EVALUATING USE OF OUTLOOK INFORMATION IN GRAIN SORGHUM STORAGE DECISIONS

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Abstract

This study examines grain sorghum storage decisions in the Texas Coastal Bend region. Decisions involving use and non-use of outlook information are compared using stochastic dominance criteria. Results indicate outlook information is of value to most classes of decisionmakers. The value of outlook information, however, is contingent upon producers' risk preferences. The methodology presented could be used to evaluate a more extensive set of marketing strategies for grain sorghum as well as for other crops.

Key words: grain sorghum, marketing, outlook information, stochastic dominance, storage.

Substantial commodity price volatility, both within and between years, complicates marketing decisions for most agricultural producers. Grain sorghum producers in southern Texas may be more vulnerable to this volatility than producers of other major commodities and in other regions of the United States. The influence of the corn crop in the Midwest and the export market are major reasons for this market risk exposure. Sorghum harvest occurs in the Texas Coastal Bend region when the Midwest corn crop is in its early stages, and most of the southern Texas grain sorghum crop is marketed through export channels.

Pricing strategies can be implemented prior to planting and through several months past harvest. These strategies can be made with or without outlook information. Producers must decide whether to use outlook information and, if so, the maximum they can afford to pay for information that may be available from private services. Previous studies (Ferris; Cornelius; Purcell; Shane and Meyer) have used market information and historical data to evaluate marketing strategies. The nature of information and the form in which it has been provided, however, have not adequately accommodated the differences in cash flow requirements, equity positions, and risk preferences of producers. This study extends previous approaches by using stochastic dominance techniques to evaluate alternative marketing strategies. Stochastic dominance techniques extend beyond the decision analysis framework (Chernoff and Moses; Raiffa) in that decisions for risk averse or risk preferring decisionmakers can be evaluated.

The generalization of the framework to include use of stochastic dominance with respect to a function (Meyer; Robison and King) to order choices and the development of a new interval approach for eliciting decisionmakers' preferences (King and Robison, 1981a) reduce previous difficulties in such analyses and open new opportunities for investigation of applied problems. Although this study does not use explicitly developed risk aversion coefficients, bounds are assumed for different types of decisionmakers and marketing strategies are evaluated within these bounds.

This study investigates the value of using outlook information in the post-harvest storage decision. Stochastic dominance decision criteria are utilized to rank market strategies involving use and non-use of outlook information. In addition, the evaluation methodology is used in an iterative manner to estimate the dollar value of available market outlook information.

COMPONENTS OF THE OBJECTIVE FUNCTION: RETURNS TO STORAGE

A producer deciding whether to sell his crop at harvest or during the post-harvest period is

interested in whether anticipated price increases during the post-harvest period will sufficiently cover storage costs and the additional risk incurred. Three cost considerations are associated with a storage decision: (1) cash storage costs, (2) opportunity costs, and (3) physical storage losses.

Post-harvest grain sales require storage from harvest-time, which is primarily July for Texas Coastal Bend grain sorghum producers, until the time at which sales occur. Fixed costs and monthly variable costs are incurred during this period. Fixed costs include: (1) initial handling costs and, in some instances, the cost of the first 1-to-3 months of storage, and (2) handling costs associated with final sale of the commodity. Fixed storage costs ranged from $.00 to $.05/cwt, and monthly variable costs ranged from $.03 to $.045/cwt for the 1972-1981 data period. The producer directly bears these expenses.

In addition to these elevator charges, a producer must consider the opportunity cost, or indirect costs, associated with delaying sales past harvest. Annual Production Credit Association interest rates were used in the equations presented below to reflect the opportunity cost of capital.

Storage of grain sorghum may also result in some physical loss due to increased handling and additional aeration and/or drying during the storage period. At the time a producer decides to use a commercial storage facility, the facility manager notes the assessed loss. This study assumes a 1 percent storage loss.

