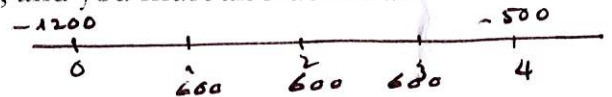


FM 2555A – Fall 2016
Solutions to Assignment No. 2
(Questions assigned for submission)

♣ Required Assignment Question 1 (Not from the textbook) [4 points]

Dry-Sand Co. is considering investing in a new project. The project will need an initial capital investment of \$1.2 million and generate \$600K (after-tax) cash flows for three years. However, at the end of the 4th year, the project will generate -\$500K of after-tax cash flow due to dismantling costs. Calculate the MIRR (modified IRR) for the project if the cost of capital is 15%. [N.B: You may use Excel or a Financial Calculator to check your answer. However, you need to demonstrate what equation you are solving including all the steps necessary to arrive at such an equation, and you must also define all variables/notation you are using.]



SOLUTION:

To eliminate the 2nd sign change, combine year 3 and year 4 cash flows:

4PTS

$$PV_3 = +600 - 500/1.15 = 165.22 \quad (1)$$

$$\text{So, } -1200 + 600(1+\text{MIRR})^{-1} + 600(1+\text{MIRR})^{-2} + 165.22(1+\text{MIRR})^{-3} = 0. \quad (1)$$

$$\text{Let } y = (1+\text{MIRR})^{-1}.$$

$$-1200 + 600y + 600y^2 + 165.22y^3 = 0 \quad (1)$$

Solving, the corresponding cubic equation above using a numerical method, Excel or financial calculator, we get MIRR = 8.1%. (1)

♣ Required Assignment Question 2 (Not from the textbook) [4 points]

Rainman Inc is in the business of producing rain upon request. Rainman's CFO must decide between 2 investment projects: a new airplane for seeding rain clouds or a new weather control machine built by Dr Nutzbum. The discount rate for the new airplane is 9% whilst the discount rate for the new weather machine is 39% (it happens to have higher market risk). Assume a 0% inflation rate and that the projected costs do not change over time. The cash flows (in \$10,000) for each investment are given below.

Year	Airplane	Weather Machine
------	----------	-----------------

1	-900	-900
2	500	550
3	600	600
4		685

Which investment should the company select and why?

SOLUTION:

4PTS

$$NPV_{Airplane} = -900 + 500(1/1.09) + 600(1/1.09^2) = \$63.72$$

$$EC\ Flow_{Airplane} = 63.72/1.72911 = \$36.22, \text{ where } 1.72911 \text{ is the 2-year annuity factor.}$$

1.75

$$NPV_{Weather\ Machine} = -900 + 550(1/1.39) + 600(1/1.39^2) + 685(1/1.39^3) = \$61.29$$

$$EC\ Flow_{Weather\ Machine} = 61.29/1.60935 = \$38.08, \text{ where } 1.60935 \text{ is the 3-year annuity factor.}$$

1.75

Since they have different life spans, the weather machine has a higher EAC and should be accepted.

0.5

***Required Assignment Question 3 (Not from the textbook) [4 points]**

A project requires an initial investment of \$200K and expects to produce a cash flow before taxes of \$120K per year for two years (i.e., cash flows will occur at $t=1$ & $t=2$). The corporate tax rate is 30%. The asset will depreciate using the MACRS year-3 schedule [$t=1$: 33%]; [$t=2$: 45%]; [$t=3$: 15%]; [$t=4$: 7%]. The company's tax situation is such that it can use all applicable tax shields. The opportunity cost of capital is 11%. Calculate IIR for the project. [N.B: Do not use Excel or a Functional Calculator for this question. You must solve explicitly the corresponding quadratic equation; otherwise you lose marks for not including an illustration of how to solve such an equation.]

