

MBA702

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- Module 6, part 2: Leverage and Capital Structure

We have looked at how firms raise capital, that is, new equity and debt. Here we are going to look at capital structure and leverage (debt).

Outline for Capital Structure and leverage

- Capital structure and the “pie” theory
- Maximizing firm value vs. maximizing shareholder interests
- Financial leverage and firm value
- M&M initial proposition II (no taxes)
- Effect of adding in taxes
- Costs of financial distress

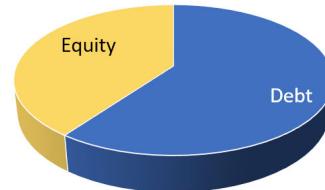
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Essentially, what capital structure means is how much of our capital that we are going to use for the firm and its investments in new projects, how much of that capital should be from equity that is from selling stocks, and how much should be borrow. That is, how much should be debt and how much of the total should be equity. Should it be all-equity, should it be mostly debt and just a little bit equity or somewhere in between? That is the capital structure question for the firm.

We will examine why it might be important to talk about capital structure, and what it has to do with firm value and maximizing shareholder interests. Then we are going to look through a leveraged firm (both equity and debt in the capital structure) and a non-leveraged firm (all-equity) with examples of when one type might be better than the other. All of this is kind of going to be couched in what we call M and M theory, the Modigliani and Miller Propositions. And one of the propositions is that there are no taxes and that creates a capital structure irrelevance theory. That will change once we add the idea of taxes and then ultimately when we also add the idea that having debt could cause financial distress as well and so then we are going to look at various types of financial distress costs.

Capital structure and value of the firm

- The value of a firm is defined to be the sum of the value of the firm's debt and the firm's equity.
- $V = \text{Debt} + \text{Equity}$
- The goal: Make the biggest pie possible



Value of the firm

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The value of a firm is defined to be the sum of the value of the firm's debt and the firm's equity.

Value = Debt + equity Note that this is the market value of equity and the market value of debt. The greater the “size of the pie”, the greater the total value of the firm.

- Unless we are provided with information on the market value of the debt, such as “the debt is selling at 90% of book value” or similar, we assume that the market and book value of debt are the same.
- The market value of equity is simply the # of outstanding shares * market price per share

If the goal of the firm's management is to make the firm as valuable as possible, then the firm should pick the debt-equity ratio that makes the pie as big as possible. Bigger pie, bigger total value of the firm.

We know that the firm's value is determined by its cash flows and the riskiness of the assets. Firm value changes based on the risks inherent in the cash flows.

- With higher debt, we just saw how cash flows become riskier and how interest reduces cash flows.
- Recall from Module 1, a firm's debt-to-equity ratio is the value of debt divided by the value of common equity. An all-equity firm (no debt) would have a debt-to-equity ratio of 0. A firm that has a equity market value of \$40 million and outstanding debt having a market value of \$70 million would have a debt-to-equity ratio of 70/40 or 1.75

Stockholders and capital structure

- There are two important questions:
 - Why should the stockholders care about maximizing firm value?
 - Perhaps they should be interested in strategies that maximize shareholder value.
 - What is the ratio of debt-to-equity that maximizes the shareholder's value?

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There are two important questions when thinking of this from the stockholder's point of view and the management is supposed to be working for the stockholders.

- The first question is why should stockholders care about maximizing the entire firm value?
 - Shouldn't they be more interested in maximizing shareholder value, that is, the value of their shares?
- So, from the stockholders' point of view, the question is the debt-to-equity ratio that maximizes shareholder value, not necessarily entire firm value?
 - As it turns out, changes in capital structure benefit the stockholders if and only if the value of the firm increases.
 - In many cases, the optimal debt-to-equity structure maximizes shareholder value, also increase the entire pie or the entire value of the firm.

Before we dive into the details and theories, here is “the whole point”

What is the optimal capital structure?

- Recall the goal of the firm – which is maximize shareholder wealth, which is achieved by maximizing the **long-term** share price.
- So, the **optimal capital structure** is the mix of debt, equity, and preferred stock that **maximizes the company’s stock price**.

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What is the optimal capital structure? Well, it varies between firms based on their products, structure, size, goals, etc. It is the mix of capital sources (debt, equity & preferred stock” that will ultimately maximize the firm’s share price.

On the following slides we will look at decisions a firm needs to consider as they are looking at their capital structure: should the firm take on more debt? How does financial leverage (debt) impact the firm’s earnings per share and return on equity?

We then move to some of the most famous capital structure theories, developed by two of the leading finance researchers: Modigliani and Miller (M&M). They have cases and propositions and no, you do NOT need to remember which is which. What these represent are specific sets of simplifications and assumptions that help them walk us through their theories. For this class, you will be provided all the assumptions and simplifications needed for any problems on the practice problems or exam.

Example: Should a firm take on debt?

- The following example is for a firm that is all equity and is considering taking on debt to buy back some of its equity.
- Good idea? Well, it depends on expected earnings for the company.
- With debt, there will be annual interest that needs to be paid.
- On the flip-side, the firm gains tax breaks on that debt
- We need to determine at what point (earnings, and here we are using EBIT), the earnings per share (EPS) is the same under the current capital structure and under debt.
 - If the firm's expect earnings (again, simplified with EBIT in the example) are greater than this "breakeven" point, then debt is beneficial to the firm. If the expected earnings are lower, the company loses value.

Financial leverage, EPS and ROE

- Consider an all-equity firm that is considering going into debt (suppose some of the original shareholders want to cash out maybe)

	Current	Proposed
Assets	\$20,000	\$20,000
Debt	\$0	\$8,000
Equity	\$20,000	\$12,000
Debt/Equity ratio	0	2/3
Interest rate	N/A	8%
Shares outstanding	400	240
Share price	\$50	\$50

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Let's look at an example of a firm that is currently all-equity and no debt. Now, some of the original shareholders want to cash out and the firm needs a way to pay them out.

The firm has assets worth \$20,000 and currently has \$20,000 in equity, with 400 shares outstanding at \$50 per share ($\$20,000/400 \text{ shares} = \50 per share). This is what we call and "unleveraged" firm.

The firm takes on \$8000 in debt to buy 160 shares (at \$50/share). This is now a "leveraged" firm.

The firm goes from a debt-to-equity ratio of 0 to $8000/12000$, or 0.67 (may also be represented as a ratio of 2/3) now that there is \$8,000 in debt and only \$12,000 in equity.

What we are interested in examining is how these two different capital structures might fare under uncertain economic outcomes. If the firm's economic future was known with certainty, the decision on capital structure would be easy, but outcomes are never certain.

EPS and ROE under the current structure (400 shares outstanding)

	Recession	Expected	Expansion
EBIT	\$1,000	\$2,000	\$3,000
Interest	0	0	0
Net Income	\$1,000	\$2,000	\$3,000
EPS	$\$1,000/400 = \2.50	\$5.00	\$7.50
ROA	$1,000/\$20,000 = 5\%$	10%	15%
ROE	$1,000/\$20,000 = 5\%$	10%	15%

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To examine earnings per share and ROE under the current capital structure we start with a simplifying assumption – that is, no taxes.

