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OSU

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Programmable Calculator
DECISION MAKER SERIES

LIVESTOCK DECISION RISK ANALYSIS

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Any decision that can result in a profit also can result in a loss. Profit, in the purest sense, is a return for taking risks. Paid laborers or managers can earn wages or salaries with little risks. Land can earn a cash rent and money in the bank can earn interest with little risk of loss. But, profits represent something more than competitive returns to land, labor, capital, and management. Profit is the reward that goes to the one who takes the risk of putting management and labor into something without a guaranteed return. Profit goes to capital and land committed without assurance of a fixed, positive return. The potential for pure profit exists only if there also exists a risk of loss.

There are two basic types of risks: business risks and financial risks. Business risk may be thought of as the probability of a loss or adverse outcome from a business decision. Financial risk is the addition to total risks that results from the use of borrowed money to finance a business activity. There are two basic types of business risks: production risks and market risks. Production risk is the probability of a loss or adverse outcome resulting from unfavorable production costs. Market risk is the probability of loss or adverse outcome resulting from unfavorable market prices. Total business risk is the sum of production risk and market risk.

Financial risks are related to the impact of debt financing or leverage. Debt repayment commitments represent a critical demand of cash flow from a business activity. Higher leverage means greater production levels from any given amount of owned equity. Higher leverage multiplies profits or losses as a percentage of owned equity. From a risk standpoint, higher leverage increases the probability that total owned equity will be lost as a result of a given business decision. And, higher leverage means greater debt service commitments.

Risk Rated Decisions

There are an infinite number of possible combinations of probabilities and profits or losses from any decision. A producer might be interested in the chances of making $10,000 or more or of losing $5,000 or more. He or she might be interested in how much profit one might expect to make one time out of ten in a situation like the present. Or one might be interested in how much he or she might lose with an one in five, or 20 percent probability. The lack of any standard measure of risks tend to make the decision process more complex than is necessary.

A producer may choose any risk level as a basis for comparison among alternative courses of action. But, selection of some basic standards or risk ratings may prove useful. A "pessimistic" rating may be assigned to an unfavorable outcome at the one-sixth probability level. Thus, there would be one-chance-in-six of an outcome as bad or worse than a "pessimistic" rated outcome. An "optimistic" rating may be assigned to a favorable outcome at the one-sixth probability level. There is one-chance-in-six of an outcome as good as or better than an "optimistic" rated outcome. An "expected" rating may be assigned to the single most likely outcome. There is a 50-50 or one-in-two chance of an outcome either better or worse than the "expected" outcome. And, there are two-chances-out-of-three of an outcome better than a "pessimistic" outcome but not as good as an "optimistic" outcome. A producer who has a good basic understanding of these three risk levels can make logical risk management decisions.

Decision Risk Analysis

Risk rated decisions follow the same basic guidelines as other decision processes. First it is necessary to set specific risk related objectives. What is the minimum cash flow or net revenue needed at the "pessimistic" probability level? What is the maximum equity exposure at the "pessimistic" level? In other words, how much risk can the operation stand? What is the target or objective net return or cash flow level? What is an acceptable probability of achieving that positive return given the current cost and market situation and outlook? All these are important questions in developing risk rated objectives.

Next, alternative courses of action must be analyzed with respect to their potential for

achieving an objective at acceptable levels of risk. At this point, programmable calculators become very useful. Programs are available to combine user estimates of "expected," "optimistic" and "pessimistic" price and cost levels. Thus, total business risks can be expressed as "optimistic", "pessimistic" and "expected" net revenues. The risk ratings of net revenues have the same interpretation as for price and cost risks. There is a one-in-six chance of net revenues higher than "optimistic" levels, one-in-six chance of net revenues less than "pessimistic" levels, and so on.

Various financial risk levels are evaluated by converting net returns to owner equity and expressing net returns as a percentage of equity. Thus, each alternative can be evaluated in terms of its total business and financial risk dimensions. This process of evaluation facilitates better overall decision making.

The following program is designed for use on a Texas Instruments TI-59 calculator with printer. The manager may input three estimates of selling prices and production costs to reflect optimistic, most likely (expected), and pessimistic situations. This information along with the price-cost correlation, expected number of units of production per item (eg. cwt./head) and the number of items (eg. head) is used to compute the output.