Modified Accelerated Cost Recovery System

SOLUTION:

1 Year-1 cash flow: $120,000(1-0.30) + [200,000(0.33)(0.30)] = 103,800$

tax expense ↑ put back depreciation expense

① Year-2 cash flow: $120,000(1-0.30) + [200,000(0.45)(0.30)] + (0.15+0.17)200,000 = 155,000$

↑ Non-cash expense to reduce taxes

Cash flow:

Time 0: -200,000

Time 1: 103,800

Time 2: 155,000

Don't forget: → Book value at the end of year 2
-0.20 if messy

0.5

We solve IRR in $-200,000 + 103,800v + 155,000v^2 = 0$, where $v = (1+IRR)^{-1}$.

Apply MACRS appropriately (similar to problem 14/154)

Using the quadratic equation, $IRR = 17.73\%$.

$$-200 + 103 \cdot 8 + 155v^2 = 0.$$

1.5

By the quadratic formula, $v_1 = 0.84940769295315$
 OR $v_2 = -1.51908511230805$, $v = (1 + IRR)^{-1}$
 ↑ not suitable
 $v_1^{-1} = 1 + IRR = 1.177290962 \Rightarrow IRR = 17.7296\%$

4

***Required Assignment Question 4 (Problem [21/190]) [4 points]**

Here are some historical data on the risk characteristics of Bank of America and Starbucks:

	Bank of America	Starbucks
Beta	1.57	0.83
Yearly standard deviation of return (%)	35.80	21.00

Assume the standard deviation of the return on the market was 23.0%.

- The correlation coefficient of Bank of America's return versus Starbucks is 0.30. What is the standard deviation of a portfolio invested half in each share? [1 pt]
- What is the standard deviation of a portfolio invested one-third in Bank of America, one-third in Starbucks, and one-third in risk-free Treasury bills? [1 pt] *3-Asset Case*
- What is the standard deviation if the portfolio is split evenly between Bank of America and Starbucks and is financed at 50% margin, that is, the investor puts up only 50% of the total amount and borrows the balance from the broker? [1 pt]
- What is the *approximate* standard deviation of a portfolio composed of 100 stocks with betas of 1.57 like of Bank of America? How about 100 stocks like Starbucks? [1 pt]

SOLUTION:

a. In general:

$$\sigma_P = (x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 + 2x_1 x_2 \rho_{12} \sigma_1 \sigma_2)^{.5} \quad \checkmark$$

Thus,

$$\sigma_P = (.5^2 \times .3580^2 + .5^2 \times .2100^2 + 2 \times .5 \times .5 \times .30 \times .3580 \times .2100)^{.5}$$

$$\sigma_P = .2331, \text{ or } 23.31\%$$

b. One of these securities, T-bills, has zero risk and, hence, zero standard deviation.

Thus,

$$\sigma_P = [(1/3)^2 \times .3580^2 + (1/3)^2 \times .2100^2 + 2 \times (1/3) \times (1/3) \times .30 \times .3580 \times .2100]^{.5}$$

$$\sigma_P = .1554, \text{ or } 15.54\%$$

Another way to think of this portfolio is that it is comprised of one-third T-Bills and two-thirds a portfolio which is half Bank of America and half Starbucks. Because the risk of T-bills is zero, the portfolio standard deviation is two-thirds of the standard deviation computed in Part (a) above:

$$\sigma_P = (2/3) \times 23.31\% = 15.54\%$$

- c. With 50% margin, the investor invests twice as much money in the portfolio as he had to begin with. Thus, the risk is twice that found in Part (a) when the investor is investing only his own money:

$$\sigma_P = 2 \times 23.31\% = 46.62\%$$

Handwritten notes: $I_0 \equiv \text{initial investment}$, $R = \text{rate of return}$
 $P = \text{portfolio value in (a)}$. $P = I_0(1+R)$
 $SD_P = I_0 \sigma_R$. Here, if $C = \text{portfolio value}$, $C = 2I_0(1+R)$

