CHAPTER 10: UNCERTAINTY AND RISK IN CAPITAL BUDGETING: PART I

10-1

		Year	ATCF
		0	-2,500,000
Initial Investment = $2,500,000		1	$1,280,000
Annual Operating Cash Flows		2	$1,280,000
Revenues	$5,000,000	3	$1,280,000
Variable Cost	$2,000,000	4	$1,280,000
Fixed Costs	$1,000,000	5	$1,280,000
Depreciation	$200,000	6	$1,280,000
EBIT	$1,800,000	7	$1,280,000
EBIT (1-t)	$1,080,000	8	$1,280,000
+ Depreciation	$200,000	9	$1,280,000
ATCF	$1,280,000	10	$1,780, 000

a. NPV of Store = -$2,500,000 + $1,280,000 (PVA,14%,10 years) + $500,000/1.14^10
= $4,311,500
IRR of Store = 50.51%

b. Sensitivity of NPV/IRR to Sales/Square Foot and Variable Costs as % of Revenues

Sales/Sq Foot	NPV	IRR
$100	-$3.199 million	NA
$200	-$1.321 million	0%
$300	$555,897	19.19%
$400	$2.433 million	35.36%
$500	$ 4.31 million	50.51%

Variable Cost	NPV	IRR
40%	$4.311 mil	50.51%
50%	$2.746 mil	37.93%
60%	$1.181 mil	24.77%
70%	- $.383 mil	10.24%

c. Break even in Financial Terms for Sales per Square Foot = $270 / square foot (NPV = 0)
Break even in Accounting Terms for Sales/Square Foot = $200/ square foot (EBIT = 0)

10-2
Initial Investment = $(10,000,000)
Annual Operating Cash Flows

Year	1	2	3	4	5
Revenues =	$5,000,000	$5,250,000	$5,512,500	$5,788,125	$6,077,531
- Variable Cost	$2,000,000	$2,100,000	$2,205,000	$2,315,250	$2,431,013
- Fixed Costs	$500,000	$500,000	$ 500,000	$500,000	$500,000
- Depreciation	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
EBIT	$500,000	$650,000	$807,500	$972,875	$1,146,519
EBIT (1-t)	$300,000	$390,000	$484,500	$583,725	$687,911
+ Depreciation	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
ATCF	$2,300,000	$2,390,000	$2,484,500	$2,583,725	$2,687,911
PV at 15%	$2,000,000	$1,807,183	$1,633,599	$1,477,253	$1,336,367

a. Total PV of Cash Inflows = $8,254,403
NPV = -$10,000,000 + $8,254,403 = $(1,745,597)
IRR of Project = 7.55%

b.

Year	CF
0	-10,000,000
1	$2,300,000
2	$2,390,000
3	$2,484,500
4	$2,583,725
5	$2,687,911

Sensitivity of Measures to Changes in Assumptions

# Units Sold	NPV	IRR
15,000	($3,390,179)	-0.13%
20,000	($1,745,597)	7.55%
25,000	($101,016)	14.58%
30,000	$1,543,565	21.15%

Sales Price/Unit	NPV	IRR
200	($3,061,262)	1.47%
250	($1,745,597)	7.55%
300	($429,932)	13.22%
350	$885,733	18.57%
400	$2,201,398	23.68%

c. Breakeven number of units (NPV = 0) = 25,307 units

Breakeven number of units (EBIT = 0) = 16,667 units

10-3

a. I would draw from these distributions to do my simulations.

b. Over a large number of simulations, I would expect the average NPV to converge to the base case (-$1.745 million) and the average IRR to also converge on the base case (7.55%).

c. I would look at the distribution of NPV and IRR across the simulations.

