ENG 111 Fall 2020 Final **Solutions**

Not Allowed: Notes/books/www

Allowed: Formula Sheet/Calculator   Mel B. Taciroglu

1. (30 points) Today, at time 0, you purchase three different bonds.

Bond I is issued by US government (denominated in $). It has $1,000 face value, 10% coupon rate, and matures in three years.

Bond II is also issued by US government (denominated in $). It has $1,000 face value, 10% coupon rate, and matures in ten years.

Bond III is issued by a country in Europe (denominated in Euros, €). It has €1,000 face value, 10% coupon rate, and matures in three years.

Today 1 US dollar buys 0.82 Euros, that is, $1 = €0.82

a) **(10 points)** Your best market opportunity is 10% and you expect the market rate as well as the exchange rate to stay the same going forward. What is the price of each bond today, in US Dollars?

Bond I Value = 100/1.1+100/1.1^2+1,100/1.1^3 = $1,000 (3 points)
Bond I Value = 100/1.1+100/1.1^2+...1,100/1.1^10 = $1,000 (3 points)
Bond I Value = 122/1.1+122/1.1^2+1,342/1.1^3 = $1,220 (4 points)

b) **(10 points)** What is your percentage return from each bond if you sell your bonds, right after your first coupon collection if the market rate and the exchange rate are still the same as before?

Since the market rate and the exchange rat still remains the same, all three bonds will return as much as the market.

New Bond Values:

Bond I Value = 100/1.1+1,100/1.1^2 = $1,000
Bond I Value = 100/1.1+100/1.1^2+...1,100/1.1^9 = $1,000
Bond I Value = 122/1.1+1,342/1.1^2 = $1,220

Since the bind values stay the same, the only return is the coupon that is collected, which is 10%. *(10 points)*

c) **(10 points)** Assume that you are still in part a, that is, at time 0! What is the promised yield of the European Bond today, if, you expect the exchange rate to stay the same (50% chance) or go down to $1 = €0.75 (50% chance) (Set the equation that will solve for the promised yield. Do not solve it)?

There is uncertainty about the exchange rate in the future. The bond is issued today and promises to pay 100 Euros per year which is equal to $122. However, it is also expected that it could be $133 (since $1 = €0.75 means $1.33 = €1).

Therefore the bond value will be affected by this TODAY (time 0)!

Expected coupon payment = 50% 122 + 50% 133 = 127.5
Expected face value payment = 50% 1220+ 50% 1330 = 1,275 (do not take off points for other rounding conventions)

Bond Value = 127.5/1.1+127.5/1.1^2+(1,275+127.5)/1.1^3 = 1,275 *(5 points)*

Promised yield can be found by equating the price of the bond today to the present value of the bond when the uncertainty is removed, that is we assume that the status quo will prevail:

1,275 = 122/(1+r) +122/(1+r)^2+ (122+1220)/(1+r)^3 *(5 points)*

2. (25 points) You are offered a project with an initial cost of $10,000 that will be followed by a cash flow of $3,000 in each of the coming 5 years.

a) **(10 points)** If you can make 10% per year in the market, what is the NPV, payback period, and discounted payback period of this project?

NPV = -10,000+3,000/1.1+3,000/1.1^2+3,000/1.1^3+3,000/1.1^4+3,000/1.1^5
NPV = -10,000 +3,000 (1/0.1)(1-1/1.1^5) = 1,373

Payback Period is 3 and 1/3 years

Discounted cash flow in each of the years from year 1 to 5 is as follows:
2,727

2,479

2,254

2,049

1,863

Then the discounted payback is ***4 and*** *(10,000-(2,727+2,479+2,254+2,049))/1,863 =* ***0.26 years.***

b) **(10 points)** Assume that you are considering investing $10,000 on this project today. Your friend is also considering investing $10,000, not on the project but on the market for <u>5 years</u>. Her plan is to withdraw the interest that accumulates each year and reinvest it at 10%. Your friend claims that her investment's NPV is higher than the NPV of your project. Is she right? You need to support your answer numerically!