- d. With 100 stocks, the portfolio is well diversified, and hence the portfolio standard deviation depends almost entirely on the average covariance of the securities in the portfolio (measured by beta) and on the standard deviation of the market portfolio. Thus, for a portfolio made up of 100 stocks each with Bank of America's beta of 1.57, the portfolio standard deviation is approximately:

$$\sigma_P = 1.57 \times 23.0\% = 36.11\%$$

Handwritten notes: $= I_0(20\sigma_R)$
 N.B. $SD_C = SD$ in \$ terms
 new volatility 1.7x

For stocks like Starbucks, the approximate standard deviation is:

$$\sigma_P = .83 \times 23.0\% = 19.09\%$$

♣ Required Assignment Question 5 (Problem [22/190]) [4 points]

Suppose that Treasury bills offer a return of about 6% and the expected market risk premium is 8.5%. The standard deviation of Treasury-bill returns is zero and the standard deviation of market returns is 20%. Use the formula for portfolio risk to calculate the standard deviation of portfolios with different proportions in Treasury bills and the market. (Note: The covariance of two rates of return must be zero when the standard deviation of one return is zero.) Graph the expected returns and standard deviations.

SOLUTION:

For a two-security portfolio, the formula for portfolio risk is

$$\sigma_P^2 = x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 + 2x_1 x_2 \rho_{12} \sigma_1 \sigma_2$$

If security one is Treasury bills and security two is the market portfolio, then σ_1 is zero, and σ_2 is 20%. Therefore,

$$\sigma_P^2 = x_2^2 \sigma_2^2 = x_2^2 \times .20^2$$

4 pts.

$$\sigma_P = .20x_2$$

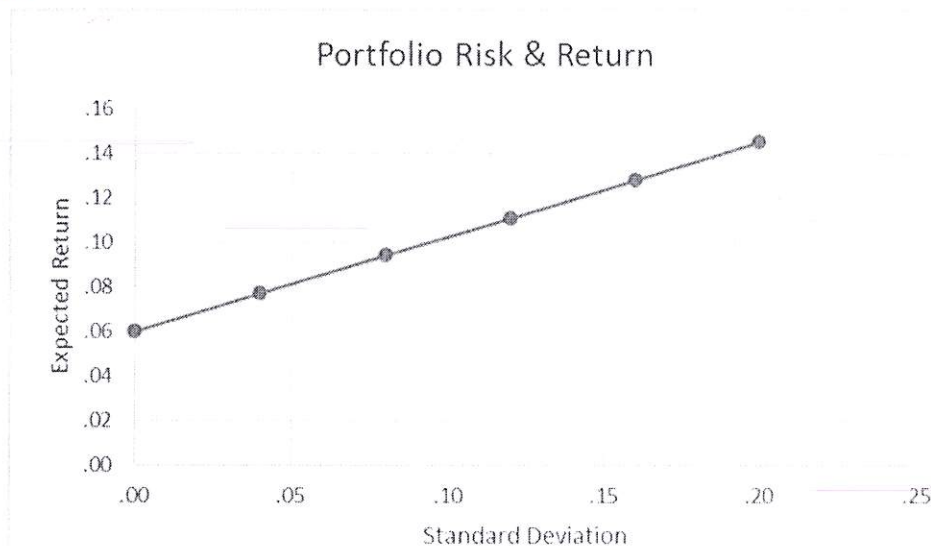
$$\text{Portfolio expected return} = x_1(.06) + x_2(.06 + .085)$$

$$\text{Portfolio expected return} = .06x_1 + .145x_2$$

Portfolio	x_1	x_2	Expected Return	Standard Deviation
1	1.0	.0	.060	.000
2	.8	.2	.077	.040
3	.6	.4	.094	.080
4	.4	.6	.111	.120
5	.2	.8	.128	.160
6	.0	1.0	.145	.200

1.5

Labels



1.5

Deduct
 (0.1) for each
 missing label