Q1. Company XYZ wants to determine the optimal capital structure. Below is a table prepared for by the financial manager of the company.



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **B/S** | **Ki** | **Ke** | **Ko** | **B/(B+S)** | **S/(B+S)** | **levered beta** |
| 0.00 | 3.00% | 14.00% | 14.00% | 0 | 1 | 1.50 |
| 0.11 | 3.00% | 15.00% | 13.80% | 0.1 | 0.9 | 1.63 |
| 0.25 | 4.00% | 16.25% | 13.80% | 0.2 | 0.8 | 1.78 |
| 0.43 | 4.00% | 17.86 | 13.70 | 0.3 | 0.7 | 1.98 |
| 0.67 | 4.00% | (A) | (B) | 0.4 | 0.6 | (C) |
| 1.00 | 4.50% | 23.00% | 13.75% | 0.5 | 0.5 | 2.63 |
| 1.50 | 4.75% | 27.50% | 13.85% | 0.6 | 0.4 | 3.19 |
| 2.33 | 5.00% | 35.00% | 14.00% | 0.7 | 0.3 | 4.13 |
| 4.00 | 6.00% | 50.00% | 14.80% | 0.8 | 0.2 | 6.00 |
| 9.00 | 7.00% | 95.00% | 15.80% | 0.9 | 0.1 | 11.63 |

Where Ki = after-tax cost of debt, Ke = cost of equity, Ko = cost of asset or WACC,   
B is the market value of debt, and S is the market value of equity.



The expected return on the market portfolio is 10%, the risk free rate is 2%, tax rate is 25%. Assume CAPM is the right model to calculate the required rate of return on its common stock.



(A) Fill in the blank 0.2

(B) Fill in the blank 0.136



(C) Fill in the blank 2.25

For the capital structure of B/S = 0.67,

Levered beta = 1.5\*(1+0.67\*(1-0.25)) = 2.25,

Ke = 0.02 + 2.25\*(0.1-0.02) = 0.2



Ko = 0.4\*0.04 + 0.6\*0.2 = 0.136



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **B/S** | **Ki** | **Ke** | **Ko** | **B/(B+S)** | **S/(B+S)** | **levered beta** |
| 0.00 | 3.00% | 14.00% | 14.00% | 0 | 1 | 1.50 |
| 0.11 | 3.00% | 15.00% | 13.80% | 0.1 | 0.9 | 1.63 |
| 0.25 | 4.00% | 16.25% | 13.80% | 0.2 | 0.8 | 1.78 |
| 0.43 | 4.00% | 17.86% | 13.70% | 0.3 | 0.7 | 1.98 |
| 0.67 | 4.00% | 20.00% | 13.60% | 0.4 | 0.6 | 2.25 |
| 1.00 | 4.50% | 23.00% | 13.75% | 0.5 | 0.5 | 2.63 |
| 1.50 | 4.75% | 27.50% | 13.85% | 0.6 | 0.4 | 3.19 |
| 2.33 | 5.00% | 35.00% | 14.00% | 0.7 | 0.3 | 4.13 |
| 4.00 | 6.00% | 50.00% | 14.80% | 0.8 | 0.2 | 6.00 |
| 9.00 | 7.00% | 95.00% | 15.80% | 0.9 | 0.1 | 11.63 |

(D) What is the optimal debt-to-equity ratio? 0.67

Ko is the smallest at B/S of 0.67. B/S of 0.67 is the best mix between debt and equity.

Q2. Company ABC operates in the Modigliani-Miller, in which there is no tax and there is no financing friction. Currently, it is financed with $100M of equity and $300M debt; the cost of equity is 20% and the pre-tax cost of debt is 5% at this capital structure. Company ABC is thinking about selling its debt entirely and using the proceeds to buy more stocks so that its capital structure becomes 100% equity. What should be the required rate of return on the equity once after Company ABC recapitalizes? 0.0875



100M/400M\*0.2 + 300M/400M\*0.05\*(1-0) = 0.0875

Q3. Which of the following is FALSE?

(A) In the Net Operating Income approach, firm value remains the same regardless of capital structure



(B) Based on the tradeoff theory in capital structure, firm value remains the same regardless of the debt-to-equity ratio



(C) In the Modigliani-Miller world, firm value remains the same regardless of capital structure



(D) In the Net Operating Income approach, the cost of equity should increase as the debt-to-equity ratio of the firm increases

Q4. There are two companies operating in the Modigliani-Miller world, which are identical to each other except for the capital structure: Company NL has no debt and Company L has some debt.

|  |  |  |
| --- | --- | --- |
|  | Company NL | Company L |
| Market Value of Debt  (Perpetual Bond) | 0 | $500 million |
| Required return on Debt | N/A | 4% |
| Required return on Equity | 9% | 10% |
| Net Operating Income | $180 million | $180 million |

Assume 100% dividend payout ratio, no growth of earnings, and no tax.



(A) Find the market value of the assets of Company NL.

$180M/0.09 = $2000M

(B) What is the overall capitalization rate of Company L, i.e. WACC for Company L?

Earnings available to equity holders = 180M – 500M\*0.04 = $160M

Market value of equity = $160M/0.1 = $1600M

Capitalization rate = 180M/(500M+1600M) = 0.086

Or WACC = 500M/2100M\*0.04 + 1600M/2100M\*0.1 = 0.086



(C) Which of the Trading Schemes below is the appropriate way to take advantage of the arbitrage opportunity? Trading Scheme I

Trading Scheme I: You short-sell 1/1,000,000 fraction of Debt of Company L, short-sell 1/1,000,000 fraction of Equity of Company, and buy 1/1,000,000 fraction of Equity of Company NL



Trading Scheme II: You buy 1/1,000,000 fraction of Debt of Company L, buy 1/1,000,000 fraction of Equity of Company, and short-sell 1/1,000,000 fraction of Equity of Company NL



**Trading Scheme I:**

Transaction 1.

Sell 1/1M fraction of Company L: Sell $1600 in Equity of Company L and Sell $500 in Bond of Company L



As a result, CF today is inflow of $2100

Your obligation is pay 1/1,000,000 fraction of Net Operating Income every year in the future, i.e. you need to $180 every year

Transaction 2.

Buy 1/1M fraction of Company NL: Buy $2000 in Equity of Company NL

As a result, CF today is outflow of $2000 today



In the future, you are entitled to receive 1/1,000,000 fraction of Net Operating Income every year in the future, i.e. you receive $180 every year



As a result of Transaction 1 and 2, you have no future obligation (your future CF on the net is 0 every year), but you gain a sure profit of $100 today.

**Trading Scheme II:**

The cashflow is exactly the opposite of Trading Scheme I. Hence, you have no obligation to pay any money in the future, yet there is cash outflow of $100 today. Hence, this is not arbitrage.

Answer: Trading Scheme I

Note that as the arbitrage chance will immediately disappear, the firm value of Company NL and the firm value of Company L should be the same eventually.