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Applied Corporate Finance

Review of Valuation Methods

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Plan of Attack

- Overview of Corporate Finance Functions
- Discounted Cash Flow Valuation Methods.
  - Free Cash Flow:
    - Valuation Using Adjusted Present Value
    - Comparing APV and WACC
  - Capital Cash Flow.
  - Equity Cash Flow.
- Valuation Using Multiples.
- Example
- Appendix: Computing Asset Betas and Equity Betas.

What is Corporate Finance?

- Aspects that have financial implications for a corporation
- Defined broadly everything a corporation does fits under corporate finance
- For example:
  - Whether to engage in a marketing campaign?
  - Whether to invest R&D to build a new product?
  - Whether to hire more workers?
  - Whether to invest in human capital of current workers?
  - Whether to enter a new market?
  - Etc…

The Goals of Corporate Finance

- The broad goal of corporate finance is to maximize firm value
- A more narrow goal is to maximize shareholders value

- This view may not be as narrow as it sounds. In an attempt to maximize profits firms will have to care for other stakeholders:
  - Consumers may punish firms that have unethical business practices
  - Firms may have to treat their employees well due to competition
- However in some circumstances for example when information does not flow or rules are not enforced, this goal main not maximize welfare

What if a firm destroys value?

- Lower Financial Returns and Cash Flows
- More restricted access to capital
- Fewer resources devoted to innovation of products and processes. Focus on cost cutting and head count.
- Loss of talented employees
- Further value destruction
- A vicious cycle!

Maximizing Value

- Investment Decision
  - Valuation
  - Considering Risk and Returns
- Financing Decision
  - Find the right financing structure for the project or firm
  - In-house vs. separate entity
  - How much Debt
  - What kind of Debt
- Payout Decision
  - How and when to payout to investors

A Famous Theorem

- Franco Modigliani and Merton Miller in a series of articles (1958, 1961, 1963) show that under certain conditions finance is irrelevant.
- Both received Nobel prizes for their contributions.
- The MM Theorem assumes:
  - No Transaction Costs.
  - No Taxes.
  - No Costs of Financial Distress.
  - No Agency Costs.
  - No Asymmetric Information.
- Use it as a road map to understand how finance can create value.

Objective for the next few hours

- We know how to value a 100% equity financed project.
- Now we want to take financing into account. Recall financing matters through:
  - Tax shields.
  - Costs of financial distress.
  - Bankruptcy costs
  - Agency Costs.
- There are different techniques in the valuation world. Much more than the ones we will cover in this course.
  - We want to review the basics of WACC, APV, Discounted Cash Flows (DCF), Equity Cash Flows (ECF), Capital Cash Flows (CCF) and Multiples/Comparables.
- Next: Real Options.

Example: Tax Deductibility of Interests

	Income Statement Firm U	Income Statement Firm L
Earnings before Interests and Taxes	1000	1000
Interests paid to bondholders		80
Pretax income	1000	920
Tax at 35%	350	322
Net Income to Shareholders	650	598
Total Income to Both Shareholder and Bondholder	$0+$650=$650	$80+$598=$678
Interest Tax Shield (0.35 X Interests)	0	28

Two Different FCF Methods

Two different methods for total firm valuation with financing:

- Weighted Average Cost of Capital (WACC).
- Adjusted Present Value (APV).

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Valuation Using Weighted-Average Cost of Capital

Weighted Average Cost of Capital Method (1)

1. Determine the free cash flow (FCF) of the investment.
2. Compute the weighted average cost of capital (WACC).

$$r_{WACC} = \frac{E}{E+D} r_e + \frac{D}{E+D} r_d (1-\tau)$$

3. Compute the value of the investment by discounting the FCF of the investment by the WACC

$$V_{L,0} = \frac{FCF_1}{1+r_{WACC}} + \frac{FCF_2}{(1+r_{WACC})^2} + \cdots + \frac{FCF_T}{(1+r_{WACC})^T}$$

Weighted Average Cost of Capital Method (2)

- FCF = Cash flow from operations + Cash flow from investments
- FCF = EBIT(1-τ) + D&A – ΔNWC – Capx + other

Note:

- Non-cash expenses should be summed-up to the FCF.
  - For example, changes in deferred taxes should be added back since it is a non-cash expense. This is tax that we owe, but do not presently have to pay.
- Non-cash income should be subtracted from the FCF.

