FIN 325 Corporate Finance

L13 (Revision): Midterm Exam Revision

Instructor: Adam Hal Spencer[1]

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[1]Departments of Economics and Finance, UW–Madison.

Midterm exam details

- Exam will be **in-class** tomorrow.
- Covers all topics **up to and including** agency problems.
- Don't worry about information asymmetry for the **midterm**. It will only **appear on the final**.
- Exam will consist of **multiple choice**, **true/false** and **analytical** style problems.
- Multiple choice and true/false problems will require you to **explain** your choice of answer.
- To prepare for the analytical problems, re-do your problem sets.
- The lecture notes are the best resource for the multiple choice problems.

Revision — Decision rules

- The best decision rule to use is NPV/discounted cash flow analysis.
- Measures the cash flows paid to all stakeholders in the company, (both debt and equity).
- Accounts for the time value of money in addition to risk.
- All about **marginal/incremental benefit** (MB) versus **marginal/incremental cost** (MC).
  - If NPV is positive — indicates that $MB > MC$.
  - If NPV is negative — indicates that $MB < MC$.
- Remember to always look at the cash flows arising from the new potential project **separately** from the rest of the firm.

Revision — Discount rates

- An input into the use of the NPV method of valuation.
- Always match the **risk** and **maturity** of the project's cash flows.
- Can be determined using the CAPM theory.

$$r_i = \underbrace{r_f}_{\text{Time value of money}} + \underbrace{\beta_i(\mathbb{E}[r_m] - r_f)}_{\text{Risk adjustment}}$$

- Risk adjustment can be broken into two parts
  - $(\mathbb{E}[r_m] - r_f)$ is the **compensation per unit** of systematic risk.
  - β_i is the **number of units** of systematic risk, to which the project is exposed.
- The riskless rate and market risk premium are aggregate variables we can easily observe.
- The β_i is something specific to the project.

Revision — Finding β_i

- The β_i coefficient for the determination of r_i measures the correlation of the project's risk with that of the market.
- When evaluating a new project, we need to find the units of risk of the underlying project, independent of capital structure.
- This is captured by the beta of assets — β_A.
- Beta of equity — β_E — captures business and financial risks.
- Unless your comparable firm has the same capital structure as you will use for the new project, β_Es are not comparable.
- We find β_A by removing the effects of capital structure — through **unlevering**.

Revision — Modigliani & Miller

- *"The total value of the securities issued by a firm is independent of the firms choice of capital structure. The firms value is determined by its real assets and growth opportunities, not by the types of securities it issues"*

- Only holds under some very specific conditions.
  - No taxes.
  - Bankruptcy is not costly.
  - Perfect and complete capital markets.
  - Capital structure doesn't affect investment decisions.
  - Symmetric information.

- If this theorem is true, then there **is no optimal leverage** level — it's indeterminate.

$$V_L = V_U$$

- In the classes subsequent, we've explored the effect of relaxing each of these assumptions.

Revision — effect of taxes on leverage (1)

- Taxes can potentially create an advantage for debt.
- One method for valuing the firm is **adjusted present value** (APV).
  - APV involves adjusting the firm's **cash flows** by adding-in those associated with the tax shields.
- Under this assumption, there will be an optimal level of leverage.

$$V_L = V_U + PV(DTS)$$

- Form of the $PV(DTS)$ term will depend on what tax rates are present.
- If you assume that the **debt level** is perpetual, then

$$PV(DTS) = D\left[1 - \frac{(1-\tau^c)(1-\tau^e)}{(1-\tau^i)}\right]$$

where τ^c is the **corporate** rate, τ^e is the **dividend** rate and τ^i is the rate on **interest**.

Revision — effect of taxes on leverage (2)

- More commonly-used method in practice is to use the **weighted average cost of capital** (WACC).
    - Method involves instead adjusting the firm's **discount rate** to account for the tax shields.

$$WACC = r_A - r_D \frac{D}{V} \tau^c$$

- Generally $WACC$ is less than r_A to inflate the value of the levered firm relative to unlevered.
- WACC assumes that the **leverage ratio** is held constant.
- If the leverage ratio is constant and we discount the DTS with r_A, then the WACC and APV methods deliver the same answer.

Revision — tradeoff theory

- When firms are unable to meet their financial obligations, they will typically incur **direct** and **indirect** costs of financial distress.
- Intuitively this means there can potentially be a cost associated with borrowing more.
- Introduces a **tradeoff** between the tax advantage of debt and the bankruptcy costs.

$$V_L = V_U + PV(DTS) - PV(CFD)$$

- Recall that if $PV(CFD) = 0$ and if $PV(DTS) > 0$, then we should see $D/V = 1$.
- There will be an optimal leverage ratio that will typically be interior when $PV(DTS) > 0$ — i.e. $0 < D/V < 1$.

