FINANCE

Final Exam – Spring 2012

May 31, 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 (5 points)

Consider the following information available at a Bloomberg terminal:

Maturity	*Spot Rates*
6 months	0.50%
1 year	0.70%
1.5 years	1.50%
2 years	1.90%

a. What is the clean price of a 2% coupon bond (annual frequency) with 1 year and 6 months to maturity?

$$B=\text{Dirty Price}=\frac{2\%}{(1+0.5\%)^{0.5}}+\frac{102\%}{(1+1.5\%)^{1.5}}=101.74\%$$

$$AI=1\%\times\frac{1}{2}=1\% \rightarrow \text{Clean Price}=101.74\%-1\%=100.74\%$$

b. What is the term structure of forward interest rates 6 months from now?

$$f_{0.5Y,1Y}=\left[\frac{(1+0.7\%)^{1}}{(1+0.5\%)^{0.5}}\right]^{\frac{1}{0.5}}-1=0.90\%$$

$$f_{0.5Y,1.5Y}=\left[\frac{(1+1.5\%)^{1.5}}{(1+0.5\%)^{0.5}}\right]^{\frac{1}{1}}-1=2.00\%$$

$$f_{0.5Y,2Y}=\left[\frac{(1+1.9\%)^{2}}{(1+0.5\%)^{0.5}}\right]^{\frac{1}{1.5}}-1=2.37\%$$

c. You are analyzing a bond available in the market, with a 7% coupon (semi-annual frequency) with 1.5 years to maturity and a face value equal of €100.

   i. What is the price of this bond?

$$B=\frac{€3.5}{(1+0.5\%)^{0.5}}+\frac{€3.5}{(1+0.7\%)^{1}}+\frac{€103.5}{(1+1.5\%)^{1.5}}=€108.18$$

   ii. What is the clean price of this bond one semester from now assuming that future spot rates are equal to the current forward rates?

$$B=\text{Dirty Price}=\frac{€3.5}{(1+0.9\%)^{0.5}}+\frac{€103.5}{(1+2\%)^{1}}=€104.95$$

$$AI=0 \rightarrow \text{Clean Price}=€104.95$$

II. Portfolio Theory and Stock Valuation (7 points)

Mr. Cliff can only invest in a combination of stock Rock, stock Sea and Treasury Bills. Stock Rock has an expected return of 10% and a standard deviation of returns of 18% while stock Sea has an expected return of 22% and standard deviation of 30%. The covariance between the returns of both stocks is 0 and the return of the Treasury Bills is 3%.

a. Compute the portfolio of stocks (weights) that maximizes the Sharpe ratio attainable by Mr. Cliff. What is the expected return and standard deviation of such portfolio?

$$w_R^T=\frac{[E(r_R)-r_f]\times\sigma_S^2-[E(r_S)-r_f]\times\sigma_{R,S}}{[E(r_R)-r_f]\times\sigma_S^2+[E(r_S)-r_f]\times\sigma_R^2-[E(r_R)-r_f+E(r_S)-r_f]\times\sigma_{R,S}}=$$

$$w_R^T=\frac{[10\%-3\%]\times 0.3^2}{[10\%-3\%]\times 0.3^2+[22\%-3\%]\times 0.18^2}=50.6\%;\ w_S^T=49.4\%$$

$$E(r_T)=50.6\%\times 10\%+49.4\%\times 22\%=15.93\%$$

$$\sigma_P=\sqrt{w_R^2\times\sigma_R^2+w_S^2\times\sigma_S^2+2\times\sigma_{R,S}\times w_R\times w_S}=\sqrt{0.506^2\times 0.18^2+0.494^2\times 0.3^2+0}=17.4\%$$

b. Compute the optimal portfolio (weights) for Mr. Cliff knowing that he is a risk-averse agent with risk aversion coefficient of 5. (if you did not answer the previous question assume the Sharpe ratio is maximized by investing 60% in stock Rock and 40% in stock Sea).