The program will generate estimates of most likely (expected) as well as optimistic and pessimistic net returns. Thus, it provides an estimate of the returns associated with "good," "expected," and "bad" price-cost outcomes. The program will also compute the probability of a return greater than (or less than) any specified critical level. The program will also compute the percentage of the estimated returns relative to the total equity invested in the strategy.

Input required

		Storage Register	Labels
1.	Optimistic selling price ($/unit)	11	OP
2.	Expected selling price ($/unit)	12	EP
3.	Pessimistic selling price ($/unit)	13	PP
4.	Optimistic production cost ($/unit)	14	OC
5.	Expected production cost ($/unit)	15	EC
6.	Pessimistic production cost ($/unit)	16	PC
7.	Correlation between selling price and production cost (%/100)	17	CP-C
8.	Expected number of production items (numbers)	18	ITMS
9.	Expected production per unit (units)	19	PROD
10.	Total equity in strategy ($)	20	EQTY
11.	Interest rate (%/100)	21	INT
12.	Months required to complete strategy (months)	22	MTHS

The units on inputs one through six (registers 11-16) could be $/cwt. In which case the units for input nine (register 19) would be the expected selling weight of the animals in cwt. Input 8 (register 18) would be the number of animals involved with the decision.

Output A

If a printer is attached, the program will print the inputs with labels. It will also compute and print labels for the following: (Alternatively, the outputs may be recalled from the denoted storage registers.)

		Recall from Register	Labels
1.	Returns if the optimistic price and optimistic cost materialize ($/item)	23	ONR
2.	Returns if the expected price and the expected cost materialize ($/item)	24	ENR
3.	Returns if the pessimistic price and pessimistic cost materialize ($/item)	25	PNR
4.	Optimistic total net returns ($)	26	OTNR
5.	OTNR percent of total equity in strategy (%)	27	%EQY
6.	Expected total net returns ($)	28	ETNR
7.	ETNR percent of total equity in strategy (%)	29	%EQY
8.	Pessimistic total net returns ($)	30	PTNR
9.	PTNR percent of total equity in strategy (%)	31	%EQY

Output B

Output B enables a manager to compute the probability of achieving or exceeding a specified total net returns or critical level (CRL). For example, to compute the probability of achieving or exceeding a critical level (PCR), enter the desired level and press B. (The calculator will display the PCR, thus a printer is not necessary.)

Output B uses information computed by output A. Therefore, A must be executed prior to B. If any of the inputs in registers 11-22 are changed, output A should be recomputed prior to output B.

Example

The program can be used to analyze many types of "risk management" decisions. Our example considers a cattle feeding situation.

Production Costs

A producer may use a number of sources to assist with estimates of production costs. Records from previous lots of cattle would be very helpful. In addition, OSU enterprise budgets or the OSU TI-59 livestock costs and returns program may be used. For our example, we estimate that our most likely or expected cost will be $65/cwt. However, if weather and feed prices are favorable, cost may be $60/cwt. (optimistic cost). On the

other hand if feed conversion is less than anticipated and death losses higher than normal, costs could be $70/cwt. (pessimistic cost).

Selling price

The producer may use OSU projections of expected, pessimistic, and optimistic fed cattle prices. Perhaps the OSU estimates could be used in conjunction with estimates from other experts to generate an individualized projection.

For our example, we project an expected price of $67/cwt., a pessimistic price of $63/cwt., and an optimistic price of $72/cwt.

Cost-Price Correlation

Pessimistic production costs (high costs) are more likely to result in optimistic selling prices (high prices) than expected prices. Conversely, optimistic production costs (low costs) are more likely to be associated with pessimistic (lower) prices. The degree of this relationship depends upon the nature of the commodity's production cycle and the concentration of production. And, in the short run, such as one growing season, the relationship is not always pronounced. For example, bumper world crops (low or optimistic production costs per bushel) are expected to be associated with low or pessimistic crop prices. If your level of output (feed conversion and rate of gain) generally rises and falls with national output, enter a positive decimal. In our example we enter 0.2. On the other hand, if you have a low feed cost and good feed conversion when everyone else has poor feed conversion, high death losses and poor rates of gain, enter a zero.

Additional Factors

For our example, we expect to feed 100 head to 11 cwt (1,100 lbs.). We have $30,000 of equity capital (EQTY) that has an opportunity cost of 17 percent (INT) and will be "tied up" for 6 months (MTHS).