Given these cost considerations plus monthly prices (Texas Department of Agriculture), the following equation represents net returns to post-harvest sales as opposed to harvest-time sales:

$$NR_{tt_0} = [(PPH_t - SC_t) * (1 - W_t) * DF_t] - PH_{t_0} - IFSC$$

with:

$$SC_t = TFSC + (M * MSC),$$

$$W_t = IL + (TM * ML), \text{ and}$$

$$DF_t = (1.0 + r)^{-TM/12};$$

where:

NR_{tt_0}:   net returns associated with a post-harvest sales strategy in month t as opposed to a harvest-time sales strategy in month t_0 ($/cwt.);

PPH_t: post-harvest sales price in month t ($/cwt.);

SC_t: storage costs associated with post-harvest sales in month t—assumes costs are paid at post-harvest sales date ($/cwt.);

W_t: proportional weight loss adjustment factor associated with a post-harvest sales strategy in month t (fraction of one cwt.);

DF_t: discount factor associated with a post-harvest sales strategy in month t;

IFSC: initial fixed storage costs, payable upon commencement of storage period ($/cwt.);

TFSC: terminating fixed storage costs, payable upon final sales of commodity ($/cwt.);

M: number of months stored past harvest time for which monthly cash storage costs are assessed ($/cwt.);

MSC: monthly storage costs ($/cwt.);

IL: initial physical storage losses (% x .01);

ML: monthly physical storage losses (% x .01);

r: effective discount interest rate (% x .01);

TM: total number of months stored from harvest-time to post-harvest sales date[1]; and

PH_{t_0}:   harvest-time sales price in month t_0 ($/cwt.).

The resulting NR_{tt_0}'s are returns to storage stated in terms of harvest time (July) dollars. Since inflation causes each year's NR_{tt_0} to have a different level of purchasing power, the Index of Prices Paid by Farmers for commodities and services, interest, taxes and wage rates was used to adjust the respective year's NR_{tt_0}'s to August 1981 dollars (U.S.D.A., *Agricultural Prices*). This standard of identifying returns to storage permits evaluation of the returns of individual post-harvest sales alternatives relative to selling all at harvest and comparison of composite post-harvest sales alternatives.

[1] It is a common practice for Texas Coastal Bend commercial elevator managers to provide producers with 1 to 5 months of "free" storage in association with the payment of the IFSC. (TM − M) identifies the number of such "free" months associated with the storage arrangement being analyzed. TM is used in calculating the opportunity costs of capital.

RETURNS TO POST-HARVEST STORAGE

For simplicity, this paper considers only the commercial storage option. Commercial storage costs for the Texas Coastal Bend region were developed for each year as described. Statistics for net returns on a per hundredweight basis for delayed sale of grain sorghum beyond harvest-time to each post-harvest month are presented in Table 1. Average net returns were positive for the post-harvest months of August through January and were negative thereafter. Net returns were quite variable, and variability for selling in those months with positive average returns tended to increase as the month of sale extended beyond harvest.

A producer attempting to identify the month(s) when postharvest sales should occur would be expected to incorporate market information into the decisionmaking process if it increased expected utility. Thus, strategies based on current and forecasted market conditions, including price forecasts, should be compared to strategies that do not use information and forecasts. An analysis of the performance of both types of strategies for a Texas Coastal Bend producer marketing 20,000 cwt. of grain sorghum during the post-harvest period is presented below assuming a 400-600 acre "representative farm" producing 3,500-4,500 pounds of grain sorghum per acre. A basic premise of the analysis is that net returns to storage for the 1972-81 data period will be representative of the area's future marketing environment (Young).[2]

Net returns and associated probabilistic characteristics for selected post-harvest marketing strategies are presented in Table 2. These include both strategies that use and do not use market information. For strategies involving use of market information, analyses are conducted using two alternative formats: (1) for strategies that explicitly *follow* the outlook information and store only in years when the recommen-

dation is to store and (2) strategies that are *contrary* to outlook information and the decision is to store only in years when the recommendation is not to store. The return to storage is zero in years when grain is sold at harvest.