$$w_T=\frac{E(r_T)-r_f}{\gamma\times\sigma_T^2}=\frac{15.93\%-3\%}{5\times 0.174^2}=85.4\%;\ w_{r_f}=14.6\%$$

For the following questions consider that the market portfolio has an expected return of 15% and a standard deviation of returns of 20%.

c. Mr. Cliff has just been briefed on a new investment possibility: stock Dune. This stock has a covariance of returns with the market portfolio of 0.05. Right now, company Dune generates net income of €10,000,000 every year and has a payout ratio of 100% (next dividend payment occurs precisely one year from now). Compute the price of stock Dune knowing that there are currently 2,000,000 outstanding shares of this company.

$$\beta_C=\frac{\sigma_{c,M}}{\sigma_M^2}=\frac{0.05}{0.2^2}=1.25\rightarrow r_C=r_f+\beta_C\times MRP=3\%+1.25\times(15\%-3\%)=18\%$$

$$S=\frac{EPS}{r_C}=\frac{€10,000,000\,/\,2,000,000}{18\%}=€27.78$$

d. Company Dune has just announced a new investment project with the following features:

- one year from now the company will invest €8,000,000 in new equipment;
- starting two years from now, the company will retain 60% of its earnings each and every year;
- the investments performed two years from now and in every subsequent year will start to generate earnings in the following year at constant rate of return of 19%.

Compute the new price per share. Should the company undertake this project? Justify your answer carefully.

$$NPVGO\ (per\ share)=\frac{\left[-€8,000,000+\frac{\left[-60\%\times€10,000,000+\frac{60\%\times€10,000,000\times 19\%}{18\%}\right]}{[18\%-19\%\times 60\%]}\right]}{(1+18\%)}=-€1.25$$

$$S'=€27.78-€1.25=€26.53$$

III. Evaluating a project (8 points)

Company *Sand* operates in the hotel industry. Currently the share price is €20, equity beta is 1.35 and there are 100,000 shares outstanding. This company is also financed with bonds that have a market value of €500,000 and a 5% yield to maturity.

This company has two available investment projects: Project A is a scale-enhancing project and Project B is a project in the technology industry. The technology industry has an equity beta of 1.84, debt-to-equity of 0.2 and cost of debt of 3%.

These two projects generate the exact same unlevered free cash flows in perpetuity and require the same initial investment. *Sand* will acquire fixed assets today for €210,000 and needs also to build up inventories to support two months of next year's sales (all other net working capital items will be zero). The investment will generate annual Sales of €360,000, COGS of €240,000 and EBIT of €50,000. The company will invest every year in order to keep the net book value of assets constant.

Corporate tax rate is 25%, risk-free rate is 3% and the expected return on the market is 8%.

a. What is the NPV of Project A if the project is financed with the current capital structure of the company and a cost of debt of 5%?

(values in €)	**0**	**1 and thereafter**	**Explanation**
EBIT		**50,000**	*Given value*
Taxes		12,500	*25% of EBIT*
NOPAT		**37,500**	*EBIT-Taxes*
Depreciation		**??**	*The value of depreciation is unknown*
OCF		**37,500+??**	*NOPAT+Dep*
CAPEX	-210,000	-??	*We must invest every year to keep Net Fixed Assets constant, which implies that we will invest the same value as depreciation*
Inv. in NWC	-40,000	0	*Since COGS will be constant over time, there is no need to invest more in NWC, the level of NWC will remain constant.*
(NWC)	*40,000*	*40,000*	$\text{Days in Inventories}=\frac{\text{Inventories}}{\text{COGS}}\times 365\rightarrow$ $\text{Months in Inventories}=\frac{\text{Inventories}}{\text{COGS}}\times 12\rightarrow$ $\text{Inventories}=\frac{\text{Months in Inventories}}{12}\times \text{COGS}\rightarrow$ $\text{Inventories}=\frac{2}{12}\times €240{,}000=€40{,}000$
Free CF	**-250,000**	**37,500**	*Equal to NOPAT because depreciation is offset by investment*