Input

		Keys Pressed
Optimistic selling price ($/unit)	OP	72 STO 11
Expected selling price ($/unit)	EP	67 STO 12
Pessimistic selling price ($/unit)	PP	63 STO 13
Optimistic production cost ($/unit)	OC	60 STO 14
Expected production cost ($/unit)	EC	65 STO 15
Pessimistic production cost ($/unit)	PC	70 STO 16
Correlation between selling price and production cost (%/100)	CP-C	.2 STO 17
Expected number of production items (number)	ITMS	100 STO 18
Expected production per unit (units)	PROD	11 STO 19
Total equity in strategy ($)	EQTY	30000 STO 20
Interest rate (%/100)	INT	.17 STO 21
Months required to complete the strategy (months)	MTHS	6 STO 22

Output A

Press A

```
RISK?
   72.00     OP
   67.00     EP
   63.00     PP
   60.00     OC
   65.00     EC
   70.00     PC
    0.20     CP-C
  100.00     ITMS
   11.00     PROD
30000.00     EQTY
    0.17     INT
    6.00     MTHS

  117.07     ONR
   47.50     ENR
  -15.69     PNR

11707.01     OTNR
   39.02     %EQY
 4750.00     ETNR
   15.83     %EQY
-1569.02     PTNR
   -5.23     %EQY
```

The first section (OP - MTHS) lists our inputs. We can easily detect data entry errors.

Section 2 (ONR - PNR) provides estimates on a per item (per head) basis. If optimistic prices and costs prevail (ONR) we expect returns of $117.07 per head. If both prices and costs are as expected (ENR) we expect returns of $47.50 per head. However, if costs are high and prices are low (PNR) we may lose $15.69 per head.

Section 3 (OTNR - %EQY) provides estimates for the entire number of items (ITMS). In our example, we plan to feed 100 steers. We expect to make $4750 which is 15.83 percent of the equity invested in the strategy.

Output B

Enter critical level (CRL) and press B.

```
 18664.02     CRL
.0227500752   PCR

 11707.01     CRL
.1586552892   PCR

  4750.       CRL
.4999999995   PCR

 -1569.02     CRL
.1586552179   PCR

 -7888.04     CRL
.0227500434   PCR
```

The probability that we will make more than $18,664 is 2.3 percent. The same probability exists for losing $7,888 or more. (These numbers represent the bounds for two standard deviations from the mean.)

Equations

$X = (INT \times MTHS \div 12) \times (EQTY \div (ITMS \times PROD))$

$EC' = EC - X$

$PC' = PC - X$

$OC' = OC - X$

$OSE = ((OP - EP)^2 - 2 \times CP\text{-}C \times (OP - EP) \times (EC' - OC'))^{.5} \times PROD$

$PSE = ((EP - PP)^2 + PC' - EC')^2 - 2 \times CP\text{-}C \times (EP - PP) \times (PC' - EC'))^{.5} \times PROD$

$ENR = (EP - EC) \times PROD$

$ONR = ENR + OSE$

$PNR = ENR - PSE$

$ENTR = EPEC \times ITMS$

$\%EQY = ENTR \div EQTY \times 100$

$OTNR = ETNR + (OSE \times ITMS)$

$\%EQY = OTNR \div EQTY \times 100$

$PTNR = ETNR - (PSE \times ITMS)$

$\%EQY = PTNR \div EQTY \times 100$

PCR = Probability of $X \geq Z$

where:

$Z = (CRL - ETNR) \div (OSE \times ITMS)$ for $CRL \geq ETNR$

$Z = (ETNR - CRL) \div (PSE \times ITMS)$ for $CRL \leq ENTR$

Worksheet

The master library module should be "loaded" into the calculator. Enter program from sides 1 (BANK 1) and 2 (BANK 2) of card 1. Enter labels from side 1 (BANK 3) of card 2. Data may be stored on, and entered from, side 2 (BANK 4) of card 2.

