

The investment assignment



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Question 1:

Latifa opens a brokerage account and purchases 500 shares of Dubai stock at 60 AED. She borrows 15,000 AED from her broker to help pay for the purchase. The interest rate on the loan is 6%.

1. What is the Margin in Latifa's account when she first purchases the stock?
2. If the shares fall to 40 AED by the end of the year what is the remaining margin in her account? If the maintenance margin is 30%, will she receive a margin call?
3. At what price does she receive a margin call?

Solution:

1. Margin left in her account = $500 \times 60 - 15000 = \text{AED } 15000$
2. If the share falls to AED 40. The cost of equity would be 20,000. So the margin left would be $20000 - 15000 = 5000$. The maintenance margin is 30% which is 9000. The margin left is only 5000 so she will receive a margin call.
3. For receiving a margin call, the price of the portfolio must fall below 9000. That means the price of the stock should be $15k + 9k = 24000$. So the stock price would be $24000/500 = \text{AED } 48$.

Question 3:

UAE stock is trading at 40 AED per share. You buy 500 shares using 15,000 AED of your own money, borrowing the remainder of the purchase from your broker. The rate on the margin loan is 8%.

1. What is the percentage increase in the net worth of your brokerage account if the price of UAE stock immediately changes to (i) 44 AED (ii) 40 AED (iii) 36 AED? What is the relationship between your percentage return and the percentage change in the price of UAE stock?
2. If the Maintenance margin is 25%, how low can UAE stock's price fall before you get a margin call?
3. How would your answer to (b) change if you had financed the initial purchase with only 10, 000 AED of your own money?
4. What is the rate of return on your margined position (assuming that you invested 15, 000 AED of your own money) if UAE stock is selling after one year at (i) 44 AED (ii) 40 AED (iii) 36 AED? What is the relationship between your percentage return and the percentage change in the price of UAE stock? Assume that UAE stock pays no dividends.

Solution:

1. Percentage change in net worth when stock price is 44 is =
 $(44-40)/40*100 = 10\%$

2. Similarly, Percentage change in net worth when stock price is 40 =
 $(40-40)/40*100 = 0\%$

Similarly, Percentage change in net worth when stock price is 36 =
 $(36-40)/40*100 = - 10\%$

Relationship: the net worth is a linear function of stock prices. The value is increasing with the value of stocks and vice versa.

3. Maintenance margin is 25% and 5000 is borrowed. That mean minimum fund that should in the account is 10, 000. So the stock price to receive margin call = $10,000 / 500 = \text{AED } 20$.
4. If only 10% of the money is investor's own, the minimum value of fund should be $10000 + 5000$ (maintenance margin) = 15000. So the stock price to receive margin call = $15000 / 500 = \text{AED } 30$.
5. After one year, the investor is entitled to 8% interest payment also. So the margin would be on the amount after paying the interest, which is AED400.
6. So, Percentage change in net worth when stock price is 44 is: $(44 * 500 - 400 - 40 * 500) / 40 * 500 = 8\%$

Similarly, Percentage change in net worth when stock price is 40 is: $(40 * 500 - 400 - 40 * 500) / 40 * 500 = -2\%$

Similarly, Percentage change in net worth when stock price is 36 is: $(36 * 500 - 400 - 40 * 500) / 40 * 500 = -12\%$.

Relationship: The portfolio value is decreasing faster with the decrease in the value of the stock.

Question 4:

Calculate the average annual return for the Emirates Securities Market since 2001 - 2009 and calculate the standard deviation of return. (Use data from page 9 of the SCA 2008 annual report + 2009 closing).

1. Calculate for ADX
2. Calculate for DFM
3. ADCB now has an index fund. Comment on the risk and return.

Solution:

The current price of the share of ADCB is AED 1.94. The prices of the stock are as shown in the figure below. So it can be commented that the risk is lesser in investing in the company (as less Standard deviation in the figure) and the return is steady (around mean seems to remain near a single point)

Question 5:

Using the historical risk premium from question 4 as your guide, what is your estimate of the expected annual HPR on the ESM if the current risk free rate is 5%?

Solution:

From question 4, the risk rate of return of ESM is 25%. (Historic)

Given the risk free rate of return = 5%.

Required/Expected rate of return would be risk + risk free rate of return = 30%.

So, in this case, the Expected rate of return will provide a good estimate of HPR for ESM which is 30%

Question 6:

For the ESM - calculate the Geometric Average of returns for 2009 on a monthly basis (i. e. 12 data points) and calculate the standard deviation. For the MSCI World Index - calculate the Geometric Average of returns for 2009 on a monthly basis and calculate the standard deviation. What is your

conclusion about the ESM with regards to risk and return versus the MSCI World?