Now let's look at 3 possible economic outcomes and how the EPS (earnings per share), ROA (return on assets or Net income/book value of assets), and ROE (return on equity or net income/book value of equity). Note that while we are examining potential outcomes, the level of earnings is still based on the firm's analysts' best estimates.

- Under a recession, EBIT (earnings before interest and taxes or operating profit) is expected to be \$1000. If the economy is normal or as expected, the firm anticipates EBIT of \$2000 and under an expansion, the EBIT is expected to be \$3000.
- The firm is currently unlevered (no debt), therefore the interest expense is 0; and net income (remember we are assuming no taxes here) and EBIT will be the same under these assumptions.
- EPS is net income/# shares and the firm currently has 400 shares, meaning in a recession, with \$1000 in net income, the EPS is \$2.50 and \$5 under expected conditions and \$7.50 in an expansion.
- ROA = NI/total assets = 5%, 10% and 15% under a recession, expected conditions, and an expansion, respectively.
- ROE is the same as this is currently an all-equity firm (equity = assets)

EPS and ROE under the proposed structure (240 shares outstanding)

	Recession	Expected	Expansion
EBIT	\$1,000	\$2,000	\$3,000
Interest	\$8000*.08 = \$640	\$640	\$640
Net Income	\$360	\$1,360	\$2,360
EPS	\$360/240 = \$1.50	\$5.67	\$9.83
ROA	360/\$20,000 = 1.8%	6.8%	11.8%
ROE	360/\$12,000 = 3.0%	11.3%	19.7%

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Now let's look at the same scenarios, but assuming the proposed structure where there is \$8000 in debt and 240 shares outstanding.

We have the same EBIT assumptions and still assuming no taxes.

With \$8000 in debt and 8% interest, we have \$640 per year in interest (assuming interest only here, as with bonds, which pay back the principal at maturity and make interest payments every year).

Net income is now \$360, \$1,360 and \$2,360 under the three scenarios.

Earnings per share are now NI/240 shares, or \$1.50, \$5.67 and \$9.83 under the 3 scenarios of recession, expected, and expansion, respectively.

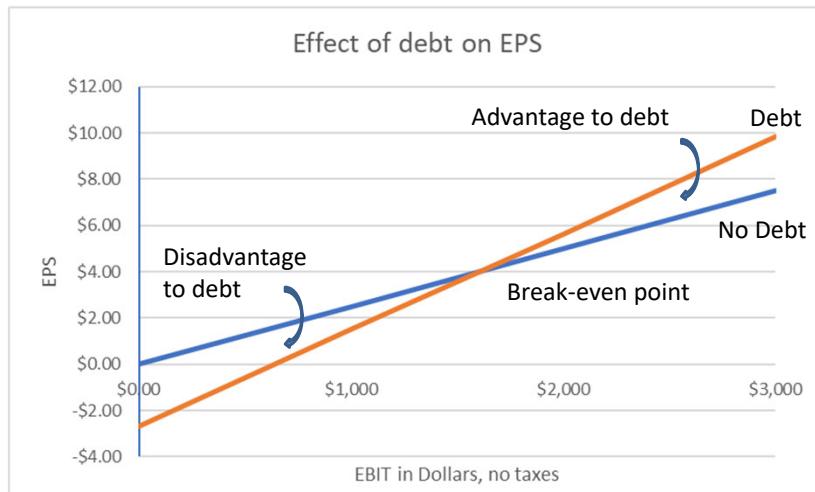
Earnings per share are now higher under the expected and expansionary conditions, but lower under the recession.

For ROA, we have NI/total assets, which are still \$20,000. With a lower net income, ROA is now 1.8%, 6.8% and 11.8% under the various conditions.

ROA has decreased under any of the conditions now that there is some debt and interest payments reduce net income.

Return on equity or ROE decreases under the recession but is higher under the expected or expansionary conditions with only 240 shares as compared to 400 shares outstanding.

Financial leverage and EPS



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Here we are comparing the two cases, the current unlevered company that is all-equity and no debt vs. the proposed capital structure that contains debt.

When EBIT is \$1000 we have earnings per share of \$2.50 for the unlevered firm and \$1.50 per share for the levered structure, showing that debt is a disadvantage at this EBIT level.

When EBIT is \$2000, the all-equity firm had an EPS of \$5 per share compared to the levered structure with \$5.67

At EBIT of \$3000, the all-equity firm's EPS was \$7.50 compared to the levered structure with \$9.83

We can see at lower levels of EBIT, debt is a disadvantage, as the burden of paying interest on the debt negatively affects EPS. However, at higher EBIT levels, debt has advantages for EPS because earnings are sufficient to easily cover the interest due.

- At the break-even point, the EPS for the two different capital structures is the same. We can solve for this value by setting EPS without debt = EPS with debt. **At this breakeven point, there is no advantage to the firm having debt.**
- The bottom line here is that if we expect EBIT to be greater than the break-even point, then leverage is beneficial to our stockholders.
- If we expect EBIT to be below the break-even point, then leverage (debt) is detrimental to the stockholders.

- **The advantage of leverage (debt) is directly related to the EBIT level** (above the BE point, the higher the EBIT, the greater the advantage of leverage).
- **If EBIT is zero, we would have \$0 EPS for the unlevered firm** with 400 shares (or any amount of shares). But, at \$0 EBIT with the levered firm, there is still \$640 in interest to be paid, bringing the EPS to $-\$640/240 \text{ shares} = -\2.67 per share .
- Further, you should note that the line for the levered firm is steeper. For every \$1000 increase in EBIT, EPS increases by \$4.17, while for the unlevered firm with 400 shares, the increase is \$2.50 per share for every \$1000 increase.
 - **THE FOLLOWING ARE CONCEPTS YOU REALLY WANT TO PAY ATTENTION TO:**
 - So, what does the “steeper curve” for the levered firm mean?
 - A steeper curve means that the **EPS for the levered firm is more sensitive to changes in EBIT than the unlevered firm.**
 - At any EBIT **below** the break-even point, the EPS for the levered will be **less** than the EPS for the unlevered firm.
 - At any EBIT **above** the break-even point, the EPS for the levered firm will be **greater** than the EPS for the unlevered firm.

Break-even EBIT

EPS same for both structures

$$\frac{EBIT}{400} = \frac{EBIT - \$640}{240}$$

$$EBIT * \frac{240}{400} = (EBIT - \$640)$$

$$EBIT * 0.6 = EBIT - \$640$$

$$0.4 EBIT = \$640$$

$$\$640/0.4 = EBIT$$

$$EBIT = \$1,600$$

$$EPS = \frac{\$1,600}{400} = \$4.00/\text{share}$$

$$\text{Confirm: } \frac{1600 - 640}{240} = \$4.00/\text{share}$$

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Here we are solving for the breakeven EBIT (and EPS)

We start by setting the EPS for the levered structure = EPS for unlevered structure

Or $EBIT/400 = (EBIT - \text{Interest of } \$640)/240$ shares

Multiply both sides by 240 and we have $EBIT * \frac{240}{400} = (EBIT - \$640)$

The next step (not shown on the slide) is combine all EBIT terms on one side

We start with $EBIT * 0.6 = (EBIT - \$640)$

Add 640 to both sides and we have $640 + (0.60 EBIT) = EBIT$

Subtract 0.60 EBIT from both sides and we have $640 = EBIT - 0.6 EBIT$

- We now rearrange and have $0.4 \times EBIT = 640$
- Divide both sides by 0.4 and we have $EBIT = 1600$
- Reformatting, we solve for breakeven $EBIT = \$1,600$ with EPS of \$4/share under either structure.