Revision — imperfect and incomplete capital markets

- **Perfect** capital markets are those whereby **arbitrage** can't arise.
- Intuitively, it can be thought of as a market that functions efficiently.
- If markets are imperfect, firms with the same cash flows but alternative capital structures can have different valuations and the market may have **no way** of correcting it.
- A market is **complete** when there exists a full set of state-contingent claims.
- Allows investors to fully insure themselves against the future states of the world.
- If markets are incomplete, then firms may no longer seek to use NPV rule for choice of projects.
- Can give rise to the clientelle effect.

Revision — agency costs of leverage

- The payout structures of debt and equity as a function of firm cash flows are fundamentally different.
- Can lead to **agency conflicts** when the equityholders are the decision makers of the firm.
- **Wealth transfers** are like the equityholders stealing from the debtholders.
- **Risk shifting** takes place when the firm skews its project choices in favour of riskier alternatives; this exploits the limited liability of shareholders.
- **Debt overhang** occurs when the firm refuses new positive NPV projects since the new value is captured primarily by the debtholders.

$$V_L = V_U + PV(DTS) - PV(CFD) - PV(\text{Agency costs of debt})$$

Revision — agency benefits of leverage

- Jensen (1986) puts forth a **free cash flow hypothesis**, which says that firms with more cash are more likely to engage in wasteful spending.
- When the firm has more leverage, it increases its obligation to paying back creditors.
- This can tie the hands of managers who want to waste the firm's money; there will be less cash lying around for negative NPV projects.

$$\begin{aligned} V_L = & V_U + PV(DTS) - PV(CFD) - PV(\text{Agency costs of debt}) \\ & + PV(\text{Agency benefits of debt}) \end{aligned}$$

Example 1

- Assume that a firm faces $\tau^c = \tau^e = 0.10$ and $\tau^i = 0.35$.
- Furthermore there are no other financial frictions present and that the firm can only assume fixed perpetual debt.
- The firm should optimally choose to take as much debt as possible. True or false?

Example 1 solution

- **False**. Under these circumstances, recall that the form of the $PV(DTS)$ expression will be

$$PV(DTS) = D\left[1 - \frac{(1-\tau^c)(1-\tau^e)}{(1-\tau^i)}\right]$$

  where the term multiplying the debt level is given by (-0.246).

- As a result, debt trades at a tax **disadvantage** to equity, meaning that the firm would optimally take zero debt.

Example 2

- Which of the following statements regarding bankruptcy is true?

  A Under Chapter 7 bankruptcy, the firm's outstanding taxes owed to the government are to be paid out before secured claims.

  B Academic studies have estimated that direct costs of financial distress greatly exceed the indirect costs.

  C Under Chapter 11 bankruptcy, the creditors of the firm present a reorganisation plan.

  D A High-Tech startup firm would generally suffer from a lower cost of financial distress than an airline company.

  E None of the above.

Example 2 solution

- E.
- Secured claims come first under Chapter 7 rather than taxes.
- Studies have shown that indirect costs like loss of customers greatly exceed direct costs such as legal fees.
- The firm's management, the debtors, are the ones who present the restructuring plan under Chapter 11.
- High tech startups generally have few tangible assets, which means they'd be likely to suffer higher CFD.

Example 3

- Consider an asset, which pays out an amount of \$C at $t = 0$.
- Following this it grows at a rate of $g > 0$ each period until $t = 5$, at which point it grows at a rate of $h > 0$ until $t = 10$.
- Find an expression for the present value of this asset assuming a discount rate of $0 < r < 1$ where $r > g$ and $r > h$?

Example 3 solutions

- The PV can be written as

$$\begin{aligned} PV &= C + \sum_{i=1}^{4} \frac{C(1+g)^i}{(1+r)^i} + \sum_{i=5}^{10} \frac{C(1+g)^4(1+h)^i}{(1+r)^i} \\ &= C + (1+g)\left[\frac{C}{r-g} - \frac{(1+g)^4}{(1+r)^4}\frac{C}{r-g}\right] - \\ &\quad \frac{(1+g)^4(1+h)}{(1+r)^4}\left[\frac{C}{r-h} - \frac{(1+h)^6}{(1+r)^6}\frac{C}{r-h}\right], \end{aligned}$$

  where the items in the parentheses just represent subtraction of one infinite sum from another.

Example 4

- Limited ChasFlow Inc. is expected to generate \$100M starting next year.
- Unfortunately, the cash flows will last only 10 years. After the last cash is generated, the company will be liquidated at a **cost (i.e. cash outflow)** of \$1M.
- Limited CashFlow Inc. has \$50M of debt outstanding.
- Assume that corporate tax rate on earnings is 35%.
- There is no personal tax rate on capital gains/capital losses. Assume that the discount rate for the firms cash flows is 10% and r_D is 5%.
- What is the market value of equity of Limited CashFlow Inc.?