Solution:

So, with reference to the entries in "close column", the geometric average of the ESM on monthly basis is 4.27% (solved by excel formula: spreadsheet attached.)

Also the SD is given as 0.064 (solved by excel formula: spreadsheet attached.)

MSCI world Index:

So, with reference to the entries in "close column", the geometric average of the MSCI world index on monthly basis is 1.8% (solved by excel formula: spreadsheet attached.)

Also the SD is given as 0.056 (solved by excel formula: spreadsheet attached.)

Comments:

ESM is providing more return with greater smoothness as the rate of return is higher and SD is also less than that of MSCI world index.

Question 7:

You manage a portfolio with an expected rate of return of 17% and a standard deviation of 27%. The T-Bill rate is 7%.

1. Your client chooses to invest 70% of a portfolio in your fund and 30% in a T-Bill money market fund. What is the expected return and standard deviation of your client's portfolio?
2. Suppose your risky portfolio includes the following investments in the given proportions:
3. Stock A 27%

Stock B 33%

Stock C 40%

What are the investment proportions of your client's overall portfolio, including the position in T-Bills?

4. What is the reward to volatility ratio (Sharpe) of your risky portfolio and your client's overall portfolio?
5. Draw the CAL of your portfolio on an expected return / standard deviation diagram. What is the slope of the CAL? Show the position of your client on your fund's CAL.
6. Suppose the client prefers to invest in your portfolio a proportion that maximizes the expected return on the portfolio subject to the constraint that the overall portfolio's standard deviation will not exceed 20%.

Solution:

1. Expected rate of return on client's portfolio is $17\% * 0.7 + 0.3 * 7\% = 14\%$.
2. The SD of the client's portfolio is given by $= 27 * 0.7 + 0 * 0.3 = 18.9$
3. The investment proportion is given as:

4. T bill 30%

Stock A 18.9%

Stock B 23.1%

Stock C 28%

5. The reward to volatility ratio is given as: $(R - R_f) / SD = (14 - 7) / 18.9 = 0.37$

6. CAL is given by following formula

7. The position of client's portfolio is marked in red.

here, the equation here is $E = p \cdot 17 + (1-p) \cdot 7$ is required to be maximum.

Given SD can not be less more than 20, i. e. $27 \cdot p \leq 20$. Now E is clearly maximum when p is maximum. So the maximum value of $p = 20/27 = 74.07\%$.

In this case, the expected return would be $0.7404 \cdot 17 + 0.259 \cdot 7 = 14.4$.

The desired proportion required is 74.07% investment in equity and rest in T bills.

Question 8:

1. What are the expected return for stocks X & Y?
2. What are the "standard deviations" of returns on stocks X & Y?
3. Your portfolio is worth 10,000 AED. Assume you invest 9,000 AED in stock X and 1,000 AED in stock Y. What is the expected return on your portfolio?

Solution:

Assumption: Portfolio only has equity investment.

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1. Expected return on Stock X = $(0.2 * -20) + (0.5 * 18) + (0.3 * 50) = 20\%$.
2. Expected return on Stock Y = $(0.2 * -15) + (0.5 * 20) + (0.3 * 10) = 10\%$.
3. SD of stock X and that of Stock Y would be the same and 27% as provided.
4. Expected return would be $(9000 * 20\% + 1000 * 10\%) / 10000 = 19\%$.
(Eugene F. Brigham, 2007)

Question 9:

An investor buys 3 shares of XYZ at the beginning of 2007, buys another 2 shares at the beginning of 2008, sells one share at the beginning of 2009, and sells all four remaining shares at the beginning of 2010. What are the arithmetic, geometric average and time-weighted rates of return for the investor?

Solution:

Rate of return = $(\text{Return} - \text{Capital} / \text{Capital}) * 100$

So, rate of return for year one (at start of 2008) = $[(117 - 110) / 117] * 100 = 5.983\%$

Rate of return for year two (at the start of 2009) = $[(107 - 115) / 115] * 100 = -6.956\%$

Rate of return for year three (at the start of 2010) = $[(-3 / 105)] * 100 = -2.857\%$

Arithmetic average rate of return is the arithmetic sum of individual rate of return.