Break-even EBIT, EPS same for both structures “All-in-one” equation

- Breakeven EBIT = $\frac{(\text{issued debt} * \text{interest rate})}{(1 - \frac{\text{levered shares}}{\text{unlevered shares}})}$
- “levered shares” is the # outstanding shares if the firm has debt
- “unlevered shares” is the # outstanding shares if the firm is all-equity (no debt)
- Issued debt = \$8000 and the interest rate is 8%
- Levered shares = 240 and unlevered shares = 400
- The numerator (top value) is the annual interest amount
- The denominator (bottom value) = 1 – ratio of levered to unlevered shares
- Breakeven EBIT = $\frac{(\$8000 * 0.08)}{(1 - \frac{240}{400})} = \frac{\$640}{0.4} = \$1600$

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An “all in one solution” is also possible, although the solution on the prior slide helps with the understanding of breakeven EBIT

$$\text{Breakeven EBIT} = (\text{issued debt} * \text{interest rate}) / (1 - \frac{\text{levered shares}}{\text{unlevered shares}})$$

- Note: What I mean when I have “levered” and “unlevered shares” is the capital structure of the firm, not the shares themselves. It is the **FIRM** that is either levered or unlevered.
- When the firm is all-equity (no debt), the number of outstanding shares reflect the “unlevered” shares
- After the firm takes on debt to buy back shares, the remaining outstanding shares are the “levered” shares
- Breakeven EBIT = $(8000 * .08) / ((1 - \frac{240}{400})$
- $640 / (1 - 0.6) = \text{Breakeven EBIT} = 640 / 0.4 = \1600
- Note: This equation is good only when a firm is going from all-equity (no debt or unlevered) to a mix of debt and equity (levered).

In the Instructor’s Example this week I work a problem where a firm already has debt, and it takes on more debt to buy back shares. The equation above is specific for levered vs. unlevered shares and is not valid for going from levered to “more levered”.

For purposes of exam-prep, note that we will only be looking at breakeven EBIT for a firm

that is starting as all equity, so the all-in-one equation will work.

What conclusions can we draw?

Based on the previous example, we can draw 3 conclusions:

1. The effect of financial leverage depends on the company's EBIT. When EBIT is relatively high, leverage is beneficial.
2. Under the expected scenario, leverage increases the returns to shareholders, as measured by both ROE and EPS.
3. Shareholders are exposed to more risk under the proposed capital structure (with more leverage) because, in this case, the EPS and ROE are much more sensitive to changes in EBIT.

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Based on the previous example, we can draw 3 conclusions:

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3. Shareholders are exposed to more risk under the proposed capital structure (with more leverage) because, in this case, the EPS and ROE are much more sensitive to changes in EBIT.

Financial leverage increases ROE and EPS when EBIT is greater than the crossover point. The variability of EPS and ROE is increased as leverage increases.

Beyond the break-even point, EPS will be larger under the debt alternative, but with additional debt, the firm will have additional financial risk that would increase the required return on its common stock. A higher required return might offset the increase in EPS, resulting in a lower firm value despite the higher EPS.

Capital Structure Theory (M&M)

- Modigliani and Miller (M&M) and capital structure irrelevance
- Underlying assumptions
 - Homogeneous Expectations
 - Homogeneous Business Risk Classes
 - Perpetual Cash Flows
 - Perfect Capital Markets:
 - Perfect competition
 - Firms and investors can borrow/lend at the same rate
 - Equal access to all relevant information
 - No transaction costs
 - No taxes

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Franco Modigliani and Merton Miller (Nobel laureates), or better known as “M & M” were the pioneers of financial research into capital structure. They proposed that (under certain conditions or underlying assumptions) a firm’s capital structure was irrelevant, it could have all debt, all-equity or anywhere in between.

Note, by “irrelevant” we mean that investors should be indifferent to a firm’s capital structure, that their returns from investing in the firm under all equity vs. part debt/part equity should not be different.

M&M begin with a set of underlying assumptions:

- All investors have the same beliefs about expectations of firm performance and risks that the cash flows of the company go on “forever”.
- Further, that capital markets themselves are very efficient, there is perfect competition and that both firms and investors can borrow and lend at the same rate.
- The firm and investors have all relevant information
- There are no transactions costs, and, very importantly, there are NO TAXES.
- Under these conditions, M&M propose that a firm’s capital structure is irrelevant.
- Once we understand the M&M “no-tax” models, we will move on to adding taxes (in other words, reality).

Why would a firm's capital structure be irrelevant to an investor?

Homemade leverage example

	Recession	Expected	Expansion
EPS of Unlevered firm	\$2.50	\$5.00	\$7.50
Earnings on 40 shares	\$100	\$200	\$300
<u>Less on interest on (\$800)</u>	<u>\$64</u>	<u>\$64</u>	<u>\$64</u>
Net profits	\$36	\$136	\$236
ROE, net profits/1,200	3.0%	11.3%	19.7%

- This demonstrates how we can invest in an all-equity company, and by borrowing part of the necessary funds (leveraging his investment), can create the same level of ROE as would be earned if investing in a similarly leveraged firm.
- Personal debt-to-equity = debt/equity = $\$800/\$1200 = 2/3$ or 0.67

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This example is simply to show the underlying thought process of why (assuming no taxes and no bankruptcy costs), a firm's capital structure is irrelevant to investors. No, you won't see "homemade leverage" on the exam, nor is it in the practice problems.

Here is an example of why a firm's capital structure might be irrelevant to an investor. It is because, as investors, we can create the same sort of payoffs that were shown in the prior example of a firm going from all equity to a debt-to-equity ratio of 2/3 (going from 400 outstanding shares and 20,000 in equity to 240 outstanding shares with \$8000 in debt and \$12000 in equity). The investor can make their own "homemade leverage".

The investor buys 40 shares in an unlevered firm by borrowing \$800 and paying the remaining \$1200 in cash ($40 \text{ shares} * \$50 \text{ per share} = \2000). Under a recession, the firm earns \$2.50 per share (see slide 6), and so the investor earns \$2.50 on each of their 40 shares for a total of \$100. Similarly, under the expected conditions, the investor earns \$200 and expects to make \$300 if there is an expansion in the economy.

The investor's personal debt-equity ratio is $800/1200 = 2/3$, which is the same as in the example for the firm on slide 7.

The investor now has to pay the annual interest on the borrowed \$800. The rate is the same 8% interest rate that the firm would pay. This is $0.08 * \$800 = \64 per year.

Net profits on the investment are the earnings less interest paid. ROE is the net profit divided by the equity. The investor in this example has \$1,200 in equity (and \$800 in debt).

The ROE under “homemade leverage” is identical to that earned by investing in a similar firm having the same 2/3 debt-to-equity ratio.

I'm not going to demonstrate, but a similar “unleveraged” example could be set up where an investor buys 24 shares of stock (\$1200 investment) in a leveraged company and then loans out \$800 in funds, earning 8% per year.