SHE IS NOT RIGHT (2 points)

Numeric justification is worth 8 points.

Year 0: She invests 10,000

Year 1: She withdraws $1,000 and invests at 10%

Year 2: Total Principal (amount invested) at this point is $11,000. The total interest accumulated is $1,100 ($1,000 from the original investment and $100 from the new investment) This amount is withdrawn and invested at 10%

Year 3: Total Principal is $12,100. Total interest accumulated is $1,210 which is withdrawn and added to the principal.

Year 4: Total principal is 13,310. Total interest accumulated is 1,331 which is withdrawn and added to the principal.

Year 5: Total principal is 14,641. Total interest accumulated is 1,464

The investment ends up being 16,105.

This is exactly same as $10,000(1.1)^5 = 16,105.

c) **(5 points)** Inspired by your friend's plan, you counter by saying "I will invest on the project and I will reinvest the cash flow I get each year on the market. This will give me even higher NPV than what I calculated in part (a) as the NPV of this project"
Is this a financially sound/accurate argument. Support your answer numerically.

IT IS NOT! (2 points)

Any amount invested at the market rate today will have an NPV of $0. (3 points)

For example $10,000 invested at 10% grows into $16,105 in five years. The NPV of this investment is exactly $0: -10,000+16,105/1.1^5 = 0

3. (25 points) You know the following information about Dani Co. 's current Income Statement and Balance Sheet:

Total Sales = $1,000
Profit Margin = 5%
Total Assets = $1,000
Total Debt = $400
Total Equity = $600
Dividend Payout Ratio = 1/2
Assume NO stock purchase or sale!

a) **(5 points)** What is Dani's current internal growth rate?

b=1/2
*ROA = 5% *1,000/1,000 = 0.05*
*IGR = b*ROA / (1-b*ROA) = (1/2)*0.05/(1-(1/2)*0.05) = 2.56%*

b) **(10 points)** Dani wants to grow its sales 10% next year. This will require a 10% increase in Assets. Will Dani need to get into new debt to achieve this goal given that its profit margin will stay the same?

YES!
*EFN = (Assets/Sales) Change in Sales - b*Sales*PM = 100-0.5*1100*0.05 = 72.5*

c) **(10 points)** If, instead, Dani wants to achieve 10% growth using only its internal funds by increasing its profit margin and not getting into new debt, what will be the required profit margin to achieve this goal?

*100 - 0.5*1100* New Profit Margin = 0*

*New Profit Margin = 100/1100*0.5 = 18.18%*

4. (20 points) A portfolio that combines the risk-free asset and the market portfolio has an expected return of 9% and a standard deviation of 13%. The risk-free rate is 5%, and the expected return on the market portfolio is 12%. Assume the capital asset pricing model holds. What expected rate of return would a stock, stock K, earn if it had a .45 correlation with the market portfolio and a standard deviation of 40% ?

Hint: beta of K , $\beta_K = \sigma_{K,M}/\sigma_M^2$ and $\rho_{K,M}=\sigma_{K,M}/\sigma_K\,\sigma_M$

Let x be the weight of risk free asset in the portfolio that has the expected return of 9%. Then,

9% = x*5%+(1-x) *12%

x=3/7
1-x=4/7 (3 points)

The market that has a weight of (4/7) in this portfolio has a standard deviation of σ_M

Then, 13% = (4/7) * σ_M
σ_M= *22.75% (5 points)*

$\rho_{K,M}=\sigma_{K,M}/\sigma_K\,\sigma_M$
0.45 = $\sigma_{K,M}$/*0.2275*.40*

$\sigma_{K,M}$*= 0.04 (4 points)*

$\beta_K = \sigma_{K,M}/\sigma_M^2$

$\beta_K = 0.04/0.2275^2$

$\beta_K = 0.7729$ *(4 points)*

CAPM holds, then, expected return of K = $r_f + \beta_K\,(r_m\text{-}r_f)$

expected return of K = 5% + 0.7729*(12%-5%) = 10.41% (4 points)