10-4 a:

Year	CF		PV of Cash Flow
0	$(10,000,000)		$(10,000,000)
1	$1,500,000		$1,339,286
2	$1,575,000		$1,255,580
3	$1,653,750		$1,177,107
4	$1,736,438		$1,103,538
5	$1,823,259		$1,034,566
6	$1,914,422		$969,906
7	$2,010,143		$909,287
8	$2,110,651		$852,457
9	$2,216,183		$799,178
10	$2,326,992	$1,000,000	$1,071,202
		NPV =	**$512,106**

b. (1) if projects continue for 5 more years, growing at 5% a year:
Terminal Value in year 10 = PV of $2,326,992 growing at 5% a year for 5 years + PV of Salvage of $1 million (discounted back 5 years) = $10,194,317
NPV of Project with this Terminal Value = $3,472,430

(2) if cash flows continue for 10 more years with no growth:
Terminal Value in year 10 = PV of annuity of $2,326,992 for 10 years + PV of Salvage of $1 million discounted back 10 years = $13,469,997
NPV of Project with this Terminal value = $4,527,111

(3) If cash flow in year 10 continues in perpetuity:
Terminal Value in year 10 = $2,326,992/.12 = $19,391,600
NPV of Project with this terminal value = $6,433,709

10-5

a:

			Cash Flows	NPV	Prob
		Better	$40 for 5 years	$60.81	0.15
	Full Introduction ($50)	As Well As	$20 for 5 years	($1.85)	0.15
Succeed		Worse Than	$5 for 5 years	($48.84)	0.15

		Regional Introduction ($20)	$(23.18)	0.15
Test Marketing ($5)				
	Fails	Stops after testing the market	($5)	0.4

b. NPV of Project = $60.81 (.15) - $1.85(.15) - $48.84 (.15) - $23.18 (.15) = $(3.96)

c. The option to abandon has no value here, since the project cash flows are always positive.

10-6

NPV	Number	Probability	NPV * Probability
$(30.00)	150	3.75%	$(1.13)
$(5.00)	350	8.75%	$(0.44)
$5.00	500	12.50%	$0.63
$15.00	1,000	25.00%	$3.75
$25.00	1,000	25.00%	$6.25
$35.00	500	12.50%	$4.38
$45.00	300	7.50%	$3.38
$75.00	200	5.00%	$3.75

a. Expected NPV = $20.56

b. Probability that NPV < 0 = 12.50%

c. I would use the entire distribution rather than just the base case NPV to make my decision.

10-7

a. Base Case Analysis:

Initial Investment = - $20 million

Annual Operating Cash Flows:

Year	Cash Flow
0	-20,000,000
1	9,280,000
2	9,280,000
3	9,280,000
4	9,280,000
5	9,280,000

Revenues	28,000,000
- Fixed Costs	10,000,000
- Var. Costs	5,200,000

- Depreciation	4,000,000
EBIT	8,800,000
EBIT (1-t)	5,280,000
+ Depreciation	4,000,000
ATCF =	**9,280,000**

NPV of Project = -$20,000,000 + $9,280,000 (PVA,12) = $13,452,323
IRR of Project = 36.67%

b. Sensitivity of NPV and IRR to number of units sold:

# of Units Sold	**NPV**	**IRR**
25,000	$799,559	13.60%
50,000	$5,017,147	21.70%
75,000	$9,234,735	29.35%
100,000	$13,452,323	36.67%
125,000	$17,669,911	43.73%

c. Breakeven number of units = 20,261

10-8
Yes. Having the flexibility to get out of the project if the cash flows do not meet my expectations will make it more likely that I take the project.

10-9
a.

Test Marketing	**Next Stage**	**Cash Flows**	**NPV**	**Probability**
	Build ($50 million)	$10 million/year for 10 yrs	$1,445,671	.6
($10 million)				
	Abandon		($10 million)	.4

NPV of Project = 0.6 * $1,445,671 + 0.4 * ($10,000) = $(3,132,597)

b. No. I would not do the test market, since the expected present value of the project does not cover the test market cost

10-10
Initial Investment = $100 million (1- .4) = $60,000,000

a. Accounting Breakeven = Fixed Costs/Contribution Margin per Units
= $10 million / $0.30 = 33,333,333

b.

