Maximin: A RightRisk$_{TM}$ Lesson Guide with EWS Farms

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With Maximin you choose the alternative with the maximum minimum level of income.

Inspired by the classic game theory text by von Neumann and Morgenstern (1944), statistician Abraham Wald (1945) was the first to formally propose the Maximin decision strategy. This strategy is based upon the principle that the decision maker is primarily interested in maximizing security rather than trying to get the most out of a risky situation by taking chances. Colman (1999) describes it as an ultra-pessimistic approach. At the very least, one can describe it as a very conservative approach when compared to other risk management strategies such as maximizing the expected value and Maximax.

It is important to understand that the Maximin decision choice criterion ignores probabilities. The relative value placed on each decision alternative is based solely on the worst outcome that could happen if that alternative is selected. The strategy can best be illustrated in a payoff matrix.

Figure 1: Payoff Matrix

		Alternative Actions		
Income	Probability	(1)	(2)	(3)
Outcome 1	20%	$20,000	$26,000	$34,000
Outcome 2	50%	$10,000	$14,000	$15,000
Outcome 3	30%	$6,000	$0	-$10,000
MINIMUM OR WORST OUTCOME		$6,000	$0	-$10,000

The Maximin decision maker does not concern themselves with probabilities.

The payoff matrix in Figure 1 displays three alternative actions that can be taken by the decision maker. Each action has three possible outcomes which occur with probabilities of 20%, 50%, and 30%, respectively. The worst outcome for each alternative is listed across the bottom row of the matrix. In this case, the worst outcomes for each alternative all come from Outcome 3 but, in general, they could come from any one of the outcomes and not all the same. The Maximin decision maker does not concern themselves with where the worst outcome came from or with the probability attached to it. They are only concerned with its value and they attach that minimum value to each respective alternative for ranking. In Figure 1, the best of the worst outcomes is

associated with Alternative 1 ($6,000). A decision maker using the Maximin strategy would therefore select alternative one if given the information in Figure 1.

It is easy to see how maximizing the minimum possible outcome is viewed as a very conservative decision choice criterion. When using this conservative strategy, a decision maker often foregoes other outcomes in the distribution that generally payoff more but are associated with more risky alternatives. In some business situations where financial security is ultra-important, the Maximin strategy can play an appropriate role in decision making. However, because it ignores probabilities and doesn't identify a payoff threshold above which other criteria take over, employing the Maximin strategy is usually a short-term business strategy used to navigate through tough financial times. On the other hand, a Maximin strategy can become a long-term strategy for the individual decision maker whose risk preferences are so risk averse that they are mentally locked in or anchored to an ultra-conservative approach. As with most risky decision making, the decision maker should evaluate the risk-return trade offs and move to another strategy when appropriate. Ultimately, it is the decision maker's choice.

Practicing Maximin with EWS Farms

RightRisk$_{TM}$ Ag Survivor scenarios provide you an opportunity to try different risk management strategies to see if they are an improvement over what you did last time. In this exercise, you are going to practice making risk management decisions using the EWS Farms scenario and the Maximin strategy to determine a best alternative.

Step 1: Log in to the EWS Farms scenario.
Step 2: Work through the four periods of the scenario making marketing decisions along the way.
Step 3: On the End of Year Financial Summary page, note the actual net cash income on the bottom line. Write this amount above Option 1 in the table in Figure 2.
Step 4: From the End of Year Financial Summary page, click 'Next' and then click 'Repeat 100 Times' to run the simulation 100 times and produce a distribution graphic.
Step 5: In the bottom row, left column of the statistics box, note the minimum value contained in the distribution. Record this value in the bottom box of the Option 1 column in Figure 2.
Step 6: From the Distribution Analysis page, click 'Compare.' Note that your decisions are recorded in the Option 1 column of the Compare Two Options table. Record these decisions in the corresponding column in Figure 2.
Step 7: Leave Option 2 blank for now and click 'Compare' in the EWS Farms scenario.
Step 8: Note the minimum value for the Option 2 distribution in the EWS Farms scenario and record it in the bottom box of the 'Do Nothing' Option 2 column in Figure 2.

Question: Is the minimum value you recorded for your Option 1 better than the minimum value for the 'Do Nothing' Option 2?

Step 9: Click the 'Return to Comparisons' button in the EWS Farms scenario.
Step 10: Enter in two new sets of decisions for Option 1 and Option 2 for the EWS Farms scenario that you think will result in a higher minimum value than the previous strategies.

Figure 2: Matrix of Alternative Decisions

Decisions			Option 1	Option 2	Option 3	Option 4	Option 5
Period 1	1	Forward Contract Wheat		Do Nothing Option			
	2	Hedge Wheat					
Period 2	3	Forward Contract Wheat					
	4	Hedge Wheat					
	5	Forward Contract Corn					
	6	Hedge Corn					
Period 3	7	Forward Contract Wheat					
	8	Hedge Wheat					
	9	Forward Contract Corn					
	10	Hedge Corn					
Period 4	11	Forward Contract Corn					
	12	Hedge Corn					
MINIMUM OR WORST OUTCOME							

Step 11: Record the decisions for these two new options in the Option 3 and Option 4 columns of Figure 2.

Step 12: Now click 'Compare' to view the results in the EWS Farms scenario.

Step 13: Record the minimum values for these two new options in the bottom box of the Option 3 and Option 4 columns, respectively, in Figure 2.

Question: Considering the four options you now have listed in Figure 2, which option results in the maximum minimum value?

Step 14: Click the 'Return to Comparisons' button in the EWS Farms scenario.

Step 15: In answer to the above question, whichever of the four options provides the maximum minimum value should be entered in as the decision set for Option 1 (or Option 2) for the next comparison in the EWS Farms scenario.

Step 16: Enter in one final set of new decisions for Option 2 (or Option 1) in the EWS Farms scenario in an effort to increase your minimum value one last time. Record these decisions in the Option 5 column of Figure 2. Click the 'Compare' button to view your results in the EWS Farms scenario.

Step 17: Record the minimum value for the last option in the Option 5 column of Figure 2.

Question: Considering all five options listed in Figure 2, which option is the Maximin choice?

Maximin Lesson

The important thing to remember is that the Maximin choice resulting from this lesson is just one of many decision choice criteria that could be used to make a selection. ***The "Maximin" decision strategy is one of the most conservative risk management decision strategies a manager could use***. As the decision maker, ***you choose the decision criterion that is right for you.*** The Maximin strategy is effective in protecting against extreme downside risk outcomes. You must assess what potential outcomes you are willing to trade off in order to provide this level of security to your business. While no strategy is perfect, any strategy will likely be more successful than no risk management strategy at all.

References

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