Item		Units	Keys Pressed	Display	Your Values		
OPTIMISTIC PRICE	OP	$/unit	72 STO 11	72.			
EXPECTED PRICE	EP	$/unit	67 STO 12	67.			
PESSIMISTIC PRICE	PP	$/unit	63 STO 13	63.			
OPTIMISTIC COST	OC	$/unit	60 STO 14	60.			
EXPECTED COST	EC	$/unit	65 STO 15	65.			
PESSIMISTIC COST	PC	$/unit	70 STO 16	70.			
COST PRICE CORRELATION	CP-C	%/100	.2 STO 16	0.2			
NUMBER OF PROCUTION							
ITEMS	ITMS	no.	100 STO 18	100.			
EXPECTED PRODUCTION							
PER UNIT	PROD	units	11 STO 19	11.			
STRATEGY EQUITY	EQTY	$	30000 STO 20	30000.			
INTEREST RATE	INT	%/100	.17 STO 21	0.17			
MONTHS REQUIRED	MTHS	months	6 STO 22	6.			
COMPUTE ESTIMATES							
OUTPUT A			A	1.			
OUTPUT B							
ENTER CRITICAL LEVEL	CRL	$	0 B				
COMPUTED PROBABILITY	PCR	%/100		0.2261			

Summary

The worksheet illustrates only one risk situation. Programmable calculators provide the decision maker with the power to analyze numerous alternatives. Thus worksheet space is provided suggesting alternative sets of prices, costs, production levels, financial arrangements, etc. This allows producers to quickly evaluate alternatives such as hedging in futures markets, higher or lower financial leveraging, alternative kinds of cattle, and alternative production practices. It is necessary to have reasonable estimates of levels and variability of prices and costs associated with each alternaitve considered and other basic information such as equity capital and interest rates. But, the calculator does all the "pencil pushing" once the appropriate numbers have been entered.

There are no guarantees for profitable decisions. The risk program is designed to deal specifically with the always present possibility of prices and/or costs less favorable than expected. The best of decisions can result in losses even when risks are taken into consideration. But, the odds of a profitable decision may be improved greatly by evaluation of potential profits and risks among all logical alternativees. Programmable calculators provide the analytical power to make such complex analyses not only possible but practical.

Program Listing

Store in BANK 1, on card 1, side 1 and BANK 2, on card 1, side 2.

000	76	LBL	041	01	1	082	01	1	123	53	(	164	65	×
001	98	ADV	042	01	1	083	02	2	124	43	RCL	165	43	RCL
002	98	ADV	043	42	STO	084	54	)	125	14	14	166	10	10
003	07	7	044	04	04	085	65	×	126	75	-	167	65	×
004	32	X↕T	045	76	LBL	086	53	(	127	43	RCL	168	43	RCL
005	97	DSZ	046	19	D'	087	43	RCL	128	36	36	169	33	33
006	00	0	047	73	RC*Ind	088	20	20	129	54	)	170	54	)
007	19	D'	048	05	05	089	55	÷	130	95	=	171	95	=
008	76	LBL	049	69	OP	090	43	RCL	131	42	STO	172	34	FX
009	11	A	050	04	04	091	18	18	132	33	33	173	65	×
010	01	1	051	73	RC*Ind	092	55	÷	133	53	(	174	43	RCL
011	00	0	052	04	04	093	43	RCL	134	43	RCL	175	19	19
012	32	X↕T	053	58	FIX	094	19	19	135	16	16	176	95	=
013	98	ADV	054	02	2	095	54	)	136	75	-	177	42	STO
014	69	OP	055	69	OP	096	95	=	137	43	RCL	178	06	06
015	00	00	056	06	06	097	42	STO	138	36	36	179	43	RCL
016	03	3	057	22	INV	098	36	36	139	54	)	180	32	32
017	05	5	058	58	FIX	099	43	RCL	140	75	-	181	33	X²
018	02	2	059	01	1	100	11	11	141	53	(	182	85	+
019	04	4	060	44	SUM	101	75	-	142	43	RCL	183	43	RCL
020	03	3	061	05	05	102	43	RCL	143	15	15	184	07	07
021	06	6	062	44	SUM	103	12	12	144	75	-	185	33	X²
022	02	2	063	04	04	104	95	=	145	43	RCL	186	75	-
023	06	6	064	43	RCL	105	42	STO	146	36	36	187	53	(
024	07	7	065	00	00	106	10	10	147	54	)	188	02	2
025	01	1	066	67	EQ	107	43	RCL	148	95	=	189	65	×
026	69	OP	067	98	ADV	108	12	12	149	42	STO	190	43	RCL
027	02	02	068	97	DSZ	109	75	-	150	07	07	191	17	17
028	69	OP	069	00	0	110	43	RCL	151	43	RCL	192	65	×
029	05	05	070	19	D'	111	13	13	152	10	10	193	43	RCL
030	13	C	071	98	ADV	112	95	=	153	33	X²	194	32	32
031	69	OP	072	91	R/S	113	42	STO	154	85	+	195	65	×
032	00	00	073	76	LBL	114	32	32	155	43	RCL	196	43	RCL
033	02	2	074	13	C	115	53	(	156	33	33	197	07	07
034	01	1	075	53	(	116	43	RCL	157	33	X²	198	54	)
035	42	STO	076	43	RCL	117	15	15	158	75	-	199	95	=
036	00	00	077	21	21	118	75	-	159	53	(	200	34	FX
037	03	3	078	65	×	119	43	RCL	160	02	2	201	65	×
038	09	9	079	43	RCL	120	36	36	161	65	×	202	43	RCL
039	42	STO	080	22	22	121	54	)	162	43	RCL	203	19	19
040	05	05	081	55	÷	122	75	-	163	17	17	204	95	=

