the use of programs such as @Risk for MonteCarlo Simulations. The following section of the paper describes these early efforts.

Simulations Using Localized Price Distributions

Other researchers have attempted to use price distributions in their research. Ngamgoko et al(1997) in the *Journal of Farm Managers and Rural Appraisers* investigated various flexible cash rent alternatives using Illinois price distributions. The distributions chosen were triangular(corn)- parameters were $1.39-low, $2.53-mean, $3.48-high and LogNormal(soybeans)-parameters were $6.22 mean, distribution- 0.98. Yield distributions obtained from BestFit estimation were Weibull in nature.

The process of simulation involves the use of Excel spreadsheet uses a marketing plan adapted from Michigan State University(Risk Mg't Education website citation, 1999). The author inserted the top fitting distributions in the price cells to examine the revenue alternatives using different locations. The pattern of marketing consisted of selling by cash methods with 30% sold prior to March 15; 25% sold late spring/early summer; 20% sold at harvest; and 25% sold postharvest (Feb). These results are summarized in Table 3. The spreadsheet is shown in Figure 1.

Table 3. Revenue Calculations using local price/yield distributions

By Location

Commodity	Region	Parameters –Price Distribution	Revenue Estimates
Corn	Mankato	Beta- (1.40, 4.19)+1.40	
Soybeans	Mankato	Beta-(1.37,1.71)*1.14+3.91	$465-530,000
Corn	Crookston	Uniform(1.31,1.80)	
Soybeans	Crookston	Uniform(3.81,4.76)	$440-515,000
Corn	Pine Island	Uniform(1.29,1.92)	
Soybeans	Pine Island	Beta (1.32,1.88)*1.22+3.73	$470-535,000
Corn	Worthington	Beta (1,96,6.03)+1.31	
Soybeans	Worthington	Extreme Value(4.30,0.22)	$435-525,000

Summary and conclusions

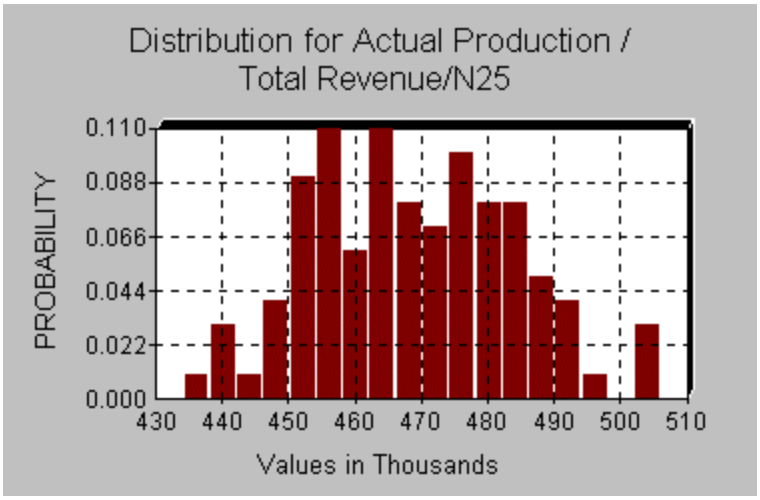
The results of this research study show that price variability as summarized in price distributions is very different in nature when viewing local areas within Minnesota. The author participated in a spatial study of basis by regional location one year ago and was able to identify this characteristic at that time. The effect on these distributions on the choice of marketing alternatives is that the combination of yield variability and local price variability will yield wildly diverse revenue results when viewd by regional location. This necessitates the use of contracting opportunities in regional locations such as the Northwest and Southwest where variability can be more problematic that areas such as South Central and Southeast Minnesota where rainfall and other climatic factors pose a less serious danger. The presence of extreme value distributions in the most weather sensitive areas also resulted in a wider dispersion of revenue as evidenced in Table 3.

Figure 1. Excel Spreadsheet with price probability Distribution

	A	B	C	D	E	F	G	H	I	J	
1		**Step 5:** Describe your plan									
2		**Corn:**		**Target**							
3		Pricing Period	Method(s) of contracting / sale	% Priced		Bushels		Price		Bushels Pric	
4				In Period	Cumulative to date	In Period	Cumulative to date	In Period	Cumulative to date	In Period	Cur to
5	1	Prior to March15		30%	30%	38,500	38,500	$1.70	$1.70	38,500	
6	2	Late Spring/ early summer		25%	55%	32,100	70,600	$1.70	$1.70	32,100	
7	3	Harvest		20%	75%	26,000	96,600	$1.70	$1.70	26,000	
8	4	Post-Harvest(Feb.)		25%	100%	31,900	128,500	$1.70	$1.70	31,900	
9											
10							Acres		Bu/acre		
11				Actual Production			1000	x	128.5	128,500	
12				Total Bushels needed to fill pre-harvest contracts						70,600	
13				Bushels needed to buy back to meet contract						0	
14				Net cost to buy back bushels to fill contract needs						$0.00	
15											
16		**Soybean:**		**Target**							
17		Pricing Period	Method(s) of contracting / sale	% Priced		Bushels		Price		Bushels Pric	
18				In Period	Cumulative to date	In Period	Cumulative to date	In Period	Cumulative to date	In Period	Cur to
19	1	Prior to March15		30%	30%	12,700	12,700	$4.49	$4.49	12,700	
20	2	Late Spring/ early summer		25%	55%	10,600	23,300	$4.49	$4.49	10,600	
21	3	Harvest		20%	75%	8,500	31,800	$4.49	$4.49	8,500	
22	4	Post-Harvest(Feb.)		25%	100%	11,200	43,000	$4.49	$4.49	11,200	
23											
24							Acres	x	Bu/acre		
25				Actual Production			1,000		43.0	43,000	
26				Total Bushels needed to fill pre-harvest contracts						33,200	

