Capital Structure in a Perfect World

(Modigliani-Miller, 1958)

Gestão Financeira II

Undergraduate Courses

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Capital Structure in a Perfect World

- The Capital Structure of a firm (or project) is the mix of Equity and Debt that the firm uses.
- In a Perfect World, as presented first by Modigliani and Miller in 1958, we will see that the capital structure choice is irrelevant.
- Why? The total value of the firm depends on the value of its assets, independently of them being financed with equity or debt. (MM Proposition I)
- Even if the cost of debt is lower than the cost of equity, on average the cost of capital of the firm is always the same (r_{WACC} does not change with the capital structure). This happens because when a firm increases its cheaper source of financing – debt – it also increases the risk for equity-holders, and hence the cost of equity goes up.

Capital Structure in a Perfect World: Compare Different Structures

- Example: Consider the following investment opportunity, with equal probability for the date 1 scenarios.

Date 0	Date 1	
	Strong Economy	Weak Economy
–$800	$1400	$900

- Capital Structure #1: 100% Equity Financing (Unlevered Equity)
  - Consider a Rf interest rate of 5%, and that you require a 10% risk premium.
  - The project's NPV is: ____________________
  - You can actually raise $1000 in equity and gain $200 on top of your required return.
  - The cash flows and returns for Unlevered Equity-holders are:

	Date 0	Date 1: Cash Flows		Date 1: Returns	
	Initial Value	Strong Economy	Weak Economy	Strong Economy	Weak Economy
Unlevered equity	$1000	$1400	$900	40%	–10%

Expected Return=0.5(40%)+0.5(-10%)=15%

Capital Structure in a Perfect World: Compare Different Structures

- Capital Structure #2: 50% Debt / 50% Equity (Levered equity)
  - Borrow $500. At rate Rf=5%, because debt will be riskless (look at cash flows)
  - Get the remainder as equity. What's the value of equity?
  - Look at the Cash Flows:

	Date 0	Date 1: Cash Flows	
	Initial Value	**Strong Economy**	**Weak Economy**
Debt	$500	$525	$525
Levered equity	*E* = ?	$875	$375
Firm	$1000	$1400	$900

  - In equilibrium the value of equity must be E=$500.
  - How can we check this?

Capital Structure in a Perfect World: Compare Different Structures

- Levered Equity has higher risk! The variability of returns is higher. Therefore, the expected return of levered equity is higher than the expected return of unlevered equity.
  - Check it:

	Date 0	Date 1: Cash Flows		Date 1: Returns		
	Initial Value	Strong Economy	Weak Economy	Strong Economy	Weak Economy	Expected Return
Debt	$500	$525	$525	5%	5%	5%
Levered equity	$500	$875	$375	75%	–25%	25%
Unlevered equity	$1000	$1400	$900	40%	–10%	15%

  - While debt might be cheaper on its own, it increases the cost of equity.
  - Therefore the cash flows for equity-holders cannot be discounted at rate 15% anymore, but rather at 25%!

Modigliani-Miller: Proposition I (MM I)

- Modigliani and Miller (MM) showed in 1958 that this result holds more generally under a set of conditions referred to as perfect capital markets:
  - Investors and firms can trade the same set of securities at competitive market prices equal to the present value of their future cash flows.
  - There are no taxes, transaction costs, or issuance costs associated with security trading.
  - A firm's financing decisions do not change the cash flows generated by its investments, nor do they reveal new information about them.

Modigliani-Miller: Proposition I (MM I)

- MM Proposition I:
  - *In a perfect capital market, the total value of a firm is equal to the market value of the total cash flows generated by its assets and is not affected by its choice of capital structure.*

$$E + D = U$$

- This is also known as the Irrelevance result: the choice of capital structure does not affect the value of the firm.

MM I: Homemade Leverage

- Example: Turning to our previous example we can understand MM's result by considering *homemade* leverage made by the investors themselves in case the firm is unlevered.
  - Suppose the firm is unlevered, and the investor creates his own leverage by borrowing $500 (or getting a margin loan) at Rf=5%.

	Date 0	Date 1: Cash Flows	
	Initial Cost	Strong Economy	Weak Economy
Unlevered equity	$1000	$1400	$900
Margin loan	–$500	–$525	–$525
Levered equity	$500	$875	$375

  - Likewise, if the firm is levered (with 50% Debt and 50% equity) an investor who wants to invest in the firm as if it were unlevered, can buy both th equity and the debt of the firm.

	Date 0	Date 1: Cash Flows	
	Initial Cost	Strong Economy	Weak Economy
Debt	$500	$525	$525
Levered equity	$500	$875	$375
Unlevered equity	$1000	$1400	$900

Modigliani-Miller: Proposition II (MM II)

- In their Proposition II, MM give the justification for Proposition I.
  - The reason why the value of the firm is unaltered by the capital structure is that higher leverage causes higher risk for equity-holders, and hence a higher costof equity.