205	42	STO	261	95	=	317	77	GE
206	34	34	262	42	STO	318	15	E
207	53	(	263	29	29	319	53	(
208	43	RCL	264	43	RCL	320	43	RCL
209	12	12	265	28	28	321	00	00
210	75	-	266	85	+	322	75	-
211	53	(	267	53	(	323	43	RCL
212	43	RCL	268	43	RCL	324	28	28
213	15	15	269	06	06	325	54	)
214	75	-	270	65	×	326	55	÷
215	43	RCL	271	43	RCL	327	53	(
216	36	36	272	18	18	328	43	RCL
217	54	)	273	95	=	329	06	06
218	54	)	274	42	STO	330	65	×
219	65	×	275	26	26	331	43	RCL
220	43	RCL	276	55	÷	332	18	18
221	19	19	277	43	RCL	333	54	)
222	95	=	278	09	09	334	95	=
223	42	STO	279	95	=	335	61	GTO
224	24	24	280	42	STO	336	10	E'
225	43	RCL	281	27	27	337	76	LBL
226	24	24	282	43	RCL	338	15	E
227	85	+	283	28	28	339	53	(
228	43	RCL	284	75	-	340	43	RCL
229	06	06	285	53	(	341	00	00
230	95	=	286	43	RCL	342	94	+/-
231	42	STO	287	34	34	343	85	+
232	23	23	288	65	×	344	43	RCL
233	43	RCL	289	43	RCL	345	28	28
234	24	24	290	18	18	346	54	)
235	75	-	291	54	)	347	55	÷
236	43	RCL	292	95	=	348	53	(
237	34	34	293	42	STO	349	43	RCL
238	95	=	294	30	30	350	34	34
239	42	STO	295	55	÷	351	65	×
240	25	25	296	43	RCL	352	43	RCL
241	43	RCL	297	09	09	353	18	18
242	20	20	298	95	=	354	54	)
243	55	÷	299	42	STO	355	95	=
244	01	1	300	31	31	356	76	LBL
245	00	0	301	92	INV SBR	357	10	E'
246	00	0	302	76	LBL	358	36	PGM
247	95	=	303	12	B	359	14	14
248	42	STO	304	42	STO	360	11	A
249	09	09	305	00	00	361	36	PGM
250	43	RCL	306	32	X:T	362	14	14
251	24	24	307	43	RCL	363	12	B
252	65	×	308	37	37	364	32	X:T
253	43	RCL	309	69	DP	365	43	RCL
254	18	18	310	04	04	366	38	38
255	95	=	311	43	RCL	367	69	DP
256	42	STO	312	00	00	368	04	04
257	28	28	313	69	DP	369	32	X:T
258	55	÷	314	06	06	370	69	DP
259	43	RCL	315	43	RCL	371	06	06
260	09	09	316	28	28	372	98	ADV
						373	91	R/S

Label Codes

Store in BANK 3, on card 2, side 1.

Code	Storage Register
1115352700.	37
1133153500.	38
1132330000.	39
1117330000.	40
1133330000.	41
1132150000.	42
1117150000.	43
1133150000.	44
1115332015.	45
1124373036.	46
1133353216.	47
1117343745.	48
1124313700.	49
1130372336.	50
1132313500.	51
1117313500.	52
1133313500.	53
1132373135.	54
1161173445.	55
1117373135.	56
1161173445.	57
1133373135.	58
1161173445.	59

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