AP/ADMS4540

Assignment #1

Fall 2017

Solution:

Question 1

ODA (20 Points)

For first time in 300 years, no one is living on Barbuda – a news headline on the CNN webpage. Suppose Canadian Govt. is considering a loan $100 million, to be amortized over 8 years by 16 semi-annual payments, after a grace period of 4 years during which only interest would be paid semi-annually to help build Antigua and Barbuda, a Caribbean island country. Canada would charge interest at a stated annual rate of 6 percent.

i.) Determine whether or not this loan would qualify as ODA.

ii.) What is the maximum interest rate Canada could charge for this loan to qualify as ODA?

[***Note 1***: To qualify as official development assistance (ODA), development loans must have a grant element of at least 25 percent, calculated using a stated annual interest rate of 10 percent.

Note 2: For linear interpolation, use 5 percent if you require to lower interest rate, or use 7 percent if you require to raise interest rate.]

Solution:

Note: Figures are in millions.
First, calculate the payments at subsidized stated annual coupon rate of 6%.
Semiannual interest payments for the first four years = 6%/2 * 100 = 3
Semiannual annuity payments for the final eight years = 100 / PVIFA(16,6%/2)
= 100 / 12.5611
= 7.961084924

(1 mark)

(2 marks)

Second, calculate the PV of these payments, discounting at the stated market annual rate of 10%, and then the grant element.
"PV" of annuity payments after 4 years at 10% = PVIFA(16,10%/2) * 7.961084924
= 10.8378*7.961084924 = 86.2804

(2 marks)

PV of these annuity payments today at 10% = 86.2804 / 1.05^8 = 58.3980

(2 marks)

PV of interest payments today at 10% = PVIFA(8,10%/2) * 3 = 19.3896

(1 mark)

PV of payments today = 58.398 + 19.3896 = 77.7876

(2 marks)

The grant element is then the difference between the loan amount disbursed (100) and the PV of payments made on the loan (77.7876) = 22.2124

(1 mark)

This grant element represents 22.2124/100 or 22.2124% of the loan, and thus this loan would not qualify as ODA. The minimum grant element is 25, or the maximum PV of payments today is 75, for the loan to qualify as ODA.

(1 mark)

Third, use the method of linear interpolation to get the maximum interest rate for a grant element of 25, or PV of payments being at most 75.
Since 6% is too high, try a subsidized interest rate of 5% and calculate PV of the payments as before.
Semiannual interest payments for the first 4 years = 5%/2 * 100 = 2.50
Semiannual annuity payments for the final 8 years = 100 / PVIFA(16,5%/2) = 7.659899

(1 mark)

"PV" of annuity payments after 4 years at 10% = PVIFA(16,10%/2) * 7.659899
= 83.016219

(1 mark)

PV of these annuity payments today at 10% = 83.016219/1.05^8 = 56.1886

(1 mark)

PV of interest payments today at 10% = PVIFA(8,10%/2) * 2.50 = 16.158

(1 mark)

PV of payments today = 56.1886 + 16.158 = 72.3466

Since the PV of payments is less than 75, we can begin interpolation:

Interest rate	PV of payments
6%	77.7876
r%	75.00
5%	72.3466

which yields r = 5.49%. Thus the maximum interest rate is 5.49%.

(Table 2 marks; Linear equation and calculation 3 marks)

Question 2

Risk and Return (30 Points)

2a) Watching Youtube Videos: Watch the following Youtube videos on your PC or laptop or mobile device and then ***write up*** a two-page summary of what you learnt from these Youtube videos. There will not be an answer key provided for this question. Instead, the markers will also have watched these videos, and if what you write of these videos is consistent with their understanding **and different from other students**, you will receive full credit. **(15 points)**

Bear Stearns is fine?
https://www.youtube.com/watch?v=1QEKdsEfLY0
Lessons from the father of modern portfolio theory
http://www.youtube.com/watch?v=5Y1MBc_Vj3w
There are no shortcuts to investing: Nobel laureate William Sharpe
http://www.youtube.com/watch?v=pGlzygsvqck

2b) Meet an asset manager who invests client funds to make movies (what the Treasury Secretary did for several years). You are hired as a temp and asked to analyze investments in zero-coupon or stripped bonds to pay for future production costs in three or five years. The flat yield curve jumped up by one percent (from 10% to 11%) recently, and the following table gives the prices of different bonds before and after the yield increase:

Bond	Price_Before	Price_After
A	1032	1012.8
B	900.6	803
C	1046.6	999
D	931	905.6
E	749.2	645.8
F	1042.4	1000

Which bond would you recommend if production costs are incurred in 3 years? Which bond would you recommend if production costs are incurred in 5 years? What are the assumptions underlying your answer? **(7 points)**

Solution:

First calculate modified duration D* using the identity: $\Delta P/P = -D^*\Delta r$. As the flat yield curve jumped by 1%, we have $\Delta r=1$ and so $\Delta P/P = -D^*$. The duration D is then calculated from $D = D^* (1+r)$ where $r = 10\%$.

