Chapter 6: Estimating Side Costs and Benefits

1. At a market share of 14.9175%, we find that we are indifferent between investing in the new distribution system or not.

	Current level	New level	Increment
Revenue	10,000,000	14,917,500	$4,917,500
Fixed Costs	2,000,000	2,000,000	$0
Variable Costs	4,000,000	5,967,000	$1,967,000
Advertising		1,000,000	$1,000,000
Depreciation		1,000,000	$1,000,000
Incremental Before-tax income			950,500
After-tax income			570,300
Depreciation			1,000,000
After-tax Operating Cashflow			1,570,300
Present value of working capital flows (increase of $1m. today and decrease of $1m. in 10 years)			536806.51
Initial Distribution system cost			10,000,000
NPV			34

This can be solved algebraically through the following equation:
(-10000000 –1,000,000)+(.6x-1000000-(.6x-1000000 1000000)*.4)(PVA,10yrs,8%)+1,000,000/1.08^10=0
Solving for X, we get X = 4,917,000
If we make the initial working capital investment a function of the revenues, we get a lower breakeven point of 4,802,025

2. The existing machine has an annual depreciation tax advantage = 500000(0.40)/5 = 40,000. The present value of this annuity equals $\frac{40000}{.1}\left(1-\frac{1}{1.1^5}\right)=151631.47$

The new machine has an annual depreciation tax advantage = 2000000(0.40)/10 = 80,000. The present value of this annuity equals $\frac{80000}{.1}\left(1-\frac{1}{1.1^{10}}\right)=491565.37$.

However, it will be necessary to spend an additional 1.7m. to acquire the new machine.
Net Cost of the New Machine = -1,700,000 + 491,565 – 151,531 = $1,360,066
. Solving, for the annual savings that we would need each year for the next 10 years,
Annual Savings = $ 1,360,066 (Annuity given PV, 10 years, 10%) = $221,344

3.

Year	Revenues	Operating Expenses	Depr	Taxable Income	After-tax income	Depr	Initial Inv and Salvage	After-tax cashflow
0							-50000	-50000
1	15000	7500	8000	-500	-300	8000		7700
2	15750	7875	8000	-125	-75	8000		7925
3	16537.5	8268.75	8000	268.75	161.25	8000		8161.25
4	17364.4	8682.19	8000	682.188	409.313	8000		8409.3125
5	18232.6	9116.3	8000	1116.3	669.778	8000	10000	18669.7781
							NPV	($15,060.22)

The net present value without the additional sales is negative.

b.

Year	Sales	Pre-tax Operating margin	After-tax operating margin
0			
1	20000	8000	4800
2	22000	8800	5280
3	24200	9680	5808
4	26620	10648	6388.8
5	29282	11712.8	7027.68
		NPV (@12%)	$20,677

The present value of the cashflows accruing from the additional book sales equals $20,677

c. The net effect is equal to $20,677 - $15,060 = $ 5,617. Hence, the coffee shop should be opened.

4. The present value of the cashflows from the gardening shop is -50000 + PV(annuity of 10000 for 10 yrs at 14%) = -50000 + $\frac{10000}{.14}\left(1-\frac{1}{1.14^{10}}\right)=52,161.16$ - 50000 = 2,161.16.

However the present value of the lost sales due to the parking conflict equals $\frac{3000(0.4)}{.14}\left(1-\frac{1}{1.14^{10}}\right)=6259.34$. Since this outweighs the present value of the flows from the gardening shop, it would not be optimal to open the gardening shop.

5. The annual after-tax operating flows from the service is 5,000,000(.20)(0.1)-36,000 = 64,000. The present value of these flows is $\frac{64,000}{.12}\left(1-\frac{1}{1.12^{10}}\right)=361,614$.

The initial costs equal 150,000, for a NPV of $211,614. Hence, it is worthwhile to offer the service. (We use the after-tax expense of $36,000 instead of the pre-tax expense of $ 60,000)

6.

· The exercise price is the initial investment, which is $300 m.

- The Value of the Underlying Asset, (S in the model) is the present value of the cashflows, which is $\frac{25}{.16}\left(1-\frac{1}{1.16^{20}}\right)=148.22m.$
- The time to expiration is 10 years.
- The standard deviation is 20%.
- If we assume that the value of the project decreases over the 10 years, the equivalent dividend yield is 1/20 = 5%.
- The riskfree rate is 12%, since that corresponds to the life of the option.