Example 4 solutions

- Use the APV method and then subtract-out the value of debt to get the equity value.
- Find first the value of the unlevered firm as follows

$$\begin{aligned} V_U &= \frac{100}{0.1}\left(1 - \frac{1}{(1.1)^{10}}\right) - \frac{1}{(1.1)^{10}} \\ &= 614.07M \end{aligned}$$

- Then find the value of the debt tax shields as follows

$$\begin{aligned} PV(DTS) &= \frac{50 \times 0.05 \times 0.35}{0.05}\left(1 - \frac{1}{(1.05)^{10}}\right) \\ &= 6.76M \end{aligned}$$

- Then add together using the APV formula

$$\begin{aligned} V_L &= V_U + PV(DTS) \\ &= 620.83M \end{aligned}$$

- Then find the equity by subtracting the debt from total firm value

$$\begin{aligned} E &= V_L - D \\ &= 620.76 - 50 \\ &= 570.83M \end{aligned}$$

Example 5

- The weighted average cost of capital (WACC) is always strictly lower ($<$) than r_A. True or false?

Example 5 solution

- False. If $D = 0$ then

$$\begin{aligned} WACC &= \frac{E}{E+0} r_E + \frac{0}{E+0}(1 - T_c) r_D \\ &= r_E \\ &= r_A. \end{aligned}$$

If $T_C = 0$ and $D > 0$ then

$$\begin{aligned} WACC &= \frac{E}{E+D} r_E + \frac{D}{E+D}(1 - 0) r_D \\ &= r_A. \end{aligned}$$

Example 6

- How are r_A, r_D and r_E related assuming that $D > 0$ and $E > 0$?
  a) $r_A > r_E > r_D$
  b) $r_A > r_D > r_E$
  c) $r_E > r_A > r_D$
  d) $r_E > r_D > r_A$
  e) None of the above.

Example 6 solution

- C.
- We know that debt is senior to equity and as a result, equity faces a greater degree of risk than debt.
- It follows then that the equity-holders need to be compensated for this risk, meaning that $r_E > r_D$.
- Then we know from the formula $r_A = \frac{D}{D+E} r_D + \frac{E}{D+E} r_E$, that the return to assets is a weighted sum of the returns to equity and debt. As a result, it must lie between the two. Therefore we conclude that $r_E > r_A > r_D$.

Example 7

- The Modigliani Miller propositions hold even if it is possible that the firm under consideration will go bankrupt next year. True or false?

Example 7 solution

- True. For the propositions to not hold, we need for bankruptcy to be costly.
- If there are no costs associated with bankruptcy, then in the event where the firm can not meet its debt obligations, the debt holders simply assume ownership of the firm.
- As long as there are no direct or indirect CFD, we can still get M&M to hold.

Example 8

- You are investing in a new machine today, and it will generate a positive cash flow for the coming three years. As this discount rate increases:

  a) The NPV increases and becomes positive when r becomes sufficiently large.

  b) The NPV decreases but remains positive regardless of how large r becomes.

  c) The NPV decreases, and when r is sufficiently large, it will always be negative.

  d) None of the above.

  e) The question does not provide sufficient information.

Example 8 solution

- C. The question says that you are investing in the machine, meaning that we have an initial outlay for the project. As a result, the NPV for the project will assume the form

$$NPV = -I + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3}$$

where I is the initial investment and C_i is the cash flow for year i. As r increases, the three positive cash flows are more heavily discounted. In contrast, the initial outlay of I is unaffected as it takes place at t=0. Hence the NPV will become negative always for a sufficiently large discount rate.

Example 9

- The government announces that in 2016 it will increase corporate tax rates. You are the manager of a firm, which maintains a fixed debt to equity ratio and only issues risk-free debt. You expect that in 2016 your firm's:

  a) Asset beta will increase, debt beta will decrease and equity beta will increase.

  b) Asset beta will decrease, debt beta will increase and equity beta will decrease.

  c) Asset beta will remain unchanged, debt beta will decrease and equity beta will increase.

  d) All of the betas will change, but you cannot predict the direction.

  e) None of the betas will change.

Example 9 solution

- E.
- Firstly notice that the β_A will remained unchanged given that the risk of the firm's cash flows is independent of the tax rate. Notice also that β_D will be unaffected given that the debt is still risk-free. That is, given that $r_D = r_f$, it follows that $\beta_D = 0$.
- The problem tells us that the firm maintains a fixed $\frac{D}{E}$ ratio, meaning that the β_E is given by

$$\begin{aligned} \beta_E &= \beta_A + \frac{D}{E}(\beta_A - \beta_D) \\ &= \beta_A \left(1 + \frac{D}{E}\right). \end{aligned}$$

  Given that none of the variables on the right of the equality of the above equation have changed, it follows that β_E will also be unaffected by the tax rate change.

Final words

- Good luck with the midterm.
- Don't stress, it's only a midterm!