Bond	Price Before	Price After	$\Delta P/P = -D^*$	D
A	1032	1012.8	-1.86	2.05
B	900.6	803	-10.84	11.92
C	1046.6	999	-4.55	5.00
D	931	905.6	-2.73	3.00
E	749.2	645.8	-13.80	15.18
F	1042.4	1000	-4.07	4.47

Since these are STRIPs or zero-coupon bonds, we could perfectly immunize against our liabilities by choosing a bond whose duration (and thus maturity) is equal to the time of each liability. Therefore bond D should be used to immunize against the three-year liability and bond C would be used to immunize against the five-year liability. To arrive at these choices, we assume yields are compounded annually, and yields do not change dramatically in the next 5 years (if they do, then we assume the price-yield curve does not exhibit too much convexity).

(7 pts)

2c) The following table gives some characteristics of two risky assets - stocks and bonds. Also shown are weights in the market portfolio P, which is assumed to be mean-variance efficient, i.e., it provides the highest expected return for its level of variance.

Asset	Weigh in Market Portfolio P	Expected Return	Standard Deviation	Correlation With Stocks	Correlation With Bonds
Stocks	0.50	?	0.30	1.00	0.60
Bonds	0.50	?	0.20	0.60	1.00

If the expected return on the market portfolio P, $E(r_P)$ is equal to 0.12 or 12 percent, what are the expected returns on stocks and bonds? Assume the risk-free rate, r_f, is equal to 0.07 or 7 percent and show all calculations clearly. **(8 points)**

Solution:

P is the market portfolio and therefore a tangency portfolio. Therefore the relationship between S's expected return $E(r_s)$ and its covariance with P (cov (s,p) = σ_{sp}) is given by a capital asset pricing relationship:

$E(r_s) = r_f + [E(r_p) - r_f] \beta_{sp}$, where

$$\beta_{sp} = \frac{Cov(s,p)}{\sigma_p^2} = \frac{\sigma_{sp}}{\sigma_p^2}$$

and $[E(r_p) - r_f]$ is the tangent portfolio's expected excess return.

As we are given $E(r_p) = 12\%$ and $r_f = 7\%$, we just need to calculate the covariance (cov (s,p)) and variance σ_p^2 to get $E(r_s)$.

The covariance is:

$cov (r_s, r_p) = cov (r_s, w_s r_s + w_b r_b) = cov (r_s, w_s r_s) + cov (r_s, w_b r_b)$

$cov (r_s, r_p) = cov (r_s, .5r_s + .5r_b) = cov (r_s, .5r_s) + cov (r_s, .5r_b)$

$= .5cov (r_s, r_s) + .5cov(r_s, r_b)$

$= .5 \, var(r_s) + .5 \, \sigma_s \sigma_b \rho_{s,b}$

$= .5 (0.3)^2 + .5 (0.3)(0.2)(0.6) = 0.063$ **(2 points)**

$$\sigma_P^2 = (w_B\sigma_B)^2 + (w_S\sigma_S)^2 + 2(w_B\sigma_B)(w_S\sigma_S)\rho_{BS}$$

$= (0.5 * 0.2)^2 + (0.5 * 0.3)^2 + 2(0.5 * 0.2)(0.5 * 0.3)0.6$

$= 0.01 + 0.0225 + 0.018 = 0.0505$ (**2 points)**

$E(r_s) = r_f + [E(r_p) - r_f] \beta_{sp} = 7\% + (12\% - 7\%) * 0.063/0.0505 = 13.2376\%$ **(2 points)**

Since $0.5E(r_s) + 0.5E(r_b) = E(r_p)$, we have $0.5(0.1132376) + 0.5Er_b = 0.12$, which yields $E(r_b) = 10.7624\%$ **(2 points)**

Question 3

Bond Refunding (15 Points)

Korean Nuclear Corporation or KNC is considering offering a new $110 million bond issue to replace an outstanding $100 million bond issue. The firm wishes to do this to take advantage of the decline in interest rates that has occurred since the original issue. The two bond issues are described in what follows. The firm is in the 30 percent tax bracket.

Old bonds: The outstanding bonds have a $1,000 par value and an 8.5 percent coupon interest rate. They were issued five years ago with a 20-year maturity. They are callable at an 8.5% premium.

New bonds: The new bonds would have a 15-year maturity and a 7.0 percent coupon interest rate. It is expected that these bonds can be sold at par for a floatation cost of 1% of the total value of the issue.