Strategies That Do Not Use Information on Current and Future Market Conditions

A producer, on the average, can realize substantial net returns by selling all of his grain sorghum in either August, October, or December (strategies 2, 3, and 4). The significant variation in the net returns of the "all or nothing" strategies suggests more diversified strategies would be considered by risk averse producers; among these are strategies 9, 10, 11, and 12 which involve diversifying sales among months in the July-December period. A producer using these marketing strategies would realize a lower average net return than those associated with strategies 2, 3, and 4; but the producer would be subject to much less variability.

Strategies That Use Information on Current and Projected Market Conditions and Price Forecasts

A relevant issue is: "If we were in the producers' shoes, would we make better decisions based upon the forecasts than we would otherwise? It's not the accuracy of the forecasts that is critical but whether or not we make better decisions" (Black and Dike). Assimilating and utilizing available outlook information should be considered. Texas Coastal Bend grain sorghum producers have at least four sources of outlook information readily available in June and early July when they are contemplating the "store/ do not store" decision: *Progressive Farmer, Farm Journal, Doane's Agricultural Report* and *Feed Outlook and Situation* (USDA, 1972-1980).[3] The results of interpreting harvest pe-

TABLE 1. NET RETURNS TO POST-HARVEST STORAGE FOR GRAIN SORGHUM IN THE TEXAS COASTAL BEND REGION, 1972-81[a]

	Net returns per sales month ($/cwt.)[b]										
	August	September	October	November	December	January	February	March	April	May	June
Mean	0.232	0.173	0.262	0.155	0.204	0.095	−0.132	−0.309	−0.575	−0.840	−0.854
Std. dev.	0.86	0.71	1.13	1.14	1.12	1.15	1.15	1.11	1.00	1.10	1.51
Coef. var.	3.72	4.11	4.31	7.34	5.50	12.06	8.68	3.60	1.74	1.31	1.77

[a] Harvest month for grain sorghum in the Texas Coastal Bend region is July. Returns are net above commercial storage costs and opportunity cost and are normalized into August, 1981 dollars for grain sorghum stored from harvest until the respective sales month. Data for the individual years/months are available upon request.

[b] Each monthly distribution was tested for both linear and quadratic dependence of observations. In only one case, January, was an apparent dependence observed. The level of significance did not merit removal of the dependency (Bessler).

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[2] A longer data period is, of course, desirable. The structural shift in the feed grain markets associated with increased exports in the mid-1970's, however, precluded use of a longer data series. Recognizing these data limitations and assuming Young's hypothesis of objective probability distributions, the analysis presented herein is assumed to be a valid approximation of future events.

[3] Another source of market outlook information is the Agricultural Extension Service. Unfortunately, a consistent time series of Extension outlook information for the study region is not available.

riod outlook information and pricing and storage recommendations available in these sources are: in crop years 1972, 1973, and 1978-80, recommendations were to "store"; and in 1974-1977, recommendations were "do not store"; i.e., sell all at harvest.

The authors of this paper independently (ex post) assessed the "store/do not store" recommendations appearing in the four cited information sources for each of the respective year's harvest period. Although within a given year there was some ambiguity among the information sources in terms of an implicit recommendation, comparison of the authors' independent subjective interpretations of the information revealed identical perceptions of the overall recommendations for each marketing period. In cases where ambiguity did exist, this study relied on other less ambiguous data such as size of feedstocks.[4]

As indicated in Table 2, average net returns are highest for strategies 24, 27, and 29, followed closely by strategies 19, 22, and 25. There is, however, a broad range of average net returns, variability in net returns and nature of variability in net returns associated with these strategies. Clearly, therefore, a prescription of a "best" post-harvest marketing strategy for an individual grain sorghum producer in the Texas Coastal Bend is contingent upon personal preferences for risk. The issue, thus, is one of ranking the strategies given producers' risk preferences.

