FINANCE

Final Exam – Spring 2012

June 25, 2012

INSTRUCTIONS

This exam consists of 3 problems.

You must solve each problem in a different answer sheet.

You have 2 hours to solve this exam.

This is a closed book exam.

You are allowed one double-sided page of notes

Calculators are permitted.

Good luck!

I. Bond Valuation

You have just started to work for an asset management company and you must provide a daily analysis of the bond market. You are responsible for analyzing the following bond portfolio of semi-annual coupon bonds (all bonds have a face value of €100):

Bond	*Maturity*	*Clean Price*	*Coupon Rate*	*Accrued Interest*	*Dirty Price*
A	3 months	€100.25	4%	$\frac{1}{2}\times€2=€1$	€101.25
B	6 months	€99.53	3%	0	€99.53
C	9 months	€100.40	5%	$\frac{1}{2}\times€2.5=€1.25$	€101.65
D	1 year	€103.16	8%	0	€103.16

a. Calculate the term structure of spot interest rates.

s_{3M}: $B_A=€101.25=\frac{2\%\times€100+€100}{(1+s_{3M})^{0.25}} \Leftrightarrow s_{3M}=3\%$

s_{6M}: $B_B=€99.53=\frac{1.5\%\times€100+€100}{(1+s_{6M})^{0.5}} \Leftrightarrow s_{6M}=4\%$

s_{9M}: $B_C=€101.65=\frac{2.5\%\times€100}{(1+3\%)^{0.25}}+\frac{2.5\%\times€100+€100}{(1+s_{9M})^{0.75}} \Leftrightarrow s_{9M}=4.5\%$

s_{1Y}: $B_D=€103.16=\frac{4\%\times€100}{(1+4\%)^{0.5}}+\frac{4\%\times€100+€100}{(1+s_{1Y})^{1}} \Leftrightarrow s_{1Y}=4.8\%$

b. What is the clean price of a 6% annual coupon bond with 9 months to maturity?

$B=\text{Dirty Price}=\frac{106\%}{(1+4.5\%)^{0.75}}=102.55\%$

$AI=6\%\times\frac{1}{4}=1.5\% \rightarrow \text{Clean Price}=102.55\%-1.5\%=101.05\%$

c. In your analysis you are recommending an addition of a Consol bond to the portfolio.

i. What is the yield to maturity of a Consol bond that pays 12% per year forever, and that is priced at 80% of face value?

$B_{Consol}=80\%=\frac{12\%}{YTM} \Leftrightarrow YTM=15\%$

ii. Explain carefully the risks associated with holding the Consol bond versus the risks of holding bond B in the portfolio.

Some topics that could be pointed out:

- **Longer maturity, higher risk**
- **Risk of the rate at which you reinvest coupons**
- **Consol has a higher coupon, corresponding to a higher risk**
- **Risk of having a loss/gain due to a shift in the Yield Curve**
- **Could relate investors' preferences, receiving the FV or having constant CF's forever**

II. Portfolio Theory and Stock Valuation

Mr. Buchannon can only invest in a combination of stock Wind, stock Surf and Treasury Bills. Stock Wind has an expected return of 8% and a standard deviation of returns of 12% while stock Surf has an expected return of 16% and standard deviation of 14%. The correlation between the returns of both stocks is 0.5 and the return of the Treasury Bills is 4%.

a. What is the portfolio of stocks that minimizes the risk taken by Mr. Buchannon. What is the expected return and standard deviation of such portfolio?

$$MVP:\ w_W=\frac{\sigma_S^2-\sigma_{W,S}}{\sigma_W^2+\sigma_S^2-2\sigma_{W,S}}=\frac{0.14^2-0.5\times0.12\times0.14}{0.12^2+0.14^2-2\times0.5\times0.12\times0.14}=65.12\%,\ w_S=34.88\%$$

$$E(r_{MVP})=65.12\%\times8\%+34.88\%\times16\%=10.79\%$$

$$\sigma_{MVP}=\sqrt{0.6512^2\times0.12^2+0.3488^2\times0.14^2+2\times0.5\times0.12\times0.14\times0.6512\times0.3488}=11.09\%$$

b. Mr. Buchannon is a risk-averse agent, but he never took a finance course. Therefore, he decides to combine the minimum variance portfolio with the risk-free asset. What will be the expected return and standard deviation of the portfolio chosen by Mr. Buchannon assuming he has a quadratic utility function with a risk aversion coefficient of 3? Is this the optimal portfolio for Mr. Buchannon to invest in? Justify graphically.

