

## Applying Minimum Regret Criteria for Evaluation Farm Product Selling Time in Iran

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**Abstract:** Risk in agricultural market is a phenomenon that must management for minimizing of maximum regret or opportunity of different decisions in different positions. With respect to importance of price risk management, in this study by using time series data of wheat and barely price and minimum regret criteria, attempted for determining the best sale time of wheat and barely. Results showed that using of minimum regret and maximum has not conflict. Also, the best sale time of wheat and barely is February. With regard to results, a model for purchasing of these crops and inventory through incentive inventory payment suggested.

**Key words:** Strategy • Risk • Wheat • Barely • Khorasan razavi

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### INTRODUCTION

Farming is an activity joint with risk and uncertainty. Farmers, especially in developing countries such as Iran face with natural and economic risks. In one hand, weakness in right prediction of crop prices, input prices and yields and the other hand, unpredictable climate conditions cause to instability of farm income. Although agricultural risk exists in all region of world but make more trouble in developing countries and is more difficult for small farmers. So it is important to use some models that result to less opportunity losses and highest possible levels of income. Regret behavior has long been hypothesized as a useful perspective for decision making under uncertainty. Its relevance has been suggested for personal, investment and management decisions [3].

Still, for non-contrived situations it is generally argued that a regret framework is a useful approach among a number of alternative management techniques for decisions under uncertainty. Among the management decisions for agricultural firms for which this behavior is potentially either practiced or potentially useful is commodity selling. In fact casual comments by producers indicate major disutility for selling decisions which looking backward results in large opportunity losses regardless of how well that decision performs on an expected value or target return basis [4,5].

Considerable research in commodity marketing has been directed to optimum return strategies both in terms of absolute profitability as well as securing target

returns. In some cases risk behavior has been attached to the analysis. Adsina and Ottara used Motad linear programming model to indicate that not only crop yields, but yield risk, income risk and prices risk has effective role in determining the best crop pattern [1]. Teague and Lee have showed with regard to risk aversion levels and available capital, there are some opportunities for farmer to decrease income risks with diversification in compressive cultivation and kind of products [7]. Patrick and Ditges have indicated the substantial reason of slow trend of agricultural credit in South West Kazakhstan is the risk of agricultural activities [6]. These researches have often used risky mathematic programming models to find the best alternatives. However, far less attention has been directed to regret avoidance which involves a different behavioral objective. The relation between regret behavior and risk defined as volatility is unclear. Whether regret is a separate objective or a subset of general volatility has not received great attention in quantitative research.

In this paper, minimum regret choices are determined for sales times (monthly) for wheat, barely, in Khorasan-Razavi province of Iran and the performance of these regret solutions are evaluated relative to other selling alternatives determined from other decision criteria.

In fact, the objective of this analysis was to determine optimum regret selling time strategies for wheat and barely and to compare these with maximum expected value strategies and various risk minimization strategies. Comparisons involve level of regret, average price and risk measures (total deviations).

## MATERIALS AND METHODS

Regret behavior has long been hypothesized as a useful perspective for decision making under uncertainty. Its relevance has been suggested for personal, investment and management decisions. In broad terms this approach attempts to minimize the largest regret or opportunity loss resulting from alternative decisions under alternative nature states or, if probabilities of states are known, the weighted regret level. The decision maker attempts to minimize the losses incurred under various states compared to the most profitable decision for that state. Looking backward the decision maker's objective is to avoid a large regret even if the strategy yielding minimum regret has a lower expected return than other alternative decisions. More formally this approach is [2]:

Min

$$R(d_i, s_j) = V^*(s_j) - V(d_i, s_j)$$

Where

$R(d_i, s_j)$  = regret associated with decision alternative  $d_i$  and state of nature  $s_j$ ,

$V^*(s_j)$  = best payoff value under state of nature  $s_j$  and

$V(d_i, s_j)$  = payoff value for alternative  $d_i$  and state of nature  $s_j$ .

For each state the regret matrix is formed by subtracting from the maximum return the return for each  $d_i$  thereby yielding a zero for the maximum return and various regret levels for other  $d_i$ . There may or may not be probabilities attached to each state. If probabilities are attached the optimum choice may be different from where no probabilities are incorporated. It can be argued that under some situations, where state probabilities are unknown the regret solution can be seemingly irrational caused by one outcome in one state. Still, for non-contrived situations it is generally argued that a regret framework is a useful approach among a number of alternative management techniques for decisions under uncertainty.

Monthly net prices for each crop were assembled for consecutive time periods (5 years for wheat and barely from 2002-2006) in Khorasan-Razavi province of Iran. These were used directly in the programming matrices related to net returns and risk (deviations). Regret entries for each year were determined by subtracting each monthly price from the maximum price for that marketing year. In addition, an alternative regret was included (termed "major regret") where only regrets above a target

regret level were counted. In this paper the target regrets were 100 Rials for wheat and barely. Also it is supposed that, there is storing facilities for all farmers and they can sell their products in the best time.

Three analyses were completed. The first developed a return-regret frontier minimizing regret as returns were varied. A sub analysis examined the same relationship except major regret was used rather than total regret. Second analysis involved a conventional MOTAD analysis of returns vs. deviations (from mean returns) that aims to minimize deviations as returns were varied. The third analysis was a regret-risk (deviation) analysis where minimum regret solutions for various deviation levels were determined. Sub analysis involved total major regret as opposed to total regret.