RANKING STRATEGIES

Developing Cumulative Distributions for Marketing Alternatives

The cumulative distribution function of net returns associated with each strategy is developed from the 9-year study period using the rule that the rth smallest observation in a set of n ordered observations is an unbiased estimate of the $r/(n + 1)^{th}$ fractile (Anderson et al., pp. 42-43). Cumulative distributions for all or subsets of the strategies can be ranked using stochastic dominance with respect to a function for producers with various risk preferences (King and Robison, 1981b, pp. 2-6). This approach identifies those strategies (i.e., the "efficient set") that maximize the decisionmaker's expected utility (see Anderson et al.; King and Robinson 1981b; or Kramer and Pope for a detailed mathematical description of stochastic dominance).

Five pairs of Pratt coefficients of absolute risk-aversion were selected to represent risk-preference characteristics varying from risk avoiders to risk preferring decisionmakers. Each pair of coefficients specifies lower and upper bounds, respectively, on the absolute risk aversion function (King and Robison, 1981b, pp. 3-9; King). The pairs chosen and their general descriptions were:

1. −.001 to .001 ; First Degree Stochastic Dominance (FSD) (These decisionmakers prefer more to less expected value of net returns to storage.),
2. .000 to .001 ; Second Degree Stochastic Dominance (SSD) (These decisionmakers have a marginal utility that is both positive and decreasing.),
3. −.00001 to .00001 ; Approximately Risk Neutral (These decisionmakers prefer to maximize the expected value of net returns to storage with tendencies towards low levels of risk preferring and/or risk aversion.),
4. .00001 to .00004 ; Moderately Risk Averse, and
5. .00004 to .00008 ; Strongly Risk Averse.

The relative nature of Pratt coefficients of absolute risk-aversion is highly dependent on the range of the performance measure analyzed;

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[4] The subjective judgment approach used in this study is intended to be an approximation of the process producers use in assimilating available market information. After reviewing the forecasts in private, many producers discuss their interpretations with others, be it by visiting with neighboring producers at the local grain elevator and/or coffee shop or through a telephone call to a broker/marketing consultant. Seldom do all market information sources provide identical forecasts of price movements, either in terms of direction and/or magnitude of change. For instance, the following information was available during the 1975-76 marketing period:

"Weak domestic feed demand has apparently overridden the extremely tight supplies, contributing to a dramatic decline in the market since last fall . . . If feed prospects are favorable this summer, some further decline in sorghum prices is likely" (USDA, Feed Outlook and Situation, May 1975, p. 15).

"Sorghum prices are getting a lift from the turn around in feedlot inventory on the Texas High Plains . . . the upturn was encouraging" (Farm Journal, June/July 1975, p. 5).

"Some price strength is likely to resume after harvest, but profits from short-term storage will be modest" (Progressive Farmer, July 1975, p. 9).

"We would suggest selling 30 percent to 40 percent of the crop at current prices, then plan to hold the balance for a short time after harvest for possible export developments" (Doane's Agricultural Report, July 4, 1975, p. 2).

Each of the authors independently assessed this and other information available in the four sources, and all determined the implicit recommendation for the 1975-76 marketing period was "Do Not Store."

TABLE 2. STATISTICAL PARAMETERS OF SELECTED POST-HARVEST MARKETING STRATEGIES FOR GRAIN SORGHUM IN THE TEXAS COASTAL BEND REGION: 1972-1981[a]