So, Arithmetic average rate of return = $(5.893 - 6.956 - 2.875) / 3 = -1.313\%$

Geometric average rate of return = $(\text{capital} / \text{return})^{(1/n)} - 1$

So, geometric average rate of return = $(106/110)^{(1/3)} - 1$, which is equal to -1.23%

Time weighted rate of return is same as geometric rate of return = -1.23%

Question 10:

Fayza's investment earns a nominal annual interest rate of 9.67% compounded quarterly. What is the annual effective interest rate?

Solution:

The effective rate of interest per quarter = $9.67\% / 4 = 2.4175\%$

So, the effective annual rate of return = $(1.024175)^4 - 1 = 10\%$

Question 11:

Marwa has an investment that earns an annual nominal interest rate of 5%. If inflation runs at an annual rate of 2.5%, what is Marwa's real rate of return on her investment?

Solution:

Let the real rate of return = i'

Now it is clear that $(1 + i') = (1 + i)/(1 + e)$, where i = rate of return and e = rate of inflation.

Putting values in the formula, $(1 + i') = (1.05/1.025) \Rightarrow i' = 2.44\%$

(Eugene F. Brigham, 2007)

Question 12:

Mohammed hopes to have sufficient savings to support an annual income of 500,000 AED after-tax, for 30 years, indexed for annual inflation of 2%. He expects the payments to be paid annually at the beginning of each year. If during retirement he can earn an annual nominal return of 6% before tax (compounded annually), and he anticipates a 15% marginal tax rate, how much money does Mohammed need at the beginning of retirement to support this stream of payments?

Solution:

Here, what we need to do is to compute the NPV of the payment stream. The NPC would be equivalent to the amount Mohammed supposed to have in the beginning of the investment.

Given $i = 6\%$

Tax rate = 15%

Inflation = 2%

Thus real rate of return = $(1.06/1.02) - 1 = 3.92\%$

So, the NPV of the above situation can be represented by the following equation.

$$NPV = 500,000(1 + 0.15)^{-1} + [1 + (1.0392)^{-1} + (1.0392)^{-2} + \dots + (1.0392)^{-29}]$$

$$\text{NPV} = 500,000 * 1.15 * 18.1457 = \text{AED } 10,433,780$$

Question 13:

Lura makes the following investments into a mutual fund:

1. 3,000 AED - 4 years ago from today
2. 2,000 AED - 3 years ago from today
3. 2,500 AED - 2 years ago from today
4. 3,000 AED - 1 year ago from today

The fund earned the following returns over the last 4 years:

1. Year 1 (4 years ago) = 20%
2. Year 2 (3 years ago) = -10%
3. Year 3 (2 years ago) = 6%
4. Year 4 (last year) = 8%

What is the value of Lura's investment in the mutual fund today and what is the internal rate of return compounded annually on the fund (i. e. Dollar Weighted Return) ?

Solution:

$$\text{Value of fund after one year} = 3000(1.2) = 3600$$

$$\text{Value of the fund after two years} = (3600 + 2000) * (0.9) = 5040$$

Value of the fund after three years = $(5040 + 2500) * (1.06) = 7992.4$

Value of the fund at the end of the four years = $(7992.4 + 3000) * (1.08) = 11,871.8$

Let Internal rate of return be i .

It can be calculated by the equation of value as:

$$11,871.8 = (3000)(1+i) + (2500)(1+i)^2 + (2000)(1+i)^3 + (3000)(1+i)^4$$

Trying by hit and trial method:

Let assume i to be 7%

The value of RHS in the equation would be 12,754.72

Now trying at 6%

The value of RHS @ 6% per year would be 12,158.46

Now trying at 4%

The value of RHS @ 4% per annum would be 11,583.3

So clearly the value of i lies between 6% and 4%.

Using linear interpolation to calculate, we can write that: $(11871.8 - 11,583.3) / (12,158.46 - 11,583.3) = (i - 0.04) / (0.06 - 0.04)$

This gives $i = 5\%$ (approx) (Frank J. Fabozzi, 2006)

Question 14:

You manage an equity fund with an expected risk premium of 11% and an expected standard deviation of 15%. The risk free rate is 5%. Your client chooses to invest 60,000 AED of her portfolio in your equity fund and 40,000 AED in the risk free asset. What is the expected return and standard deviation of your client's portfolio?

Solution:

Here the expected rate of return on risk free investment = 5%.

The expected rate of return on equity = $11 + 5 = 16\%$ {by CAPM}

So, the expected return on the portfolio under given case is $(60000 * 16 + 40000 * 5) / 100000 = 11.6\%$.

The standard deviation of the portfolio is $(15 * 60000 + 0 * 40000) / 100000 = 9\%$.

References:

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