## RESULTS AND DISCUSSION

In Table 1 the monthly price averages and value of regret and major regret for each crop in period of 2002:1-2006:12 are presented. The highest average net prices for wheat and barely is respectively 1732 and 1635 rilas in February. For each year each month's differential from the highest price was determined and then totaled for all years. These are presented as total regret. Similarly the totals for maximum regret are presented for each month. In terms of minimum (maximum) regret for wheat the months are February (April). For barely, they are February and March (April). When major regret is applied to decision making, from October to March, have minimum regret for wheat and from January to march for barely. The results of the analysis are presented respectively for each of the three analysis.

Return-Regret-In table 2 six solutions are presented for each crop. These include the minimum regret solution, the minimum return solution and four other solutions at various return levels. It is not unexpected that a selling strategy which involves minimum regret is one which has the highest average monthly net selling price. This is the case for all two crops and no tradeoff between the two objectives is observed. While returns decrease, regret values increase. So with applying return-regret analyses, February is the best month for selling both products. The same analysis was also completed where the major regret criterion was used. These results are presented in Table 3 for the same return points as Table 2. Results again suggest that for these two crops, higher returns cause to greater regret for a portion of the return range. Minimum regret for wheat appears in February and November and for barely in February.

Table 1: Monthly average net prices and regret values for Wheat and Barely (2002:1-2006:12)

Months	Wheat			Deviation	Barely			Deviation
	Average price (rial)	Total regret	Total major regret		Average price (rial)	Total regret	Total major regret	
January	1718	130	0	306	1608	155	0	390
February	1732	60	0	312	1635	20	0	385
March	1712	160	0	316	1628	55	0	385
April	1558	930	840	291	1399	1200	1130	354
May	1571	865	795	299	1384	1275	1275	356
June	1604	700	630	297	1340	1495	1495	331
July	1646	490	390	277	1338	1505	1505	361
august	1654	450	260	285	1361	1390	1390	368
September	1676	340	150	296	1414	1125	1125	370
October	1697	234	0	299	1442	985	985	345
November	1703	205	0	301	1496	705	665	392
December	1721	115	0	308	1554	425	225	367

Table 2: Return-regret analysis for monthly sales of Wheat and Barely

Criteria	Wheat	Barely
Regret(rial)	60	20
Return(rial)	1732000	1635000
	February	February
Regret(rial)	205	425
Return(rial)	1703000	1554000
	November	December
Regret(rial)	340	705
Return(rial)	1676000	1496000
	September	November
Regret(rial)	490	1125
Return(rial)	1646000	1414000
	July	September
Regret(rial)	700	1275
Return(rial)	1604000	1384000
	June	May
Regret(rial)	930	1505
Return(rial)	1558000	1338000
	April	July

Table 3: Return-major regret analysis for monthly sales of Wheat and Barely

Criteria	Wheat	Barely
Major regret(rial)	0	0
Return(rial)	1732000	1635000
	February	February
Major regret	0	225
Return	1703000	1554000
	November	December
Major regret	150	665
Return	1676000	1496000
	September	November
Major regret	390	1125
Return	1646000	1414000
	July	September
Major regret	630	1275
Return	1604000	1384000
	June	May
Major regret	840	1505
Return	1558000	1338000
	April	July

Table 4: Return-deviation analysis for monthly sales of Wheat and Barely

Criteria	Wheat	Barely
Deviation	312	385
Return	1732000	1635000
	February	February
Deviation	301	367
Return	1703000	1554000
	November	December
deviation	296	392
Return	1676000	1496000
	September	November
deviation	291	370
Return	1558000	1414000
	April	September
deviation	277	331
Return	1646000	1340000
	June	July

Table 5: Regret-deviation frontier for monthly sales of Wheat and Barely

Criteria	Wheat	Barely
Regret	930	1505
deviation	291	361
	April	July
regret	700	1275
deviation	297	356
	June	May
regret	490	1125
deviation	277	370
	July	September
regret	205	425
deviation	301	367
	November	December
regret	60	20
deviation	312	385
	February	February

Return-Deviation- In table 4 solutions are presented for the minimum risk (deviation) and maximum return solutions as well as three other solutions for various returns. Over the entire range for increase in returns,

Table 6: Deviation-major regret frontier for monthly sales of Wheat and Barely

Criteria	Wheat	Barely
Major regret	390	1495
deviation	277	331
	July	June
Major regret	260	1130
deviation	285	354
	August	April
Major regret	0	1390
deviation	301	368
	November	august
Major regret	0	0
deviation	308	385
	December	February
Major regret	0	665
deviation	316	392
	march	November

the risk is rising in both crops. July (June) is the best month for selling wheat (barely) because has minimum deviation.

Regret-Deviation-The trade off between regret and risk is demonstrated in table 5 for each crop. The minimum deviation solution and the minimum regret solution are presented as well as three other solutions in various regret values. As risk is reduced, regret increases. While this phenomenon was observed indirectly before, it is clearly evident in this table. For wheat Minimum risk is in July and for barely in may.

Table 6 demonstrates the regret-risk relationship except major regret is the variable under examination. On the basis of these results, highest major regret is related to lowest deviations. With this criteria November, December and March are chosen for wheat and February for barely.

### CONCLUSION

In this paper, minimum regret solution as a decision making rule was used to show the relation between risk

and deviation in agriculture marketing problems and a new way suggested to assessment of farm products selling time on the basis of minimum opportunity losses. Results demonstrated that for wheat and barely any trade off occurred between net returns and regret. Thus, high return sales months also yielded low regret. This was also observed when only large or major regret was used to define regret. The usual expected tradeoff between returns and risk (deviation) was observed in this analysis. As risk increased, however, regret decreases resulted in a significant tradeoff between these two behavioral aspects.

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