THE POINT? An investor should be indifferent to a firm's debt/equity structure under the simplifying assumptions of M&M as they can either leverage or “deleverage” on their own by borrowing or lending funds to earn the ROE that they may desire.

The value of a leveraged firm (V_L) = value of a unleveraged firm (V_U)

Keep in mind that we are still assuming no taxes, a very important assumption.

M&M, firm value assuming no taxes

- We can create a levered or unlevered position by adjusting the trading in our own account
- This homemade leverage suggests that capital structure is irrelevant in determining the value of the firm:
- The value of a leveraged firm (V_L) = value of an unleveraged firm (V_U)

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The M and M proposition number one is with no taxes, we can lever or un-lever a position just by trading in our own account and this homemade leverage suggests that the capital structure is irrelevant and if it is irrelevant, then it won't have any impact on the value. The value of the firm is the same whether it is a levered firm or an unlevered firm because it is irrelevant, that the leveraging itself is irrelevant under this proposition

M&M, assuming no taxes, no bankruptcy costs: firm value and cost of equity

- Firm value (Proposition I)
 - The value of the firm is NOT affected by changes in the capital structure
 - The cash flows of the firm do not change; therefore, value doesn't change
- Cost of equity (Proposition II)
 - The WACC of the firm is NOT affected by capital structure
 - Cost of equity depends on 3 factors: the required return on the firm's assets, the firm's cost of debt and the firm's debt-equity ratio

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M&M Proposition I—without corporate taxes and bankruptcy costs, the firm cannot affect its value by

altering its capital structure.

- M&M Proposition I states that the value of the firm (size of the pie) is not related to how the firm is
 - financed (how the pie is divided).
- M&M—a firm's cost of equity capital is a positive linear function of its capital structure
- (still assuming no taxes) – basically, the greater the debt level, the greater the cost of equity.
- What M&M's Case 1 (no taxes) demonstrates is that it doesn't matter how we divide our cash flows between stockholders and bondholders, the cash flow of the firm doesn't change.
- Since the cash flows don't change; and we haven't changed the risk of existing cash flows, the value of the firm won't change.
- M&M also states that the cost of equity (risk & return for investors) depends on 3 factors:
 - the required return on the firm's assets
 - the firm's cost of debt
 - and the firm's debt-equity ratio.

WACC (assuming no taxes or bankruptcy costs)

$$WACC = R_A = \left(\frac{E}{V} * R_E \right) + \left(\frac{D}{V} * R_D \right)$$

$$R_E = R_A + \left[(R_A - R_D) * \frac{D}{E} \right]$$

- WACC, or R_A is defined as the “cost” of the firm’s **business risk** (the risk of the firm’s assets)
- $(R_A - R_D) \frac{D}{E}$ is the “cost” of the firm’s **financial risk** (i.e., the additional return required by stockholders to compensate for the risk of leverage)

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This is M&M Proposition 2, where they find that the cost of equity is based on 3 items:

- 1) The required rate of return on the firm’s assets (R_A)
- 2) The firm’s cost of debt (R_D)
- 3) The firm’s debt-to-equity ratio (D/E)

$$WACC = R_A = \left(\frac{E}{V} * R_E \right) + \left(\frac{D}{V} * R_D \right)$$

E is value of equity; D is value of debt; and V = E + D or total value of the firm.

As the firm takes on more and more debt, the return on equity (ROE) increases, but this is offset by the proportion of debt-to-equity, such that WACC doesn’t change.

Business risk is the risk directly related to the firm’s operations. It depends on the systematic risk of the firm’s assets and it determines the first part of the required return on equity, (R_A).

Business risk is the risk that comes from the nature of the firm’ operating activities. In other words, is this a risky business, such as oil exploration and development (lots of dry holes out there) or is this more like a firm that manufactures and sells paper products that

are in demand no matter what happens in the economy?

Financial risk on the other hand is the extra risk to shareholders that comes from debt financing. It determines the second part of the required return on equity: $(R_A - R_D) \frac{D}{E}$

With financial risk, we are adding the effects of debt financing, which raises the risk for equity investors.

M&M's conclusion from Case 1 (no taxes and no bankruptcy costs), how a firm divides up cash flows between shareholders and bondholders doesn't matter, the cash flow of the firm doesn't change. Because the cash flow doesn't change, we haven't changed the risk of the existing cash flows, the value of the firm doesn't change.

Note the WACC equation is as we had under cost of capital with one very important difference, the $(1 - T_c)$ factor to adjust for the tax break on debt is not included here. We are still in M&M's perfect world with no taxes.

The next bit is only for those that want to see how we got from equation 1 to equation 2 in the slide:

$$\text{The derivation of WACC} = R_A = \left(\frac{E}{V} * R_E \right) + \left(\frac{D}{V} * R_D \right) \text{ to } R_E = R_A + \left[(R_A - R_D) * \frac{D}{E} \right]$$

$$R_A = \left(\frac{E}{V} * R_E \right) + \left(\frac{D}{V} * R_D \right)$$

$$\frac{E}{V} * R_E = R_A - \left(\frac{D}{V} * R_D \right)$$

$$R_E = (R_A - \left(\frac{D}{V} * R_D \right)) * \frac{V}{E} \quad \text{multiply both sides by V/E}$$

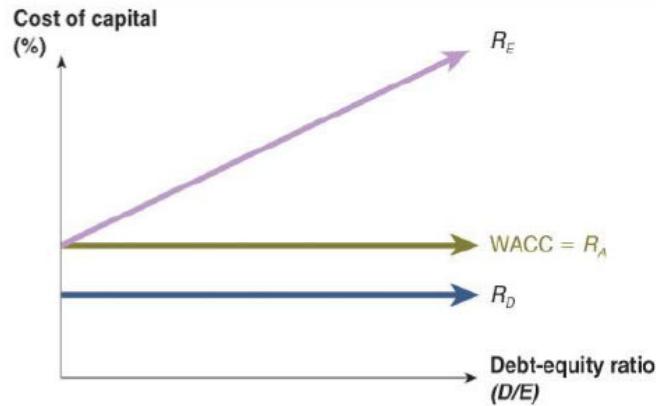
$$R_E = \frac{V}{E} R_A - \left(\frac{D}{E} * R_D \right)$$

And $V = (D + E)$ so, $V/E = 1 + D/E$, therefore

$$R_E = \frac{E+D}{E} R_A - \left(\frac{D}{E} * R_D \right) = R_E = (1 + \frac{D}{E}) R_A - \left(\frac{D}{E} * R_D \right)$$

$$R_E = R_A + \left[(R_A - R_D) * \frac{D}{E} \right]$$

WACC doesn't change with increased debt when assuming no taxes or bankruptcy costs



$$R_E = R_A + (R_A - R_D) \frac{D}{E} \quad (\text{M\&M Proposition II})$$

$$\text{WACC} = R_A = \left(\frac{E}{V} * R_E \right) + \left(\frac{D}{V} * R_D \right) \quad \text{Where } V = D + E$$

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Here we have a graph that shows the change in capital structure weights (E/V and D/V) is exactly offset by the change in the cost of equity (R_E), resulting in a constant WACC.

This equation for WACC (or R_A , the “required return on assets”) is the same as we used last week for WACC, note that E/V = weight of equity and D/V = weight of debt.