- Proposition II:
  - *The cost of capital of levered equity is equal to the cost of capital of unlevered equity plus a premium that is proportional to the market value debt-equity ratio.*

$$r_E = r_U + \frac{D}{E}(r_U - r_D)$$

- r_E: Cost of Levered Equity
- r_U: Cost of Unlevered Equity
- D: Market Value of Debt
- E: Market Value of Equity
- r_D: Cost of Debt

Modigliani-Miller: Proposition II (MM II)

- If we want we can visualize MM's reasoning by looking at a Market Value Balance-Sheet:

U	D E

- Therefore when we compute the average cost of capital of the firm, we find that it's always the same in a perfect world. It equals the unlevered cost of capital (R_U):

$$\frac{E}{E+D} R_E + \frac{D}{E+D} R_D = R_U$$

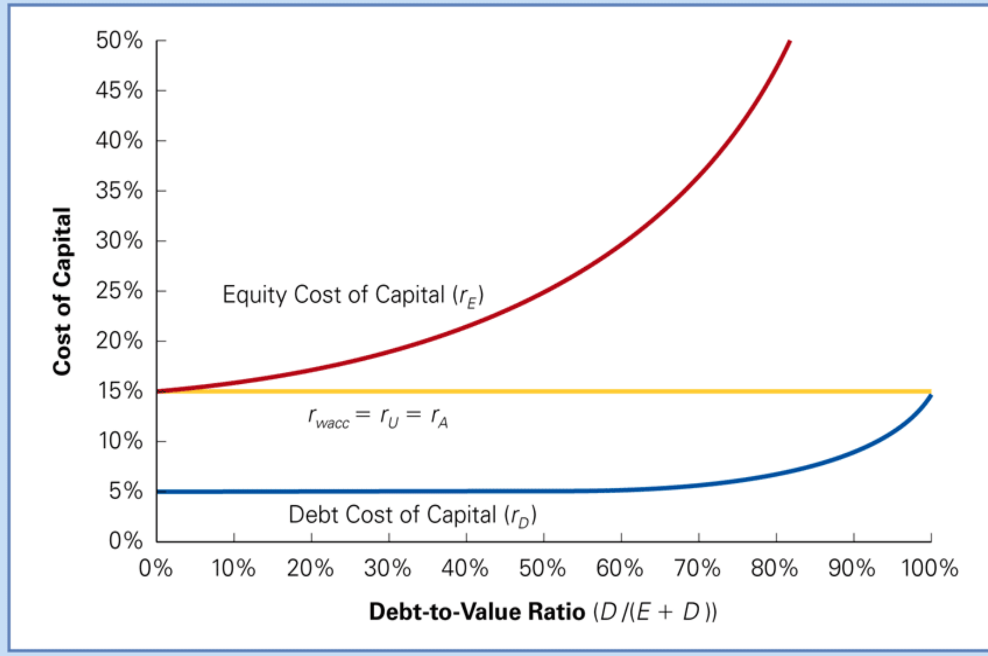
Cost of Capital in a perfect world

- We define the Unlevered Cost of Capital (or pre-tax WACC) as:

$$r_U = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D$$

- And we know that in the MM world, the WACC equals the Unlevered Cost of Equity, which is the Cost of Capital of the firm's Assets:

$$r_{wacc} = r_U = r_A$$



(a)

E	D	r_E	r_D	$\frac{E}{E+D} r_E + \frac{D}{E+D} r_D$	$= r_{wacc}$
1000	0	15.0%	5.0%	1.0 × 15.0% + 0.0 × 5.0%	= 15%
800	200	17.5%	5.0%	0.8 × 17.5% + 0.2 × 5.0%	= 15%
500	500	25.0%	5.0%	0.5 × 25.0% + 0.5 × 5.0%	= 15%
100	900	75.0%	8.3%[4]	0.1 × 75.0% + 0.9 × 8.3%	= 15%

(b)

Additional Comments

- Computing the WACC with multiple securities:
  - It is possible to compute a WACC rate if we want to consider more types of financing than just coimmon stock and debt.
- Levered Betas (   ) and Unlevered Betas (   ):
  - The beta of a stock is going to vary according to the level of debt of the firm. We can apply the same logic of MM II to betas:

$$\beta_U = \frac{E}{E+D}\beta_E + \frac{D}{E+D}\beta_D$$

$$\beta_E = \beta_U + \frac{D}{E}\left(\beta_U - \beta_D\right)$$

- Holding Cash: Holding cash has the opposite effect of having debt.
  - When calculating *D* we use Net Debt.
  - Example: E=$114.8 billion; Debt = $10.3 billion; and Cash and short term investments= $33.6 billion.
    - We use D=$10.3-$33.6= - $23.3 billion