7. a. The PV of the after-tax cash inflows = $\frac{500,000}{.15}\left(1-\frac{1}{1.15^{10}}\right)$ = 2,509,384.30 . The initial investment is $50(100,000) = $5m. The PV of the $5m. sales price in 10 years = $5/1.15^{10}$ = 1,235,923.50. The NPV = -5,000,000 + 1,235,923.50 + 2,509,384.30 = -$1,254,692.20 < 0. Hence from a standard capital budgeting perspective, the project would not be accepted.

b. The standard deviation of prices per square foot can be estimated, using the provided data as:

Year	Price	% change	Squared Deviation
-6	20		
-5	30	0.5	0.08019603
-4	55	0.83333	0.38009983
-3	70	0.27273	0.00312663
-2	55	-0.21429	0.18584435
-1	50	-0.09091	0.09469163
0	50	0	0.047007
		Variance	0.1582

The option is to buy at today’s price which is $ 50 per square foot. Thus,
S = $ 50
K = $ 50
Riskless rate = 6%
T = 5
Variance = 0.1582
Value of the call option per square foot = $ 22.20
Total Value of Call option =100,000 * $22.20 = $2,220,000

Problem 8
In the absence of better information, we use the 25 year bond rate of 7% as the discount rate. This would be acceptable to the extent that the risk in the mine is diversifiable; and in fact, there is some evidence that commodity futures betas are close to zero. We also assume that the tax rate is zero.
The traditional method of computing the value of the mine using a discount rate of 7% yields a Net Present Value of $309,755.06, as shown below.

Year	Revenue	Cost	Net profit	PV
0			-3000000	-3000000
1	340000	160000	180000	168224.2991
2	353600	164800	188800	164905.2319
3	367744	169744	198000	161626.9796
4	382454	174836.32	207617.44	158390.3509
5	397752	180081.41	217670.501	155196.0588
6	413662	185483.852	228178.135	152044.7259
7	430208	191048.367	239160.099	148936.8898
8	447417	196779.818	250636.986	145873.0081
9	465313	202683.213	262630.264	142853.4625
10	483926	208763.709	275162.307	139878.5639
11	503283	215026.621	288256.436	136948.5563
12	523414	221477.419	301936.96	134063.6211
13	544351	228121.742	316229.212	131223.8805
14	566125	234965.394	331159.598	128429.4018
15	588770	242014.356	346755.636	125680.2001
16	612321	249274.787	363046.005	122976.2426
17	636814	256753.03	380060.593	120317.4507
18	662286	264455.621	397830.547	117703.7038
19	688778	272389.29	416388.325	115134.8417
20	716329	280560.968	435767.751	112610.6678
21	744982	288977.798	456004.071	110130.9508
22	774781	297647.131	477134.012	107695.428
23	805772	306576.545	499195.844	105303.8074
24	838003	315773.842	522229.443	102955.7695
25	871523	325247.057	546276.359	100650.9699

The NPV = $309,755.06

b. The option value of the mine can be computed using the following inputs:
interest rate = 7%, variance = $.25^2$ = 0.0625, the dividend rate = 1/25 = 4%, exercise price = $3m., the value of the underlying asset = 3,309,755.06, option maturity = 25 years.
Using these inputs, the option value can be computed as:
$3{,}309{,}755.06e^{-0.04(25)}\ N(d_1) - 3{,}000{,}000e^{(-0.07)(25)}N(d_2)$, where
$d_1 = [\ln(3{,}309{,}755.06/3{,}000{,}000) + (0.07-0.04 + .0625/2)25]/(0.0625x25)^{0.5} = 1.30$
$d_2 = 0.053$

$N(d_1)$ =0.9038; $N(d_2)$ = 0.5214
The option value equals $828,674.

c. The two values are different because in the traditional method, we have not taken into account the ability to delay the project.

9. a. The value of the project based on traditional NPV = $250m. - $200m. = $50m.
b. There is an additional value based on the option to delay the project for up to 5 years. The inputs to this option valuation are: the value of the underlying asset = $250m.; the exercise price = $200m.; the maturity of the option = 5 years; the variance = .04; the yearly payment can be modeled as a dividend payment, which is equal to 12.5/250 = 5%; the riskfree rate = 8%.

Using these inputs, the option value can be computed as:
$250e^{-0.05(5)} N(d_1) - 200e^{(-0.08)(5)}N(d_2)$, where
$d_1 = [\ln(250/200) + (0.08-0.05 + .04/2)5]/(0.04x5)^{0.5} = 1.06$
$d_2 = 0.61$
$N(d_1) = 0.85$; $N(d_2) = 0.73$
The option value equals 68.68.

c. The two values are different because in the traditional method, we have not taken into account the ability to delay the project. The value of this depends mainly on the variance of the cashflows.

10. The present value of the asset = 250m; the exercise price = 500m.; the life of the option = 10 years; the dividend rate = 1/10 = 10%; the variance = 0.36; the riskfree rate = 6%

The option value equals $250e^{-0.1(10)} N(d_1) - 500e^{(-0.06)(10)}N(d_2)$, where
$d_1 = [\ln(250/500) + (0.06 - 0.10 + .36/2)5]/(0.36x10)^{0.5} = 0.3725$
$d_2 = -1.53$
The option value equals $39.35 million
This value will be reduced by the present value of $10 million in research that the firm has to invest each year to keep its patent alive.

If the variance increases, the value of this option will increase. Consequently, it can be argued that patents in technologically volatile areas will have much more value than patents in stable businesses.

11. a. False.
b. Generally true; there must be some comparative advantage, such that the project will not be taken up by competitors if the company fails to act on it immediately.
c. Not necessarily true. The expected growth rate may be set high enough to allow for the effect of these options on future earnings.
d. False
e. True.