To calculate the cost of equity (required return for shareholders) under various levels of leverage (debt to equity) =

The cost of equity capital, or R_E is plotted against the debt-to-equity ratio on the X axis. The slope of the cost of equity is a straight line with the slope of $(R_A - R_D)$, the cost of assets minus the cost of debt.

At the y intercept, the firm has a debt-to-equity ratio of zero, where $R_A = R_E$.

As the firm raises its debt-to-equity ratio, the increase in leverage raises the risk of equity and therefore the return or cost of equity (R_E).

WACC is unchanged or not dependent on the debt-to-equity ratio of the firm.

Example for cost of equity assuming no taxes, no bankruptcy costs

- Assume: Required return on assets (R_A) = 16%, cost of debt (R_D) = 10%, percentage of debt = $D/V = 45\%$
- Review debt-to-equity ratio

$$\frac{D}{E} = \frac{D/V}{E/V} = \frac{D/V}{1 - D/V} \quad \text{Plugging in: } \frac{D}{E} = \frac{0.45}{1 - .45} = 0.8182$$

- Cost of equity = ?
 - $R_E = R_A + (R_A - R_D) * \frac{D}{E} = 16\% + (16\% - 10\%)(0.8182) = 20.91\%$
 - What if the cost of equity was 25% (and R_A still = 16%), what would the debt-to-equity ratio be?
- $25\% = 16\% + (16\% - 10\%)(D/E)$
- $D/E = (25\% - 16\%) / (16\% - 10\%) = 1.5$

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In this example (assuming no taxes and no bankruptcy costs), we will assume that R_A , the required return on assets is 16%, the cost of debt (R_D) is 10% and the percentage of debt (weight) is D/V . Where D is the dollar amount of debt and V is the total Value of the assets.

Thus D/V is the percentage of debt in the firm. It is the percentages that really matter here, we do not need to know the values of debt and equity or assets, merely the percentage allocation.

Let's look at the debt-to-equity ratio a bit.

If the firm is financed with 45% debt, then it is financed with 55% equity. One way to compute the D/E ratio is $\% \text{debt} / (1 - \% \text{debt})$.

Debt divided by equity = value of debt/value of assets (D/V) divided by value of equity/value of assets (E/V). This can be rewritten as debt (D) over value of assets (V) divided by $(1 - \text{debt}/\text{value of assets}) = 0.45/(1 - .45) = \text{debt/equity ratio of } 0.8182$

Now we can calculate the cost of equity. $R_E = R_A + (R_A - R_D) * \frac{D}{E} = 16\% + (16\% - 10\%)(0.8182) = 20.91\%$

Now, to reinforce that R_A does not change as the capital structure changes based on M&M Proposition I, where, without corporate taxes and bankruptcy costs, the

firm cannot affect its value by altering its capital structure.

You may not immediately see how to get the % of equity from the D/E ratio. Note that $D+E = V$. We are looking at ratios, so the actual dollar amount of D and E is not important. All that matters is the relationship between them.

Cost of equity– Add Corporate taxes

- Interest on debt is tax deductible
- Therefore, when a firm adds debt, it **reduces** taxes, all else equal
- The reduction in taxes **increases** the cash flow of the firm
- How should an **increase** in cash flows affect the value of the firm?
- *Go to the next slide for a comparison which will make the levered vs. unlevered firm situation clearer.*

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Even with the tax law changes in 2017, the U.S. government subsidizes corporate debt by making interest payments tax-deductible, which reduces net income but increases cash flow.

If a firm is subject to taxes and makes a profit, it will pay taxes. If the firm has debt, their cost of debt will be reduced because of the tax break on debt. In other words, their after-tax cost of debt is less than the pre-tax cost of debt.

Case II Example, now we have corporate taxes (still no personal)

- Assume the firm with debt (levered) has \$6,250 in debt at 8% and a 21% corp. tax rate

	Unlevered firm	Levered firm
EBIT	\$5,000	\$5,000
Interest	\$0	\$500
Taxable Income	\$5,000	\$4,500
Taxes at 21%	\$1,050	\$945
Net Income	\$3,950	\$3,555
Cash flow from assets	\$3,950	\$4,055

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- Start with a firm that has earnings before interest and taxes of \$5000. This is revenues less expenses and depreciation.
- The levered firm has \$6,250 in debt, paying 8%, or \$500 in interest.
- Here we are comparing cash flow from assets (which is EBIT – Taxes).
 - The depreciation expense is the same in either case and as such, will not affect cash flow from assets (CFFA) on an incremental basis. This is an important point here, we are looking at cash flow from assets, not operating cash flow, which is EBIT- Taxes + depreciation. As noted, CFFA is unaffected by this distinction because the depreciation under a levered vs. unlevered situation is still the same.
- At this point we have taxable income for the unlevered (no debt) situation with the same firm having \$500 in annual interest payments. When unlevered the firm has \$5,000 in taxable income, but only \$4,500 in taxable income if it pays interest on debt.
- Tax saving equals to the interest payment (\$500) multiplied by the corporate tax rate (21 percent): $\$500 \times .21 = \105 .
- The unlevered firm now has Net income of \$3,950 and cash flow from assets (EBIT – taxes) while the levered firm has a **lower** net income due to the fact the tax savings on debt is of course, only 21% of the total debt payment.
- Cash flow from assets, as mentioned above, excludes the interest payment, yet it includes the tax savings related to the interest payments.

- What we are seeing is that the total cash flow to L (the levered firm) is \$105 greater than the unlevered firm. This cash flow difference is the tax savings on debt.
- A firm that can finance at least some of its assets with debt will see higher cash flow from assets – provided of course that the firm has sufficient funds to pay the interest. The firm is riskier than the unlevered firm, because non-payment of debts can lead to bankruptcy.

Interest tax shield for corporations

- Annual interest tax shield
 - Tax rate times interest payment
 - \$6,250 in 8% debt = \$500 in interest expense
 - Annual tax shield = $.21(\$500) = \105
- Present value of annual interest tax shield
 - Assume perpetual debt
 - $PV = \$105 / .08 = \$1,312.50$
 - $PV = D(R_D)(T_C) / R_D = D * T_C = \$6,250(.21) = \$1,312.50$

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- The annual tax interest shield is the interest expense multiplied by the tax rate
- With \$6,250 in debt at 8%, the annual interest expense is \$500
- Providing a tax shield = tax rate * interest payment = $0.21 * \$500 = \105
- We are assuming perpetual debt, that is, for all intents and purposes, the firm just keeps paying 8% per year on the same amount of debt.
- We can calculate the PV of the debt then as a perpetuity, interest expense/interest rate = $\$105/.08 = \$1,312.50$
- This is the amount of debt multiplied by the interest rate multiplied by the corporate tax rate, then dividend by the interest rate which simplifies to the amount of debt multiplied by the corporate tax rate or \$1,312.50
- The increase in cash flow in the example is exactly equal to the interest tax shield. The interest tax shield is the tax savings arising from the tax deductibility of interest. It is the key benefit of borrowing over issuing equity.
- *All else equal, a lower tax rate reduces the value of the tax shield. Thus, the recent Tax Cuts and Jobs Act, which reduced corporate tax rates, may induce firms to reduce the amount of debt in their structure.*

- What does the interest tax shield mean if the firm doesn't pay taxes?
- If the firm has a zero tax rate, there is no benefit from the interest tax shield.
- If the firm has no debt (the firm is unlevered), there is no benefit from the interest tax shield.
- If the firm is levered, (has debt), there will be a benefit from the interest tax shield. Note, however, that this benefit from the interest tax shield must be high enough to outweigh the amount of interest paid by the firm. Further, pay close attention to the Bankruptcy Cost section near the end of these lecture notes. The bankruptcy costs can also outweigh any interest tax shield.

