Sensitivity Analysis for Decision Trees

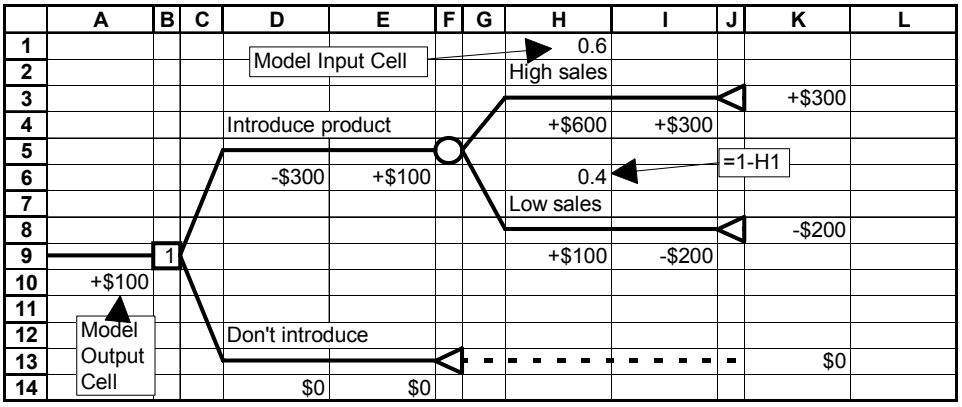
17

17.1 ONE-VARIABLE SENSITIVITY ANALYSIS

One-Variable Sensitivity Analysis using an Excel data table

1. Construct a decision tree model or financial planning model.
2. Identify the model input cell (H1) and model output cell (A10).
3. Modify the model so that probabilities will always sum to one. (That is, enter the formula =1-H1 in cell H6.)

Figure 17.1 Display for One-Variable Sensitivity Analysis



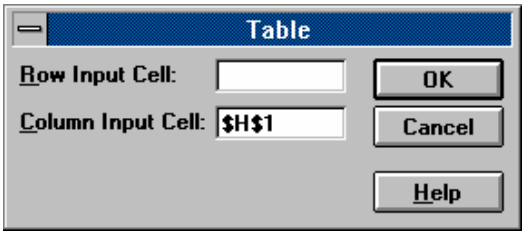
4. Enter a list of input values in a column (N3:N13).
5. Enter a formula for determining output values at the top of an empty column on the right of the input values (=A10 in cell O2).
6. Select the data table range (N2:O13).
7. From the Data menu choose the Table command. In Excel 2007, choose Data | What-If Analysis | Data Table.

Figure 17.2 Setup for Data Table

	M	N	O	P
1				
2			+$100	=A10
3		0.00		
4		0.10		
5		0.20		
6		0.30		
7		0.40		
8		0.50		
9		0.60		
10		0.70		
11		0.80		
12		0.90		
13		1.00		
14				

8. In the Data Table dialog box, select the Column Input Cell edit box. Type the model input cell (H1), or point to the model input cell (in which case the edit box displays H1). Click OK.

Figure 17.3 Data Table Dialog Box



9. The Data Table command substitutes each input value into the model input cell, recalculates the worksheet, and displays the corresponding model output value in the table.