Strategies	Average net return	Standard deviation	Coefficient of variation	Skewness
No outlook information	August 1981 dollars			
1. Sell all at harvest ...	0	0	∞	∞
2. Sell all in August	4,644	17,292	3.72	.25
3. Sell all in October .	5,244	22,588	4.31	.87
4. Sell all in December	4,088	22,470	5.50	.20
5. Sell all in January ...	1,911	23,046	12.06	.43
6. Sell all in February .	−2,644	22,964	8.69	.62
7. Sell 1/12 each month	−2,644	15,760	5.96	−.27
8. Sell 1/4 in July, Oct., Jan. and April	−1,088	13,763	12.64	−.24
9. Sell 1/3 in July, October and January	2,400	13,323	5.55	.01
10. Sell 1/2 in July and August	2,355	8,639	3.67	.25
11. Sell 1/2 in July and October	1,333	12,473	9.36	.71
12. Sell 1/2 in July and December	2,044	11,250	5.50	.20
13. Sell 1/2 in July and January	955	11,462	12.00	.43
14. Sell 1/2 in July and February	−1,311	11,470	8.75	.62
Use outlook information[b]				
15. FOLLOWS, sell 1/12 each month	155	10,948	70.63	.48
16. CONTRARY, sell 1/12 each month	−2,800	11,292	4.03	−1.77
17. FOLLOWS, sell 1/4 in July, October, January and April	488	9,407	19.28	.39
18. CONTRARY, sell 1/4 in July, October, January and April	−1,577	9,945	6.31	−1.22
19. FOLLOWS, sell 1/3 in July, October and January	2,088	8,629	4.13	.57
20. CONTRARY, sell 1/3 in July, October and January	311	10,223	32.87	.28
21. FOLLOWS, sell in August	1,822	9,609	5.27	.93
22. CONTRARY, sell in August	2,822	14,773	5.23	.66
23. FOLLOWS, sell in October	1,200	7,488	6.24	.43
24. CONTRARY, sell in October	4,044	21,565	5.33	1.18
25. FOLLOWS, sell in December	3,244	13,702	4.22	1.26
26. CONTRARY, sell in December	844	17,981	21.30	.38
27. FOLLOWS, sell in January	5,066	19,217	3.79	.85
28. CONTRARY, sell in February	−3,155	11,218	3.56	−1.45
29. FOLLOWS, sell in February	3,711	18,513	4.99	.77
30. CONTRARY, sell in February	−6,355	11,468	1.80	−1.33

[a] Net returns are for the marketing of 20,000 cwt. in the respective month(s) associated with each action or strategy.
[b] FOLLOWS—Indicates storage only in those years that the forecast suggest *storage*.
 CONTRARY—Indicates storage only in those years that the forecast suggests *not to store*.

i.e., in this case, the expected value of net returns to storage. This relative nature, in turn, influences the ability of the stochastic dominance decision criterion to distinguish among alternatives in determining the efficient set. One

means of assessing the relative nature of Pratt coefficients is to compare their respective certainty equivalents (CE) for a range of expected returns in a given utility function (King). "As the name implies, a *certainty equivalent* is the amount exchanged with certainty that makes the decisionmaker indifferent between this and some particular risky prospect. . . . When the CE is less than the EMV (expected money value), the decisionmaker is said to display an aversion to risk . . ." (Anderson et al., p. 70).

This study's October distribution of expected returns to storage has a range of outcomes from −$26,400 to $55,400 with an EMV of $5,544. Assuming a negative exponential utility function (King),

$$U(y) = -e^{-\lambda y}$$

where y is expected returns to storage and λ is the Pratt coefficient of absolute risk aversion, the following ranges of CE's are calculated with respect to the October distribution of expected returns to storage,

1. −.00001 to .00001 (Approximately Risk Neutral),
   CE's = $7,686 to $3,134;

2. .00001 to .00004 (Moderately Risk Averse),
   CE's = $3,134 to −$1,798; and

3. .00004 to .00008 (Strongly Risk Averse),
   CE's = −$1,798 to −$6,720.

Efficient Strategies Without Outlook Information

Efficient sets of marketing strategies involving use and non-use of information on current and forecasted market conditions are presented in Table 3. Application of first degree stochastic dominance (FSD) decision criterion eliminates only three of the 14 "no outlook" information strategies; the sure bet "sell all at harvest" strategy with an expected net return of $0 dominates the eliminated strategies, all of which have negative average net returns. Application of second degree stochastic dominance (SSD) decision criterion eliminates 9 "no outlook" information strategies. The efficient set includes strategies 1, sell 100 percent in July; 2, sell 100 percent in August; 3, sell 100 percent in October; 9, sell 1/3 in July, August, and January; and 10, sell 1/2 in July and August. Assuming the cumulative distributions of the alternatives are normal, SSD is equivalent to identifying an EV set in which strategies with lower expected net returns and the same variance are eliminated (Anderson et al., p. 287).