$$\mathbf{NPV=-I_0+\sum_{t=1}^{T}\frac{E(FCF_U)}{(1+WACC)^t}=-I_0+\frac{E(FCF_U)}{WACC}=-€250{,}000+\frac{€37{,}500}{8.55\%}=€188{,}596}$$

$$\mathbf{WACC=\frac{€2{,}000{,}000}{€2{,}500{,}000}\times 9.75\%+\frac{€500{,}000}{€2{,}500{,}000}\times 5\%\times(1-25\%)=8.55\%}$$

$$\mathbf{r_E=r_f+\beta_L\times MRP=3\%+1.35\times(8\%-3\%)=9.75\%}$$

Equity=Share Price ×# of Shares Outstanding= €20×100,000=€2,000,000

b. Project A may be financed through perpetual bonds with a face value of €150,000. These bonds will be issued at par with a cost of debt of 5%. Due to the new debt, annual after-tax cost of financial distress is €20,000 with a probability of 2%. The remaining initial investment would be financed with a stock issue.

i. What is the APV of Project A?

APV: $NPV_L = NPV_U + NPVF = €166,667 + €29,500 = €196,167$

$$NPV_U = -I_0 + \frac{E(FCF_U)}{r_0} = -€250,000 + \frac{€37,500}{9\%} = €166,667$$

$$r_E = 9.75\% = r_0 + (r_0 - r_D)\frac{D}{E}(1-t) = r_0 + (r_0 - 5\%)\frac{€500,000}{€2,000,000}(1-25\%) \Rightarrow r_0 = 9\%$$

$$NPVF = PVTS - PV(\text{Financial Distres Costs}) = €37,500 - €8,000 = €29,500$$

$$PVTS = t \times D = 25\% \times €150,000 = €37,500$$

$$PV(\text{Financial Distres Costs}) = \frac{E(\text{Annual Financial Distress Cost})}{r_D} = \frac{2\% \times €20,000}{5\%} = €8,000$$

ii. Construct the balance sheet of company *Sand* based on market values after the issuance of securities to finance this project.

Market Value Balance Sheet after issuance of securities			
Value before project	**€2,500,000**	Equity before project	€2,000,000
		NPV of Project	€196,167
NPV of Project	**€196,167**	Newly issued equity	€100,000
		TOTAL EQUITY	**€2,296,197**
		Debt before project	€500,000
Cash from securities issuance	**€250,000**	Newly issued Debt	€150,000
		TOTAL DEBT	**€650,000**
Total EV	**€2,946,167**	**Total EV**	**€2,946,167**

iii. What is the share price after the issuance of securities?

After announcement:

$$\text{Share Price} = \frac{\text{Equity after announcement}}{\#\text{ of outstanding shares}} = \frac{€2,000,000 + €196,167}{100,000} = €21.96$$

After issuance of securities (just to confirm that it will be €21.96):

$$\text{Share Price} = \frac{\text{Equity after issuance}}{\text{New \# of outstanding shares}} = \frac{€2,000,000 + €196,167 + €100,000}{100,000 + \frac{€100,000}{€21.96}} = €21.96$$

c. What is the NPV of Project B if the project is financed with a debt-to-equity of 0.5 at a cost of debt of 5%?

$$NPV = -I_0 + \sum_{t=1}^{T}\frac{E(FCF_U)}{(1+WACC)^t} = -I_0 + \frac{E(FCF_U)}{WACC} = -€250,000 + \frac{€37,500}{10.083\%} = €121,901$$

$$WACC = \frac{1}{1.5} \times 13.25\% + \frac{0.5}{1.5} \times 5\% \times (1-25\%) = 10.083\%$$

$$r_E = r_0 + (r_0 - r_D)\frac{D}{E}(1-t) = 11\% + (11\% - 5\%) \times 0.5 \times (1-25\%) = 13.25\%$$

$$r_0 = r_f + \beta_0 \times MRP = 3\% + 1.6 \times (8\% - 3\%) = 11\%$$

$$\beta_0 = \frac{\beta_L}{1 + \frac{D}{E} \times (1-t)} = \frac{1.84}{1 + 0.2 \times (1-25\%)} = 1.6$$