$$w_{MVP}=\frac{E(r_{MVP})-r_f}{\gamma\times\sigma_{MVP}^2}=\frac{10.79\%-4\%}{3\times0.1109^2}=183.93\%;\ w_{r_f}=-83.9\%$$

$$E(r_P)=183.93\times10.79\%+(-83.9\%)\times4\%=16.49\%$$

$$\sigma_P=\sqrt{1.8393^2\times0.1109^2}=20.4\%$$

c. Mr. Buchannon has just been presented with the possibility of investing in company "C.J.". This company has an equity beta of 1.3 and a standard deviation of 13%. In addition, the market has an expected return of 12% and a standard deviation of 8%.

   i. What is the idiosyncratic risk of C.J.?

$$\text{total risk}_{CJ}=\text{systematic risk}_{CJ}+\text{idiosyncratic risk}_{CJ}=\sigma_{CJ}^2=0.13^2=0.0169$$

$$\text{systematic risk}=\beta^2\sigma_m^2=1.3^2\times0.08^2=0.010816$$

$$\text{idiosyncratic risk}=\sigma_{e_{CJ}}^2=\sigma_{CJ}^2-\beta_{CJ}^2\sigma_m^2=0.0169-0.010816=0.006084$$

   ii. This company has just paid a dividend of €1.5 per share (there are currently 1 million shares outstanding) and those dividends are expected to grow at 2% per year in the next 4 years. However, in year 5 (and only in that year), the company must replace all their equipments and for that reason it will retain 100% of the earnings and, furthermore, ask for an investment of €3 million by the current shareholders. With these new equipments, which will increase the growth rate of dividends to 5% forever, the dividend in year 6 is expected to be of €2. Compute the current price of each share of C.J.

$$E(r_P)=4\%+1.3\times(12\%-4\%)=14.4\%$$

$$S=\frac{€1.5\times(1+2\%)}{14.4\%-2\%}\times\left[1-\left(\frac{1+2\%}{1+14.4\%}\right)^4\right]+\frac{-\frac{€3,000,000}{1,000,000}+\frac{€2}{14.4\%-5\%}}{(1+14.4\%)^5}=€13.87$$

III. Project Valuation

Company *NovaWave* produces Lupin Beans and has a market capitalization of €100,000. Currently, this firm's equity beta is 0.8 and it has 20,000 shares outstanding. Two years ago this company issued five hundred Zero Coupon Bonds with a maturity of 10 years. Each bond has a face value of €100 and is currently traded at €78.94.

NovaWave has the opportunity to invest in a surf shop. This project will last 3 years and requires a single investment right now of €50,000 (€30,000 to acquire fixed assets and €20,000 to invest in working capital). Fixed assets have an economic life of 5 years and are expected to have a market value of €10,000 at the end of the project. By then, the company will also recover the investment in net working capital.

Throughout the three years, the project's operations are expected to generate annual EBIT of €12,000. However, this project is expected to have an annual negative impact (€2,000 after taxes) in current business cash flows.

There is a comparable company in the surf shop industry with an equity Beta of 1.5 and a capital structure with 75% of equity based on market values. This company is able to borrow at the risk-free rate.

The corporate tax rate is 25%, the risk-free rate is 3% and the expected market risk premium is 6%.

a. Construct the balance sheet of the company based on market values after the stock issuance assuming that the project will be fully financed with a stock issue. In addition, what is the new number of shares?