Revenue
– COGS
= Gross Profit
– Operating Expenses (e.g., SG&A)
= EBITDA
– D&A (often included in SG&A)
= EBIT/Operating Profit/Operating Income
– Taxes
= EBIAT/NOPAT
+ D&A
– Capx
– ΔNWC
= Free Cash Flow (FCF)

Weighted Average Cost of Capital Method (3)

- Cost of debt (r_d)
  - Return on a traded, long-term obligation
  - Typically use:
    - Quoted spread over treasuries for given debt ratings.
    - YTM of comparable bond (though YTM > true r_d)
    - Computed β_d
- Cost of equity (r_e)
  - Typically use $r_e = r_f + \beta_e(MRP)$:
    - firm's CAPM β_e (if capital structure has been stable)
    - Industry β_A, re-levered to match capital structure
  - More on this in a few slides during APV discussion

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Valuation Using Adjusted Present Value

The Adjusted Present Value Method (1)

- An alternative approach to the WACC is to compute the Adjusted Present Value (APV).

- The three simple steps involved in computing the APV are:
  - **Step 1**: Value of the project as if all-equity financed: use the after-tax cash flows and discount them at the cost of capital.
    - Remember that for an all-equity firm the cost of capital equals the cost of equity (i.e., pre-tax WACC).
  - **Step 2**: Add the present value of the tax shield (TS) generated by the project.
  - **Step 3**: Account for other financing effects (if any), such as costs of financial distress or loan subsidies.

$$APV \equiv NPV_{\text{all equity}} + PV(\text{Financing Choices})$$

The Adjusted Present Value Method (2)

- To be clear:

$$APV \equiv NPV_{\text{all equity}} + PV(TS) - PV(CFD) + PV(\text{other effects})$$

- APV is also known as a valuation by components.

- In the simpler form, we consider only the Tax Shield:

$$APV \equiv NPV_{\text{all equity}} + PV(TS)$$

The Adjusted Present Value Method (3)

- This is simply MM Proposition I with taxes in action.

$$APV = V_L = V_U + PV[TS]$$

- The APV method uses the value additivity principle to evaluate the contribution of both cash flows and increased debt tax shields.
  - It can easily be adapted to include other financing side effects.

- We do this to separate the value of running the business from the value created by financing.

- Doing this allows us to identify the sources of value and to discount different risks appropriately.

Inputs Involved in Step 1

- Forecast the cash flows from running the business as an all equity firm for 5 or 10 years (until you get to a stable period).
- Discount these cash flows at the appropriate rate for the risk of running the business.
- Account for the terminal value and discount it.

Lets analyze in detail each of the substeps involved in Step 1…

Which Discount Rate? (1)

- You need the rate that would be appropriate to discount the firm's cash flows if the firm were 100% equity financed.

- This rate is the expected return on equity if the firm were 100% equity financed.

- To get it, you need to:
  - Find comparables, *i.e.*, publicly traded firms in same business.
  - Estimate their expected return on equity if they were 100% equity financed, by unlevering the equity betas.