Value of the firm, now with corporate taxes

- The value of the firm increases by the present value of the annual interest tax shield
 - Value of a levered firm (V_L) = value of an unlevered firm (V_U) + PV of the tax shield
 - Value of equity = Value of the firm – Value of debt
- Assuming perpetual cash flows
 - $V_U = EBIT(1-T_C)/R_U$
 - $V_L = V_U + DT_C$

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The value of the firm increases by the present value of the annual interest tax shield

Value of a levered firm (V_L) = value of an unlevered firm (V_U) + PV of the tax shield

Value of equity = Value of the firm – Value of debt

Assuming perpetual cash flows

$$V_U = EBIT(1-T_C)/R_U$$

$$V_L = V_U + DT_C$$

R_U is the cost of capital for an unlevered firm, which is RA for a unlevered firm

V_U is the PV of the expected future cash flow from assets for an unlevered firm.

Example

Value of firm with corporate tax shield

- Assume that EBIT = \$25mm; tax rate = 21%, debt = \$75mm; cost of debt = 9%, unlevered cost of capital = 12%
- $V_U = \frac{EBIT (1 - TC)}{R_U} = \$25(1 - .21)/.12 = \$164.58\text{mm}$
- $V_L = V_U + DT_C = \$164.58\text{mm} + 75(.21) = \180.33mm
- Equity, or $E = \$180.33 - 75 = \105.33mm

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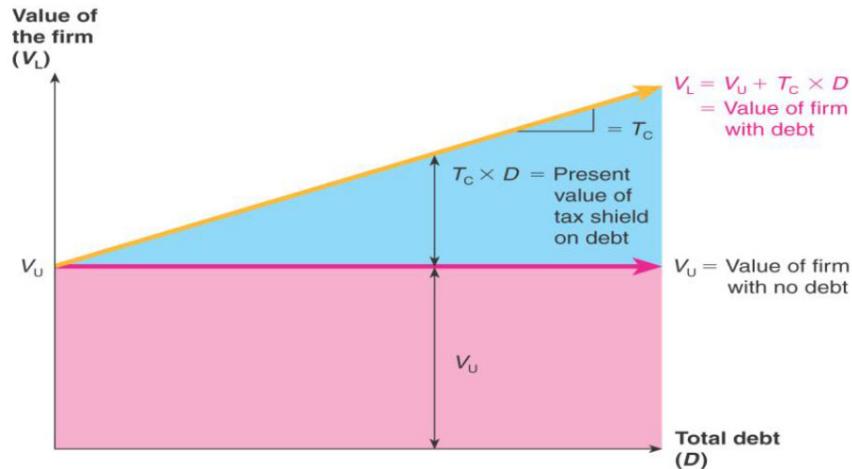
In this example we assume that EBIT = \$25mm; tax rate = 21%, debt = \$75mm; cost of debt = 9%, unlevered cost of capital = 12%

We calculate the value of the unlevered firm: $V_U = \frac{EBIT (1 - TC)}{R_U} = \$25(1 - .21)/.12 = \$164.58\text{mm}$

Now, the value of the levered firm = $V_L = V_U + DT_C = \$164.58\text{mm} + 75(.21) = \180.33mm

The value of equity, or $E = \$180.33 - 75 = \105.33mm

M&M value of firm assuming corporate taxes



The value of the firm increases as total debt increases because of the interest tax shield. This is the basis of M&M Proposition I with taxes.

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Here we can see a graphical illustration of the M&M Proposition I with taxes.

The value of the unlevered firm is constant as there is no debt.

As debt is taken on, the value of the unlevered firm increases based on the tax benefit of debt, which is the amount of debt * corporate tax rate.

Annual interest tax savings = $D(R_D)(T_C)$ If we assume perpetual debt, then the present value of the interest tax savings = $D(R_D)(T_C) / R_D = DT_C$ We also assume perpetual cash flows to the firm. This is done for simplicity, but the ultimate result is the same even if you use cash flows that change through time.

Value of an unlevered firm, $V_U = EBIT(1 - T_C) / R_U$, where R_U is the cost of capital for an all-equity firm.

Value of a levered firm, $V_L = V_U + DT_C$

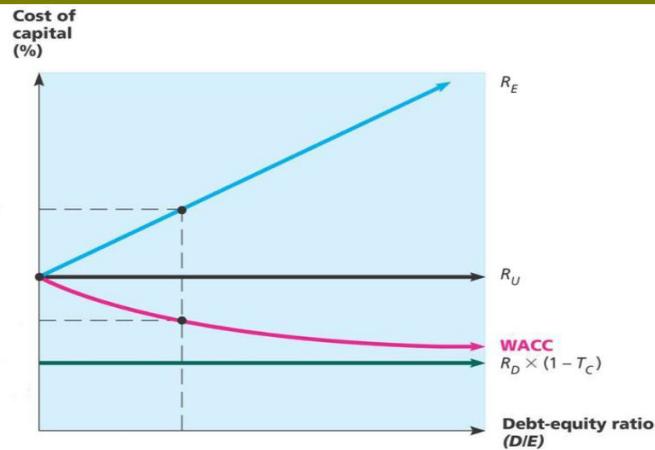
WACC and the cost of equity, assuming corporate taxes

- The weighted average cost of capital (WACC, here we will use R_A) decreases as the debt-to-equity (D/E) ratio increases because of the government subsidy on interest payments.
- $R_A = \left(\frac{E}{V} * R_E\right) + \left(\frac{D}{V} * R_D * (1-T_C)\right)$
- $R_E = R_U + ((R_U - R_D) * \frac{D}{E} * (1-T_C))$

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- Note: We are ignoring preferred stock in this module, we look at only debt and common equity.
- We know that changing the capital structure of the firm does not change the firm's total value, it does cause important changes in the firm's debt and equity. Here we are looking at what happens to a firm financed with debt and equity in the presence of taxes.
- R_U is the WACC or cost of capital for an unlevered firm (all common equity)
- $R_A = (E/V)R_E + (D/V)(R_D)(1-T_C)$
- We also know that if a firm has no debt (unlevered), then $R_A = R_E$, the cost of equity
- We then restate the basic R_A equation to solve for R_E in the presence of debt:
 - $R_E = R_U + (R_U - R_D)(D/E)(1-T_C)$
- The WACC (R_A) decreases as more debt is taken on, but with more debt, the riskiness of equity becomes greater.
- Consider owning stock in a firm with no debt, you know if the firm has financial difficulties, at least nothing needs to be spent on interest payments, reducing the threat of bankruptcy.
- Once debt is taken on, bankruptcy risks increase, and the riskiness of equity increases. This is why the value of R_E for a levered firm will be higher than the cost of equity for an unlevered firm (here defined as R_U).