The firm expects a 3-month period of overlapping interest while it retires the old bonds. The firm can defray some of the costs by investing the issue at 4 percent, the short-term interest rate. The additional $10 million from the new bond issue could be invested in a 15 year project with an expected NPV of $2.5 million.

Solution:

Step 1: Find the appropriate after tax discount rate

r = (1 – t) x coupon on new issue

r = (1 - 0.3) x 0.07 =4.9% **(4 points)**

Step 2: The costs of refunding

1) Call premium costs:

8.5% call premium x ($100,000,000) = $8,500,000**(1 point)**

Note that a call premium is not a tax-deductible expense.

2) Flotation Costs: *Although flotation costs are a one-time expense, for tax purposes they are amortized over the life of the issue, or five years, whichever is less. For KNC, flotation costs amount to 1% x $110million = $1,100,000.This results in an annual expense for the first five years after the issue.*

- $1,100,000/5yrs = $220,000
- Flotation costs produce an annual tax shield of $66,000.

  $220,000 x (30% tax rate) = $66,000
- The tax savings on the flotation costs are a five-year annuity and would be discounted at the after-tax cost of the debt to be issued (7 %(1 - 0.30) = 4.9%). This amounts to a savings of $286,537:

  66,000 x PVIFA (4.9%, 5 yrs) = 66,000*4.3415 = 286,537
- Net flotation costs = Flotation Costs – PV of tax savings

  =1,100,000 – 286,537 = 813,462 **(3 points)**

Extra interest paid on old issue= $100,000,000 x (8.5% x 3/12) = $2,125,000

After tax extra interest paid on old issue=$2,125,000 x (1 - 0.30) = $1,487,500**(1 points)**

Interest on short term investment: $110,000,000 x (4% x 3/12) = $1,100,000

After-tax interest earned on short term investment=$1,100,000 x (1- 0.30) = $770,000**(1 points)**

The total additional interest is:

Extra interest paid	$1,487,500
Extra interest earned	(770,000)
Total additional interest	$717,500 **(1 point)**

- Total cost is therefore:

Call premium	$8,500,000
Flotation costs	813,462
Additional interest	717,500
Total cost	$10,030,962 **(1 point)**

Step 3: The benefits of refunding

- Interest savings on new issue

Interest on old bond =$100,000,000 x 8.5% =	$8,500,000
Interest on new bond = $110,000,000 x 7% =	$7,700,000
Annual savings =	$800,000

After-tax savings = $800,000 x (1 - 0.30) = $560,000

PV of annual after tax savings over 15 years discounted at after-tax rate

= $560,000 x PVIFA (4.9%, 15 yrs) =$560,000 x 10.4502= $5,852,098**(2 points)**

Step 4: NPV for the refunding operation

Interest savings	$5,852,098
NPV of the extra $10m from the new issue	$2,500,000
Investment	–10,030,962
NPV	($ 1,678,865)

NPV is negative therefore do not proceed with refunding. **(1 point)**

Question 4

Canadian Tradition/APT (15 Points)

Meet (Curious) George and The Man (with the Yellow Hat). They are financial managers who network with other managers and analysts. Hoping to work in the industry, you follow them around to impress them and their friends with your knowledge of finance.

4a. George and The Man (and you) visit Caillou, CFA, a Canadian mutual fund manager. Caillou uses arbitrage pricing to find asset values. Suppose portfolio returns in Quebec can be described by a 2-factor model with intercept (3 factors including intercept). You have been tasked to determine the equation that describes the equilibrium returns for the following portfolios: **(9 marks)**

Portfolio	Expected Return (%)	β_{i1}	β_{i2}
A	22.0	1.6	0.8
B	28.8	2.0	1.2
C	34.7	2.4	1.5

4b. Assume there is a portfolio D with $\beta_{D1} = 1.8$. What is the equilibrium return on portfolio D? What is the sensitivity of portfolio D to factor 2 β_{D2}? What is the relationship of portfolio D to factor 2? **(4 marks)**

4c. Suppose there is another portfolio E with the following characteristics: Actual Return = 32%; $\beta_{E1} = 2.0$ and $\beta_{E2} = 1.5$. Would you recommend investment in portfolio E? Why? **(2 marks)**

Solution:

4a. We solve for the factor premia λ_0. λ_1 and λ_2 from the following three equations:

$0.22 = \lambda_0 + 1.6\,\lambda_1 + 0.8\,\lambda_2$ (1)

$0.288 = \lambda_0 + 2.0\,\lambda_1 + 1.2\,\lambda_2$ (2)

$0.347 = \lambda_0 + 2.4\,\lambda_1 + 1.5\,\lambda_2$ (3)