(values in €)	0	1	2	3	Explanation
EBIT		12,000	12,000	12,000	*Given value*
Taxes		3,000	3,000	3,000	*25% of EBIT*
NOPAT		9,000	9,000	9,000	*EBIT-Taxes*
Depreciation		6,000	6,000	6,000	$\frac{\text{Asset Value}}{\text{Economic Life}} = \frac{30{,}000}{5} = 6{,}000$
OCF		+15,000	+15,000	+15,000	*NOPAT+Dep*
CAPEX	-30,000				*Given value*
Salvage Value				+10,000	*Given value*
Taxes on resale				+500	-Tax rate×Capital gain (loss)= $-25\% \times [10{,}000 - (30{,}000 - 3 \times 6{,}000)] = -25\% \times (-2{,}000) = +500$ (Or assume that it is zero since it is a capital loss and therefore it will not be subject to taxes)
Inv. in NWC	-20,000	0	0	+20,000	*Given values*
Erosion		-2,000	-2,000	-2,000	*Given values, already net of taxes*
Free CF	**-50,000**	**13,000**	**13,000**	**43,500**	*Sum of all cash flows*

$$NPV = -I_0 + \sum_{t=1}^{T} \frac{E(FCF_U)}{(1+r_0)^t} = €5{,}006.15$$

$$\beta_0 = \frac{\beta_L}{1+\frac{D}{E}\times(1-t)} = \frac{1.5}{1+\frac{0.25}{0.75}\times(1-25\%)} = 1.2 \rightarrow r_0 = r_f + \beta_0 \times MRP = 3\% + 1.2 \times 6\% = 10.2\%$$

Market Value Balance Sheet after issuance of securities			
Value before project	**€139,470**	Equity before project	€100,000
		Project NPV	€5,006
Project NPV	**€5,006**	Newly issued equity	€50,000
		TOTAL EQUITY	**€155,006**
Cash from Stock Issue	**€50,000**	**TOTAL DEBT**	**€39,470**
Total EV	**€194,476**	**Total EV**	**€194,476**

$$\text{Share Price after announcement} = \frac{\text{Equity after announcement}}{\#\text{ of outstanding shares}} = \frac{€100{,}000 + €5{,}006}{20{,}000} = €5.25$$

$$\text{New \# of outstanding shares} = 20{,}000 + \frac{€50{,}000}{€5.25} = 29{,}524$$

b. What is the NPV of the project if it is financed with a debt-to-equity ratio of 1 and the current cost of debt?

$$NPV=-I_0+\sum_{t=1}^{T}\frac{E(FCF_U)}{(1+WACC)^t}=-I_0+\frac{E(FCF_U)}{WACC}=€6,551.14$$

$$WACC=0.5\times15.6\%+0.5\times3\%\times(1-25\%)=8.93\%$$

$$r_E=r_0+(r_0-r_D)\frac{D}{E}(1-t)=10.2\%+(10.2\%-3\%)\times1\times(1-25\%)=15.6\%$$

$$r_D:\ B=€78.94=\frac{€100}{(1+r_D)^8}\Leftrightarrow r_D=3\%$$

c. What is the APV of the project if it is partially financed with a loan of €30,000 to be repaid in three annual constant installments at a below market rate of 2%?

$$€30,000=\frac{I}{2\%}\times\left[1-\frac{1}{(1+2\%)^3}\right]\Leftrightarrow I=€10,402.64$$

(values in €)	0	1	2	4
Outstanding Debt	*30,000.00*	*20,197.36*	*10,198.67*	*0*
Installment		*10,402.64*	*10,402.64*	*10,402.64*
Reimbursement		*9,802.64*	*9,998.69*	*10,198.67*
Interest		*600,00*	*403.95*	*203.97*
Tax Shield		150.00	100.99	50.99
Debt proceeds	30,000.00			
Installments		-10,402.64	-10,402.64	-10,402.64
Fin CF	**30,000.00**	**-10,252.64**	**-10,301.65**	**-10.351,65**

$$APV:\ NPV_L=NPV_U+NPVF=€5,006.15+€862.46=€5,868.61$$

$$NPVF=30,000.00-\frac{€10,252.64}{(1+3\%)^1}-\frac{€10,301.65}{(1+3\%)^2}-\frac{€10,351.65}{(1+3\%)^3}=€862.46$$