10. Optional: Change the formula in cell O2 to =CHOOSE(B9,"Introduce","Don't").

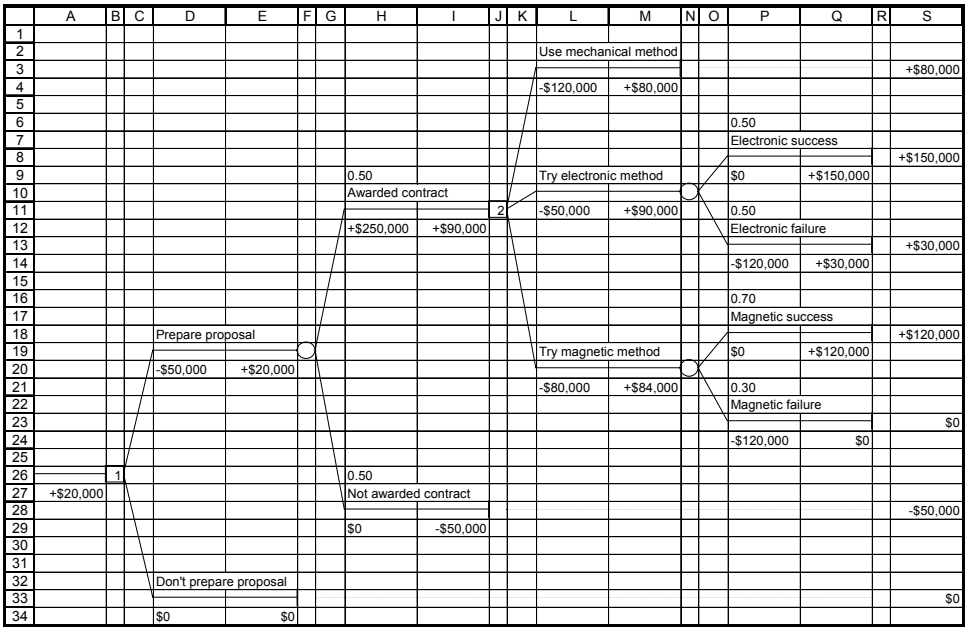
Figure 17.4 Data Table Results

	M	N	O	P
1		P(High Sales)	Exp. Value	
2				
3		0.00	0	
4		0.10	0	
5		0.20	0	
6		0.30	0	
7		0.40	0	
8		0.50	50	
9		0.60	100	
10		0.70	150	
11		0.80	200	
12		0.90	250	
13		1.00	300	
14				

17.2 TWO-VARIABLE SENSITIVITY ANALYSIS

Two-Variable Sensitivity Analysis using an Excel data table

Figure 17.5 Decision Tree for Strategy Region Table



Optional: Activate the Base Case worksheet. From the Edit menu, choose Move Or Copy Sheet. In the Move Or Copy dialog box, check the box for Create A Copy, and click OK. Double-click the new worksheet tab and enter Strategy Region Table.

Setup for Data Table

Select cell P11, and enter the formula =1–P6. Select cell P21, and enter the formula =1–P16.

In cell U3 enter P(Elec OK). In cell V3 enter 1, and in cell V4 enter 0.9. Select cells V3:V4. In the lower right corner of cell V4, click the fill handle and drag down to cell V13. With cells V3:V13 still selected, click the Increase Decimal button once so that all values are displayed with one decimal place.

Select columns V:AG. (Select column V. Click and drag the horizontal scroll bar until column AG is visible. Hold down the Shift key and click column AG.) From the Format menu choose Column | Width. In the Column Width edit box type 5 and click OK.

In cell W1 enter P(Mag OK). In cell W2 enter 0 (zero), and in cell X2 enter 0.1. Select cells W2:X2. In the lower right corner of cell X2, click the fill handle and drag right to cell AG2. With cells W2: AG2 still selected, click the Increase Decimal button once so that all values are displayed with one decimal place.

Select cell V2 and enter the formula =CHOOSE(J11,"Mech","Elec","Mag"). With the base case assumptions the formula shows Elec.

Figure 17.6 Setup for Data Table

	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1			P(Mag OK)										
2		Elec	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
3	P(Elec OK)	1.0											
4		0.9											
5		0.8											
6		0.7											
7		0.6											
8		0.5											
9		0.4											
10		0.3											
11		0.2											
12		0.1											
13		0.0											

Obtaining Results Using Data Table Command

Select the entire data table, cells V2:AG13.

From the Data menu, choose Table. In Excel 2007, choose Data | What-If Analysis | Data Table. In the Table dialog box, type P16 in the Row Input Cell edit box, type P6 in the Column Input Cell edit box, and click OK.

With cells V2:AG13 still selected, click the Align Right button.