Subtracting (1) from (2) yields (4) and subtracting (1) from (3) yields (5)

$0.068 = 0.4\,\lambda_1 + 0.4\,\lambda_2$ (4)

$0.127 = 0.8\,\lambda_1 + 0.7\,\lambda_2$ (5)

Multiplying (4) by 2 yields:

$0.136 = 0.8\,\lambda_1 + 0.8\,\lambda_2$ (6)

Subtracting (5) from (6) yields:

$0.009 = 0.1\,\lambda_2$ which implies that $\lambda_2 = 0.09$

Substituting $\lambda_2 = 0.09$ into (4) yields:

$0.068 = 0.4\,\lambda_1 + 0.4\,(0.09)$ or $\lambda_1 = 0.08$

Substituting $\lambda_1 = 0.08$ and $\lambda_2 = 0.09$ into (1) yields:

$0.22 = \lambda_0 + 1.6\,(0.08) + 0.8\,(0.09)$ which implies that $\lambda_0 = 0.02$.

Thus the equation for APT is:

$r_i = 0.02 + 0.08\,\beta_{i1} + 0.09\,\beta_{i2}$ **(9 marks)**

4b. No arbitrage requires that the expected return for portfolio D be on the straight line between A and B. We can solve for the portfolio weights to show that $w_A = w_B = 0.5$.

Equilibrium return $= 0.5 * 0.22 + 0.5 * 0.288 = 0.254$ or 25.4%. **(1 marks)**

Sensitivity $= 0.5 * 0.8 + 0.5 * 1.2 = 1$ **(1 marks)**

Portfolio D has the same systematic risk as factor 2. **(2 marks)**

4c. $E(r_E) = 0.02 + 0.08\,(2) + 0.09\,(1.5) = 0.315$ or 31.5 % **(1 mark)**

But actual return is 32%. Therefore E has overperformed, E is underpriced, and investment in portfolio E is recommended because the actual return is higher than the expected. **(1 mark)**

Question 5

Financial Planning (20 points)

Consider the following income statement and balance sheet for the "**Great Again**" Corporation:

GREAT AGAIN CORPORATION

Income Statement

Sales		$90,000
Costs		$60,000
EBIT		$30,000
Interest expense		$4,000
Taxable income		$26,000
Taxes (34%)		$8,840
Net income		$17,160
Dividends	$4,000	
Addition to retained earnings	$13,160	

GREAT AGAIN CORPORATION

Balance Sheet

Assets ($)		Liabilities and Owners' Equity ($)	
Current assets		**Current liabilities**	
Cash	$3,000	Accounts payable	$5,000
Accounts receivable	$6,000	Notes payable	$7,000
Inventory	$9,000	Total current liabilities	$12,000
Total current assets	$18,000		
		Long term debt	$20,000
Net Plant and equipment	$45,000	**Owners' equity**	
		Common stock	$25,000
Total Assets	$63,000	Retained earnings	$6,000
		Total liabilities and owners' equity	$63,000

Assume costs vary with sales and the dividend payout ratio is constant. What is the projected addition to retained earnings?

Assume that all assets and accounts payable vary with sales, whereas notes payable, interest expense and LT debt do not.

Prepare a pro forma income statement balance sheet showing EFN, assuming a 15 percent increase in sales, no new external debt or equity financing.

Solution

Assuming costs vary with sales and a percent increase in sales, the pro forma income statement will look like this:

GREAT AGAIN CORPORATION
Pro Forma Income Statement

Sales	$	103,500
Costs		69,000
		-
EBIT	$	34,500
Interest expense		4,000
Taxable income	$	30,500
Taxes		10,370
Net income	$	20,130

(3 points)

The payout ratio is constant, so the dividends paid this year is the payout ratio from last year times net income, or:

Dividends = (4000/17160) (20130)= 4692 **(3 points)**

Addition to retained earnings = 20130-4692=15438 **(3 points)**

New accumulated retained earnings = 6000+15438=21438 **(3 points)**

The pro forma balance sheet will look like this:

GREAT AGAIN CORPORATION
Pro Forma Balance Sheet

Assets ($)		**Liabilities and Owners' Equity ($)**	
Current assets		**Current liabilities**	
Cash	$3,450	Accounts payable	$5,750
Accounts receivable	$6,900	Notes payable	$7,000
Inventory	$10,350	Total current liabilities	$12,750
Total current assets	$20,700		
		Long term debt	$20,000
Net Plant and equipment	$51,750	**Owners' equity**	
		Common stock	$25,000
Total Assets	$72,450	Retained earnings	$21,438
		Total liabilities and owners' equity	$79,188

(5 points)

So the EFN is:

EFN = Total assets – Total liabilities and equity

EFN = 72450 - 79188 = -6738 **(3 points)**