Annual Operating Cash Flows	
Revenues	$37,595,940

- Variable Cost	$15,038,376	# of Units = 75,191,880
- Fixed Cost	$10,000,000	
EBIT	$12,557,564	
EBIT (1-t)	$7,534,538	
NPV of Project =	**$1.49**	

Approximately 75,191,880 cans have to be sold to break even financially.

10-11

a. Initial Increase needed in Working Capital = .2 (6) - .1 (4) = $800,000.00
Annual Increase in after-tax cash flows = $2 million (.1) = $200,000.00

NPV = - $800,000 + $200,000 (PVA,14%,10 years) + $800,000/1.14−10 = $459,018.18
Yes. You should offer credit.
[We assume that working capital is fully salvaged.]

b. The revenues will have to increase roughly $778,000 for the firm to break even.

c. The solution is not sensitive to the number of years you stay in business, as long as the working capital is fully salvageable.

10-12

a.

Variable	***Base Case***	***Break Even***	***Margin for Error***
Volume	100,000	92,000	8.00%
Price/Unit	$1,000	$875	12.50%
Operating Margin	15%	14.10%	6.00%
Discount Rate	12.50%	14%	-12.00%
Life of Project	15	12.7	15.33%

b. I would examine the margins for error to ensure that I felt comfortable with these margins.

c. I might also spend money on acquiring more information on those variables where I felt that my margin for error was too slim. I might also try to enter into agreements to reduce uncertainty on some variables (say, labor cost).

10-13

a. Initial Investment = ($10,000,000)

Annual Operating Cash Flows:

Revenues	$15 per subscriber
Variable Cost	$5 per subscriber
EBIT per subscriber	$10 per subscriber
EBIT (1-t)	$6 per subscriber

Annual Cash Flow needed to make NPV positive in two years
= $10,000,000 / (APV,14%,2) = $6,072,897
Number of Subscribers needed for 2-year life to have positive NPV
= $6,072,897/($6*12) = 84,356

b:
If 500,000 subscribers are signed,
ATCF = $3,000,000
Number of years the firm has to stay in business:
-10,000,000 + 3000000 (PVA,1.16667%,n) = 0 ! Monthly breakeven Solving
n is between 3 and 4 months
.

10-14
If the discount rate already reflects the risk, and the project has a positive NPV, it can be argued that the risk in the project has already been considered. The fact that a what-if analysis leads to negative NPVs should then not be a basis for rejecting the project. However, the discount rate may reflect only market risk, whereas the what-if analysis can look at all risk.

10-15
Initial Investment = ($15,000,000)
After-tax Operating Cash Flow per unit sold = $80

a. Annual CF needed over 3 years to make NPV positive
= $15,000,000 (APV,15%,3years) = $6,569,654
Number of units you would need to sell to breakeven = $6,569,654/$80 = 82,120.68

b. If I was uncertain about the life, I would have to calculate this break even for each life time (2 years, 3 years, 4 years etc.) and then look at an expected value for the break even.

10-16
a:

		Mega Well	**NPV**	**Probability**
		500,000 barrels for 20 years:	$10,833,568	0.2
	Full Rig	*Typical Well*		
	($50,000,000)	250,000 barrels for 20 years	$(2,083,216)	0.2
Initial Cost		*Bust Well*		
($10,000,000)		50,000 barrels for 20 years	$(12,416,64)	0.2
			$(10,000,000)	0.4

Expected NPV without abandonment option = $(4,733,258)

b. The company should not spend any money for the option to explore, since the expected NPV is negative.

c. If you can abandon the project, you would under the 50,000 barrels scenario.
Expected NPV with abandonment option = $(3,684,090)
Value of the abandonment option = $1,049,168