WACC and cost of equity, visually



M&M Proposition I with taxes implies that a firm's WACC decreases as the firm relies more heavily on debt financing:

$$WACC = \left(\frac{E}{V}\right) \times R_E + \left(\frac{D}{V}\right) \times R_D \times (1 - T_C)$$

M&M Proposition II with taxes implies that a firm's cost of equity R_E , rises as the firm relies more heavily on debt financing:

$$R_E = R_U + (R_U - R_D) \times (D/E) \times (1 - T_C)$$

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The cost of equity continues to go up as debt levels increase (recall that we are still assuming no default risk to corporate debt). The cost of capital to the unlevered firm doesn't change, nor does the cost of debt. What decreases for the levered firm is their WACC as the debt-to-equity ratio increases. The weight of the lower cost debt is increasing, which lowers the overall weighted average cost of capital.

Now, add bankruptcy costs, still assuming corporate tax shield

- As the D/E ratio increases, the probability of bankruptcy increases.
- This increased probability will increase the expected bankruptcy costs.
- At some point, the additional value of the interest tax shield will be offset by the increase in expected bankruptcy cost.
- At this point, the value of the firm will start to decrease, and the WACC will start to increase as more debt is added.

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As the D/E ratio increases, the probability of bankruptcy increases.

This increased probability will increase the expected bankruptcy costs.

At some point, the additional value of the interest tax shield will be offset by the increase in expected bankruptcy cost.

At this point, the value of the firm will start to decrease, and the WACC will start to increase as more debt is added.

This expected bankruptcy cost is in a statistical sense. We know that if a firm goes bankrupt, there will be some level of costs incurred. If the firm is all-equity, then the expected bankruptcy cost is zero, since the probability of bankruptcy is zero with no debt. As the firm adds debt, the probability of incurring the bankruptcy costs increases, and thus the expected bankruptcy cost increases.

Recall that when a firm is unable to pay back its interest and/or principal, debtholders (bondholders or banks) can force the firm into bankruptcy proceedings to try to get their money back.

The costs of bankruptcy

- Direct costs
 - Legal and administrative
 - Ultimately cause bondholders to incur additional losses
 - Disincentive to debt financing
- Financial distress
 - Significant problems in meeting debt obligations
 - Firms that experience financial distress do not necessarily file for bankruptcy

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The downside of using debt is the risk of bankruptcy costs; if a firm has debt, there is a risk that the firm will not be able to repay its debt holders (most commonly, bondholders).

One limiting factor affecting the amount of debt a firm might use comes in the form of bankruptcy costs. As the debt-equity ratio rises, so too does the probability that the firm will be unable to pay its bondholders what is promised to them. When this happens, ownership of the firm's assets is ultimately transferred from the stockholders to the bondholders.

In principle, a firm becomes bankrupt when the value of its assets equals the value of its debt. When this happens, the value of the equity is zero, and the stockholders turn over control of the firm to the bondholders. When this takes place the bondholders hold assets whose value is exactly equal to what is owed on the debt. In a perfect world, there are no costs associated with this transfer of ownership, and the bondholders don't lose anything. This idealized view of bankruptcy is not, of course, what happens in the real world. Ironically, it is expensive to go bankrupt. The costs associated with bankruptcy may eventually offset the tax-related gains from leverage.

The costs can be direct, for legal and/or administrative costs; bondholders may ultimately incur additional losses

It isn't just bankruptcy that is a problem, there is financial distress whenever a firm has significant problems in meeting their debt obligations.

Firms that experience financial distress may not necessarily file for bankruptcy. They may try to renegotiate or refinance their debt, all of which means time and money.

Indirect bankruptcy costs (Case III)

- Indirect bankruptcy costs
 - Larger than direct costs, but more difficult to measure and estimate
 - Stockholders wish to avoid a formal bankruptcy
 - Bondholders want to keep existing assets intact so they can at least receive that money
 - Assets lose value as management spends time worrying about avoiding bankruptcy instead of running the business
 - Lost sales, interrupted operations, and loss of valuable employees, low morale, inability to purchase goods on credit

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The indirect bankruptcy costs outpace the direct costs, yet they are more difficult to measure and estimate.

Stockholders do not want a formal bankruptcy and at the same time, bondholders want to keep existing assets intact so they can at least receive that money.

- Assets lose value as management spends time worrying about avoiding bankruptcy instead of running the business
- Lost sales, interrupted operations, and loss of valuable employees, low morale, inability to purchase goods on credit

Effect of adding bankruptcy costs



- At some point, the additional value of the interest tax shield will be offset by the expected bankruptcy costs
- At this point, the value of the firm will start to decrease and the WACC will start to increase as more debt is added.

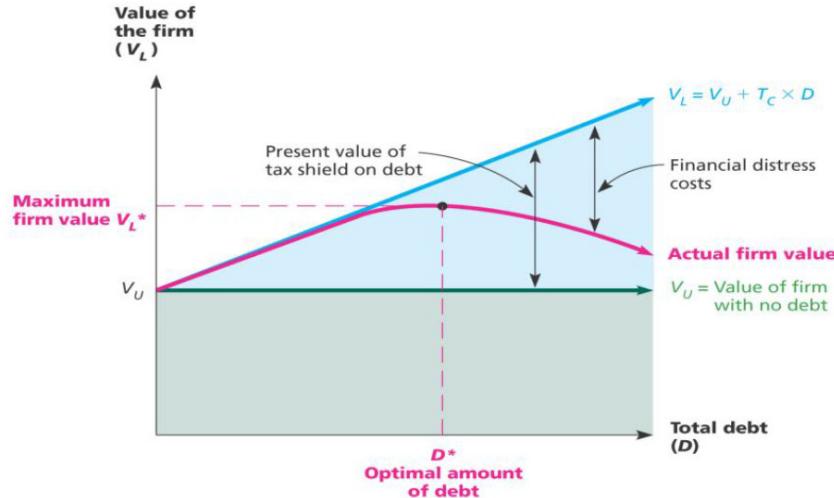
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As the debt-equity ratio increases, the probability of bankruptcy increases.

As this probability increases, expected bankruptcy costs increase.

At some point, the advantages of debt are outweighed by the potential of bankruptcy.

“Optimal” capital structure



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According to the static theory, the gain from the tax shield on debt is offset by financial distress costs. An optimal structure exists that just balances the additional gain from leverage against the added financial distress cost.

We have the value of the levered firm increasing, but when the financial distress costs are factored in (pink line), the value of the levered firm decreases. As expected, the value of the unlevered firm does not change.

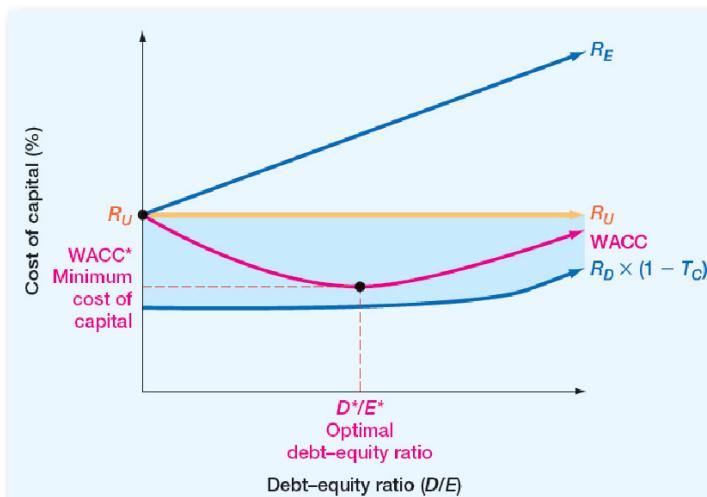
The optimal amount of debt is where the actual firm value peaks, maximizing the PV of the tax shield on debt before this is outweighed by the financial distress costs.