TABLE 3. STOCHASTIC DOMINANCE RESULTS: EFFICIENT SETS OF POST-HARVEST MARKETING STRATEGIES FOR GRAIN SORGHUM IN THE TEXAS COASTAL BEND REGION: 1972-81[a]

Marketing alternative	Coefficients of absolute risk aversion				
	−.001 to .001 (FSD)	.000 to .001 (SSD)	−.00001 to .00001 (Risk neutral)	.00001 to .00004 (Risk averse)	.00004 to .00008 (Risk averse)
1. Sell all at harvest in July	✓	✓			✓
2. Sell all in August	✓	✓	✓	✓	
3. Sell all in October	✓	✓	✓		
4. Sell all in December	✓				
5. Sell all in January	✓				
6. Sell all in February					
7. Sell 1/12 each month beginning in July					
8. Sell 1/4 in July, October, January and April	✓	✓			
9. Sell 1/3 in July, October and January	✓	✓			
10. Sell 1/2 in July and August	✓	✓		✓	✓
11. Sell 1/2 in July and October	✓				
12. Sell 1/2 in July and December	✓				
13. Sell 1/2 in July and January	✓				
14. Sell 1/2 in July and February					
15. STORE, Sell 1/12 each month[b]					
16. NOT STORE, sell 1/12 each month					
17. STORE, sell 1/4 in July, October, January and April					
18. NOT STORE, sell 1/4 in July, October, January and April					
19. STORE, sell 1/3 in July, October and January	✓	✓			
20. NOT STORE, sell 1/3 in July, October and January	✓				
21. STORE, sell in August	✓				
22. NOT STORE, sell in August	✓				
23. STORE, sell in October	✓	✓			
24. NOT STORE, sell in October	✓				
25. STORE, sell in December	✓	✓		✓	
26. NOT STORE, sell in December					
27. STORE, sell in January	✓	✓	✓	✓	
28. NOT STORE, sell in January					
29. STORE, sell in February	✓	✓			
30. NOT STORE, sell in February					

[a] For each respective pair of risk aversion coefficients, those actions and strategies which are checked comprise the efficient or undominated set. The unchecked actions and strategies are, therefore, to be interpreted as being inferior to some element of the efficient set.

[b] Strategies 15-30 involve use of market information. Strategies marked as STORE follow the recommendations of this information and store only when it is suggested. Strategies marked as NOT STORE represent a contrary marketing approach, storing only when the outlook information suggests not to store.

If risk preferences can be more narrowly defined, a smaller efficient set can be identified for an individual or a group of decisionmaker(s). For the approximately risk-neutral decisionmakers, two "no outlook" information strategies are included in the efficient set—strategies 2 and 3 (sell all in August and sell all in October). These results are not surprising since these strategies have the greatest average net returns and the choice criterion ignores the variance. The efficient set for moderately risk averse decisionmakers contains "no outlook" information strategies 2 and 10 (sell all in August and sell 1/2 in July and August). The efficient set for strongly risk averse decisionmakers contains strategies 1 and 10 (sell all at harvest and sell 1/2 in July and August).

Efficient Strategies Using Outlook Information

Simultaneous consideration of strategies involving use and non-use of outlook information is revealing regarding the value of outlook information. An efficient set consisting of only strategies involving the use of outlook information is suggestive of a high value of such information for the respective class of decisionmakers. Inclusion in the efficient set of strategies that involve both use and nonuse of outlook information, however, suggests outlook information may be of a more marginal value.

Again, the risk parameters that approximate FSD and SSD do not significantly reduce the choice set, Table 3. The efficient set of strategies for the approximately risk neutral decisionmakers contains strategies 2 and 3 (do not use outlook information) and strategy 27 (uses outlook information). As indicated in Table 2, these marketing alternatives have, by definition, the highest average net returns of the 30 strategies considered—$4,644, $5,244, and $5,066, respectively. They also have relatively large standard deviations—$17,292, $22,588, and $19,217, respectively.