Figure 2. Revenue Distributions Using BestFit Price Distributions

Crookston:



Hutchinson:

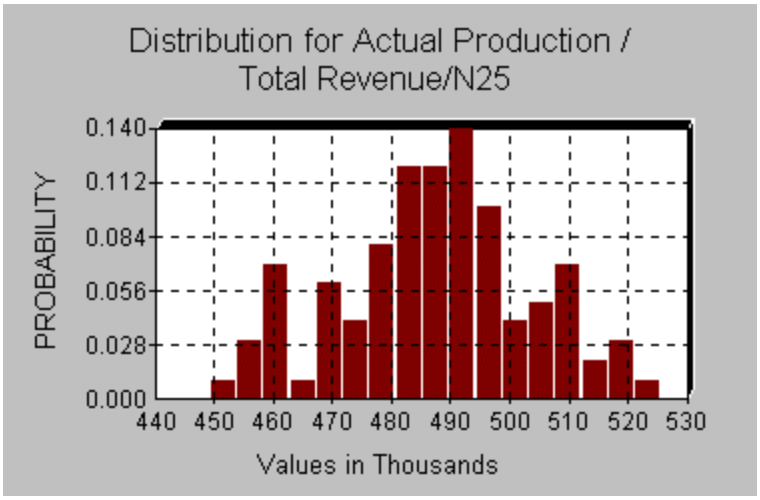
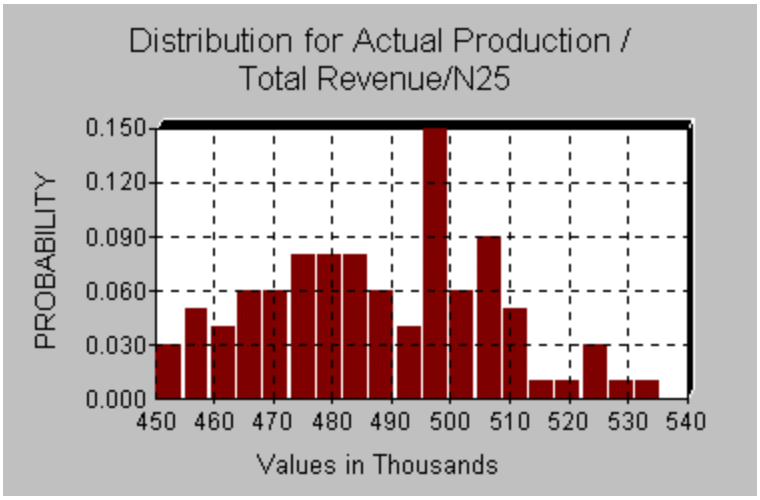
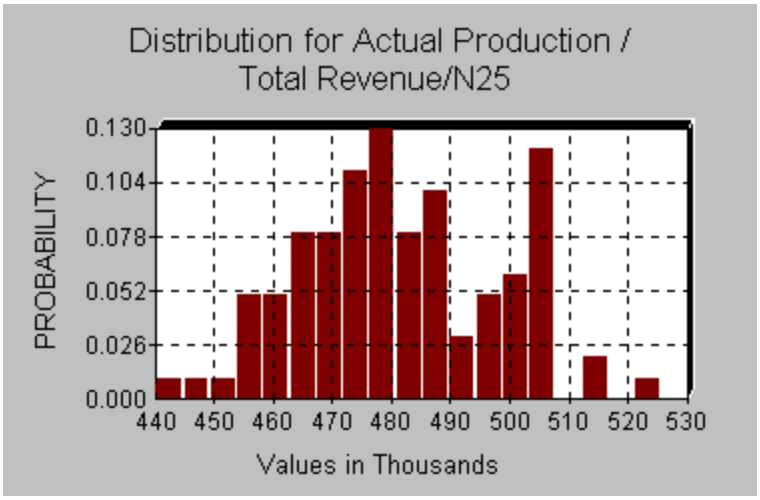


Figure 2(Continued). Revenue Distributions Using BestFit Price Distributions

PineIsland:



Worthington:



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Appendix -Revenue Distributions for Regional Locations

Mankato:

Hutchinson:

Yield distribution(use normal):