



Lecture 18

The Modigliani-Miller Theorem With No Taxes

- Q 1: Does capital structure matter?
- Q 2: Does dividend policy matter?
- Readings:
 - BM: chapters 16, 17 & 18
 - Reader: Lecture 18

Distinguishing Firm Risk and Market Risk (One Last Time)

- In real applications, firm risk and market risk often become entangled over time periods.
- For example, suppose you are running a shipping service that faces two risks:
 - Your ship might sink.
 - Your cargo might have a higher or lower market value.
 - Which is market risk? Which is firm risk?
- Now let us recognize that if the ship sinks, then your goods will not get to market.
 - Does this change your mind regarding what is market risk?
- This all matters because it determines the proper discount rate: risk free or with risk premium!

Indian Spice Ship in Year 1675: Example

■ Assumptions:

- There is 40% chance ship will sink before it can return to England.
- If ship does not sink, you can sell the spices in one year.
- Spice prices are related to market events and have a β of 2.
- The spices cost 1,000, the ship costs 10,000.
- If the ship returns, you sell spices for 20,000 and ship for 10,000.
- $r_f = .05$ and $r_m = .15$?

■ What discount rate to use for computing spice PV?

- Key Point: Whether or not the ship sinks has nothing to do with the spice market. The ship sinking is all idiosyncratic risk.
- Answer: The discount rate on the spices (using the spice β) is:
$$r = r_f + 2(r_m - r_f) = .05 + 2(.15 - .05) = .25.$$

Spice Ship Evaluation

■ The net present value of the spices equals:
 $PV_s = -1,000 + [.6(20,000) + .4(0)]/1.25 = 8,600.$

Probabilities
Spice Cost Safe value Fail value 1+discount rate

■ Since the ship is always worth 10,000 it has a beta of zero.

■ Therefore, ship has a present value of:

$$- 10,000 + [.6(10,000)+.4(0)]/1.05 = -4,285.71.$$

■ The expected value of the project is:

$$PV = 8,600 - 4,285.71 = 4,314.29 > 0.$$

■ You should set sail.

Modigliani Miller Theorem

(Why corp. fin. may not matter)

- Assuming "perfect capital markets", Modigliani and Miller found, without taxes, **the total value of a firm is unaffected by its security structure.**
 - I.e. Whether or not an investment makes sense does not depend on how we are going to raise the money to pay for it.
- Why is this true?
 - A firm's cash flow is like a pizza: to change the firm's capital structure is to change the size of individual pizza slices.
 - This does not change the overall size of the pizza.
 - Nor does it change the overall value of the firm.

Modigliani and Miller and Pizza (continued)

- Pizza:
 - We might have an unsliced pizza, but want slices:
We can then always cut it up ourselves.
 - Or, we have have a bunch slices, but want a whole pizza:
we can always stick them back together.
- Moral: We should be willing to pay the same price for one whole pizza or an equivalent bunch of slices.
- **The M&M argument applied to corporate leverage:**
 - Individual investors can modify any corporate leverage, so that their own portfolio has the personally desired level of leverage.

M&M Proposition 1: Leverage Cannot Influence Firm Value

- Consider two firms, U (unlevered) and L (levered), identical except for capital structure.
 - Firm U is all equity financed, and is worth a total of V_U .
 - Firm L is levered, with equity worth E_L and debt of D_L .
Its total value is $V_L = E_L + D_L$.
- Can V_U and V_L be different?
 - No, for exactly the same reason as the pizza.
 - I.e. given either firm, we can create the other our self.

Proposition 1: Proof

- Format of the MM Argument:
 - If 2 investment positions provide exactly the same cash flow, then..
 - The market value of the 2 positions must be identical.
- Firms U and L have the same net operating income (NOI)
(Reader calls this profits).
- (1) If you buy 1% of the Equity in Firm U:
 - Cash flow = (1%)(NOI)
- (2) If you buy 1% of Equity in L + 1% of debt in L:
 - Cash flow = (1%)(NOI – interest) + (1%)(interest) = (1%)(NOI)
- Since the cash flow of (1) and (2) are identical,
Value (1% U equity) = Value (1% L equity + 1% L debt)
 $V_U = V_L (= E_L + D_L)$

Replication of Firm L Equity

(1) We can buy firm L equity directly. Cash flow:

	Investment	Return
Equity of L	0.01 V_L	(0.01)(NOI - Interest)

(2) Or borrow (1%)(D_L) + buy 1% firm U equity:

	Investment	Return
Equity of U	0.01 V_U	(0.01)(NOI)
Borrowing	-0.01 D_L	-(0.01)(Interest)
Total	0.01 $(V_U - D_L)$	(0.01)(NOI-Interest)

Again we see: $V_L = V_U - D_L$; or $V_U = V_L + D_L$

MM Proposition 2: Dividend Irrelevance

- The MM theorem can be extended to show that a firm's dividend policy does not influence its value.
- Our demonstration uses the following example:
 - Initially firm will pay dividend stream such that:
Value (equity) = PV(dividends)
 - Now suppose firm raises its dividend at date 0
 - Extra dividend is funded by new debt issued at date 0.
- Question: Does this financial action influence the value of the firm's equity?

Dividend Irrelevance Proof

- More precisely:
 - Firm initially plans to pay dividends with PV (dividends)
 - Now firm decides to pay additional date 0 dividend of M.
 - It must also issue M dollars worth of debt. So....
- Value (equity) = PV(dividends) + M - PV(debt).
 - But PV(debt) must equal M (otherwise the people purchasing the new securities would not give the firm M dollars). Thus,
- Value (equity) = PV(dividends) + M – M = PV (dividends)
- Nothing has changed.
- Lesson: A firm can arbitrarily alter its dividend stream without altering its value.

Key Assumptions for MM Propositions

- Individual investors must be able to borrow at same terms as firm.
 - An investor can thus transform unlevered firm U equity into a levered position by borrowing and using the extra cash to buy firm U equity on margin.
- Individual investors must be able to lend at same terms as firm.
 - An investor can thus transform levered firm L equity into an unlevered position by selling some of the L equity and lending out the proceeds of the sale.