The Static theory of capital structure

Theory that a firm borrows up to the point where the tax benefit from an extra dollar in debt is exactly equal to the cost that comes from the increased probability of financial distress.

- Firms borrow because tax shields are valuable
- Borrowing is constrained by the costs of financial distress
- The optimal capital structure balances the incremental benefits and costs of borrowing

Financial distress costs and WACC



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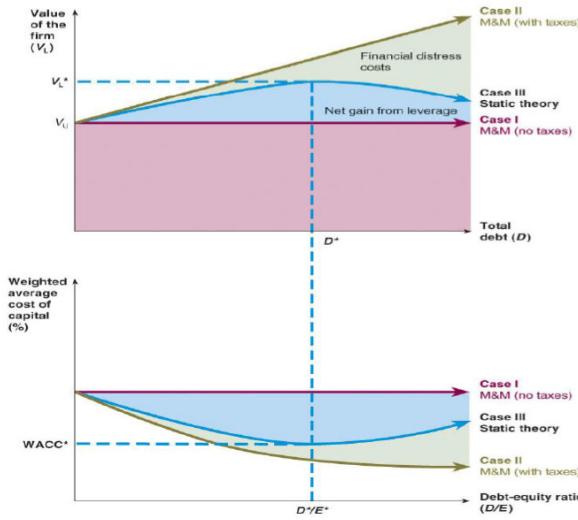
According to the static theory, the WACC falls initially because of the tax advantage of debt. Beyond the point D^*/E^* , it begins to rise because of financial distress costs.

The optimal capital structure is the debt-equity mix that minimizes the WACC. It is at this point that shareholder value and the value of the firm are maximized.

M&M Capital structure summary

- Case I – no taxes or bankruptcy costs
 - No optimal capital structure
- Case II – corporate taxes but no bankruptcy costs
 - Optimal capital structure = 100% debt
 - Each additional dollar of debt increases the cash flow of the firm
- Case III – corporate taxes and bankruptcy costs
 - Optimal capital structure is part debt and part equity
 - Occurs where the benefit from an additional dollar of debt is just offset by the increase in expected bankruptcy costs

Capital structure question, pulling it together



Case I: With no taxes or bankruptcy costs, the value of the firm and its weighted average cost of capital are not affected by capital structure.

Case II: with corporate taxes and no bankruptcy costs, the value of the firm increases and the weighted average cost of capital decreases as the amount of debt goes up.

Case III: with corporate taxes and bankruptcy costs, the value of the firm, V_L , reaches a maximum at D^* , the optimal amount of borrowing. At the same time, the weighted average cost of capital, WACC, is minimized at D^*/E^*

More factors for more management to consider

- Taxes
 - The tax benefit is only important if the firm has a tax liability (the larger the liability, the greater the benefit)
 - Higher tax rate → greater incentive to use debt
- Risk of financial distress
 - The greater the risk of financial distress, the less debt will be optimal for the firm
 - The cost of financial distress varies across firms and industries

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Taxes – tax shields are more important for firms with high marginal tax rates. While firms all face the same 21 percent federal tax rate beginning in 2018, other taxes (such as state taxes) create different effective tax rates. The higher the effective tax rate, the greater the incentive to borrow.

Financial distress – the lower the risk (or cost) of distress, the more likely a firm is to borrow funds

Bottom Line: “Optimal” capital structure

- There is no single “optimal” capital structure
- Each firm needs to determine the mix of equity and debt that:
 - Results in the lowest weighted average cost of capital (WACC) – that will maximize firm value
 - As in prior slides, debt is “cheaper” than equity
 - Up to some debt level, WACC is decreasing
 - After that level (whatever it is for a given firm), risk and potential bankruptcy costs increase, increasing the WACC
 - **Bottom line: the “optimal” capital structure is the one that results in the lowest WACC, which in turn results in the maximizing of the stock price (shareholder wealth)**

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The optimal capital structure occurs at the debt level where the tax savings from an additional dollar of debt financing is exactly balanced by the increased bankruptcy costs associated with the additional borrowing.

Optimal capital structure IS NOT about maximizing the amount of debt

Optimal capital structure IS NOT about minimizing the firm's cost of equity

Optimal capital structure IS NOT about minimizing the firm's cost of debt

Optimal capital structure IS NOT about maximizing the earnings per share

Optimal capital structure is finding the mix of debt, equity, and preferred stock that maximizes the company's stock price.

Alternative theory of capital structure: Pecking-Order

- The Pecking Order theory stating that firms prefer to issue debt rather than equity if internal financing is insufficient
 - Rule 1: Use internal financing first.
 - Rule 2: Issue debt next, new equity last.
- The pecking-order theory is at odds with the tradeoff theory (M&M):
 - There is no target D/E ratio.
 - Profitable firms use less debt.
 - Companies like financial slack.

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Asymmetric information between buyers and sellers means that existing firm owners know more than potential investors. The view is that existing owners will sell equity when it is overvalued, which is a negative signal to investors. Thus, this is avoided at all costs, particularly since equity issuance is also costly.

A. Internal Financing and the Pecking Order

Rules of the pecking order:

#1: Use internal financing first

#2: Issue debt next

#3: New equity last

B. Implications of the Pecking Order

The pecking-order theory is in contrast to the (M&M) tradeoff theory in that:

-there is no target D/E ratio.

-profitable firms will use less debt.

-companies like financial slack.

Capital structure by industry

Debt as a percentage of the market value of equity and debt (industry averages, 2017)

	Leverage %
High Leverage	
Homebuilding	66.29
Hotel/gaming	55.28
Steel	47.93
Construction supplies	42.57
Environmental & waste services	38.98
Low Leverage	
Healthcare products	17.96
Pharmaceutical	14.58
Semiconductor	14.09
Online retail	9.63
Internet software	4.27

Source: <http://pages.stern.nyu.edu/~amadodar/>, January 5, 2017

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We know that capital structure varies by industry, homebuilding is at the high end with roughly 2/3 of their capital from debt. Next would be hotel/gaming, steel, and construction supplies.

At the lowest end would be internet software, with healthcare products and pharmaceuticals as key players in the low leverage area.

Leverage varies by the amount of fixed assets. In a pinch, homebuilders and the like have hard assets that can be sold to meet their debt obligations.

Firms with intangible assets and the like carry lower levels of debt.

Next steps

- First, don't panic. I know this is a very concept and theory heavy module.
- Start by reviewing the Instructor's Example video, I will demonstrate a few examples to help solidify these concepts.
- Next, go to the practice problems. The equations you need for the problems will be included in the solutions, and these will be your guide for what to put on your equation sheet for the exam.
 - As in the previous module, I will include several concept questions to give you a feel for the type and complexity of concept questions that you should be able to answer on the exam.