Moderately risk averse decisionmakers are represented by absolute risk aversion parameters of .00001 to .00004. Strategy 3 is not included in this efficient set, and strategies 10 and 25 are included. The average net returns

of strategy 10 (does not use outlook information), $2,355, and strategy 25 (uses outlook information), $3,244, are much lower than those of strategy 3, $5,244; but the variability characteristics associated with these marketing alternatives result in their inclusion in the efficient set. The efficient set for the strongly risk averse class of decisionmakers considered includes strategy 1, the sure bet "sell all at harvest" alternative, and strategy 10, sell 1/2 at harvest and 1/2 in August.

These results support previous discussion regarding the difficulty of prescribing a "best" post-harvest marketing strategy without due consideration of individual risk preferences. The significance of these results is threefold: (1) FSD is virtually useless in identifying decision choices; (2) SSD, while eliminating some choices, is unable to identify a manageable set of decision choices; and (3) stochastic dominance with respect to a function is able to identify a manageable set of alternatives when the classes of decisionmakers are narrowly defined by their respective absolute risk aversion parameters.

Outlook information is clearly useful in the sense that strategies which use outlook information remain in the efficient sets of all but the most risk averse decisionmakers. Strategies that use outlook information, however, did not decisively dominate strategies that did not use outlook information for any of the choices considered, given the width of the risk aversion intervals used in the analysis. All efficient sets included at least one strategy that did not use outlook information. It should be noted that where outlook information is used, the *contrary* strategies appear in the efficient set only when the risk parameters approximate FSD. This indicates that outlook information is of value to all but the most risk averse decisionmakers.

Economic Value of Information

The usefulness of market outlook information for selected classes of decisionmakers raises the question, "How valuable is the information?" Insight into this question can be gained by solving for the annual charge at which strategies 25 and 27 (use outlook information) would be eliminated from the efficient set of the mod-

erately risk averse decisionmakers. Strategy 27 was eliminated at a price of $450 per year and strategy 25 was eliminated at a price of $600 per year.[5]

The information discussed herein is readily available for much less than this estimated value and, as such, should be obtained and utilized by most decisionmakers represented by the third and fourth class of Pratt risk aversion parameters. Naturally, value of information for these classes of producers would increase as the volume of sales increases.

CONCLUSIONS

A major contribution of this analysis is the evaluation of market outlook information. Application of the stochastic dominance criterion to compare strategies that use market outlook information to strategies that do not use market information permits evaluation of the conditions under which information has value. Sources of market information available to Texas Coastal Bend grain sorghum producers may be valuable to all but the most risk averse. Some strategies that use outlook information are not dominated by one or more strategies that do not use outlook information and vice versa. Those strategies that follow the outlook information tend to dominate those strategies that entail a contrary approach.

Results of this study must be regarded with caution due to the limited sample upon which the inferences are based.[6] The approach described herein can be extended to encompass the broader spectrum of both pre- and post-harvest marketing strategies involving cash, forward contracting, and the futures market, among other available marketing alternatives. The approach taken needs to be replicated in more areas. Future applications should include additional marketing instruments and should provide for updating strategies as new information becomes available during a marketing period. By pursuing a vigorous application of this methodology, one should be able to ascertain what the evidence to date indicates about our ability to forecast market movements and if we are indeed providing valuable information to producers.

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[5] This is not the standard Bayesian method of calculating the value of information in a decision theoretical framework. The increase in expected profits or increase in utility of expected profits associated with having the additional information available is not determined. The analysis was conducted by reducing net returns to storage by $25 for each observation comprising the cumulative distributions of strategies 25 and 27 until the respective strategies were deleted from the efficient set. As long as the strategies remained in the efficient set of marketing alternatives, the inference was that their value exceeded the imposed cost.

[6] Methods for developing tolerance intervals for non-parametric data sets of limited size are presented by Ziemer.

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