Figure 17.7 Data Table Results

	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1			P(Mag OK)										
2		Elec	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
3	P(Elec OK)	1.0	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec
4		0.9	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec
5		0.8	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec
6		0.7	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Mag
7		0.6	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Mag	Mag
8		0.5	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Mag	Mag	Mag
9		0.4	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
10		0.3	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
11		0.2	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
12		0.1	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
13		0.0	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag

Embellishments

Select cells U1:AG13, and click the Copy button. Select cell AI1, right-click, and from the shortcut menu choose Paste Special. In the Paste Special dialog box, click the Values option button, and click OK. Right-click again, choose Paste Special, click the Formats option button, and click OK.

Select columns AJ:AU. Choose Format | Cells | Width, type 5, and click OK.

Select cell AJ2, right-click, and from the shortcut menu choose Clear Contents. Select cells AK2:AU2, move the cursor near the border of the selection until it becomes an arrow, click and drag the selection down to cells AK14:AU14. Similarly, select cell AK1 and move its contents

down to cell AP15. Also, move the contents of cell AI3 to cell AI8. Select cell AN1, and enter Strategy Region Table.

Figure 17.8 Results with Embellishments

	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1						Strategy Region Table							
2													
3		1.0	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec
4		0.9	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec
5		0.8	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec
6		0.7	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Mag
7		0.6	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Mag	Mag
8	P(Elec OK)	0.5	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Mag	Mag	Mag
9		0.4	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
10		0.3	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
11		0.2	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
12		0.1	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
13		0.0	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
14			0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
15								P(Mag OK)					

Apply borders to appropriate ranges and cells to show the strategy regions. Apply shading to cell AR8 to show the base case strategy.

Figure 17.9 Borders for Strategy Regions

	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1						**Strategy Region Table**							
2													
3		1.0	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec
4		0.9	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec
5		0.8	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec
6		0.7	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Mag
7		0.6	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Mag	Mag
8	P(Elec OK)	0.5	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Elec	Mag	Mag	Mag
9		0.4	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
10		0.3	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
11		0.2	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
12		0.1	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
13		0.0	Mech	Mech	Mech	Mech	Mech	Mech	Mech	Mag	Mag	Mag	Mag
14			0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
15								P(Mag OK)					

17.3 MULTIPLE-OUTCOME SENSITIVITY ANALYSIS

Sensitivity Analysis for Multiple-Outcome Event Probabilities

Choose one of the outcome probabilities that will be explicitly changed.

For example, focus on P(Low Sales).

Keep same relative likelihood (base case) for the other probabilities.

Figure 17.10 Display for Multiple-Outcome Sensitivity

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1								0.2						P(Low Sales)	OptStrat
2								High Sales							
3											+$1,500			1.00	Don't
4								+$2,500	+$1,500					0.90	Don't
5														0.80	Don't
6								0.5						0.70	Don't
7				Intro				Medium Sales						0.60	Intro
8											+$500			0.50	Intro
9				-$1,000	+$400			+$1,500	+$500					0.40	Intro
10													Base ->	0.30	Intro
11								0.3						0.20	Intro
12								Low Sales						0.10	Intro
13		1									-$500			0.00	Intro
14	+$400							+$500	-$500						
15															
16															
17				Don't											
18											$0				
19				$0	$0										

Figure 17.11 Formulas for Multiple-Outcome Sensitivity

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1								=(0.2/(0.2+0.5))*(1-H11)						P(Low Sales)	OptStrat
2								High Sales							=CHOOSE(B13,"Intro","Don't")
3														1.00	
4														0.90	
5														0.80	
6								=(0.5/(0.2+0.5))*(1-H11)						0.70	
7				Intro				Medium Sales						0.60	
8														0.50	
9														0.40	
10													Base ->	0.30	
11								0.3						0.20	
12								Low Sales						0.10	
13														0.00	
14															
15															
16															
17				Don't											
18															
19															