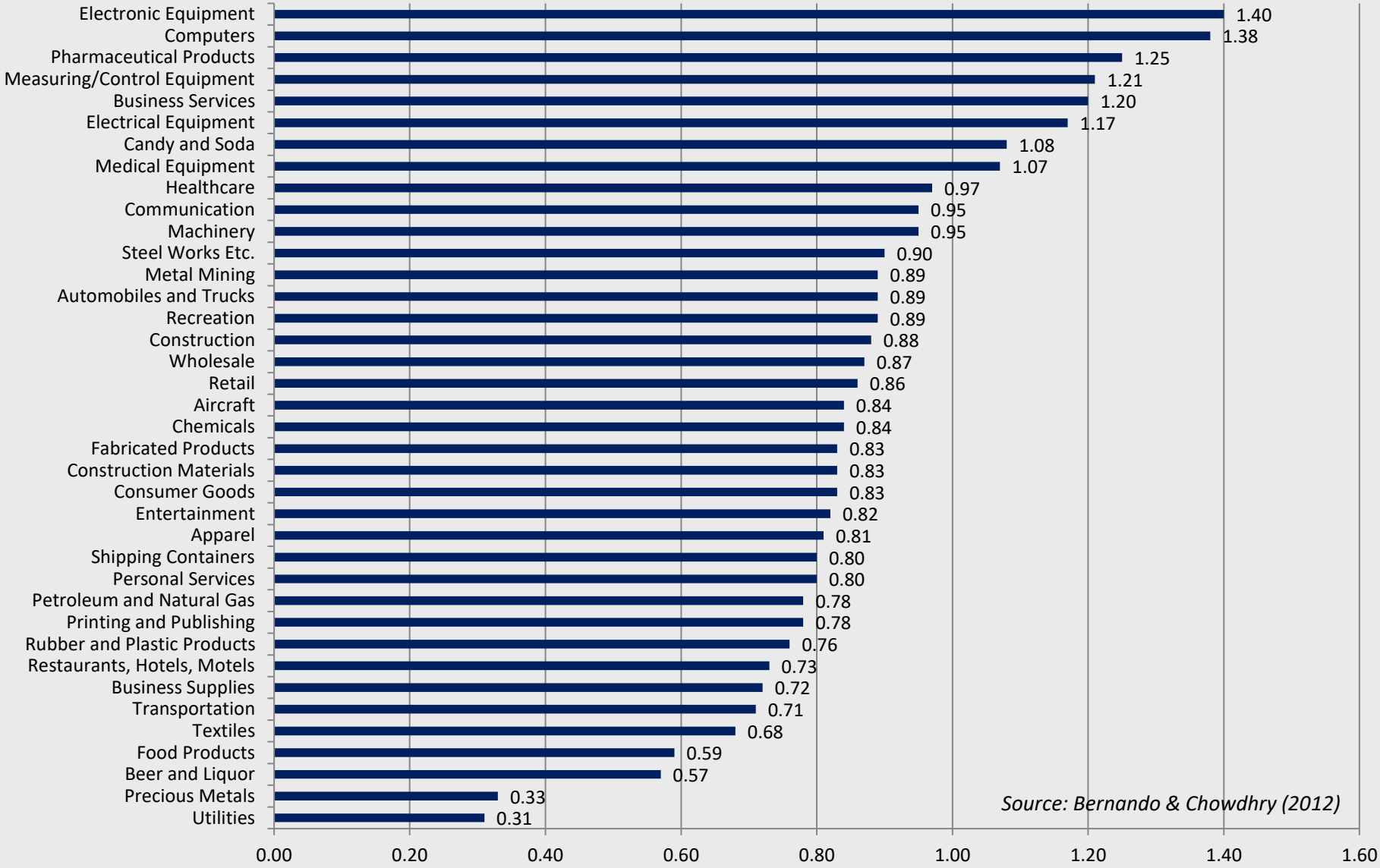
  - **If** the project is in line with the firm's current operations **and** there are data available, can use own beta.

Which Discount Rate? (2)

Unlever each comp's β_E to estimate its asset beta

- *D* and *E* are market values.
  - If no market value for *D*, use book value.
  - Note: using book values for the debt of highly levered or distressed firms may cause problems.
- In *D,* only include interest bearing debt.
  - Include interest bearing short-term and long-term debt.
- Deduct Excess Cash (only) from debt.
- **Bottom Line:** Beta is not perfect, but it is the best we have.

Which Discount Rate? (3)



Which Discount Rate? (4)

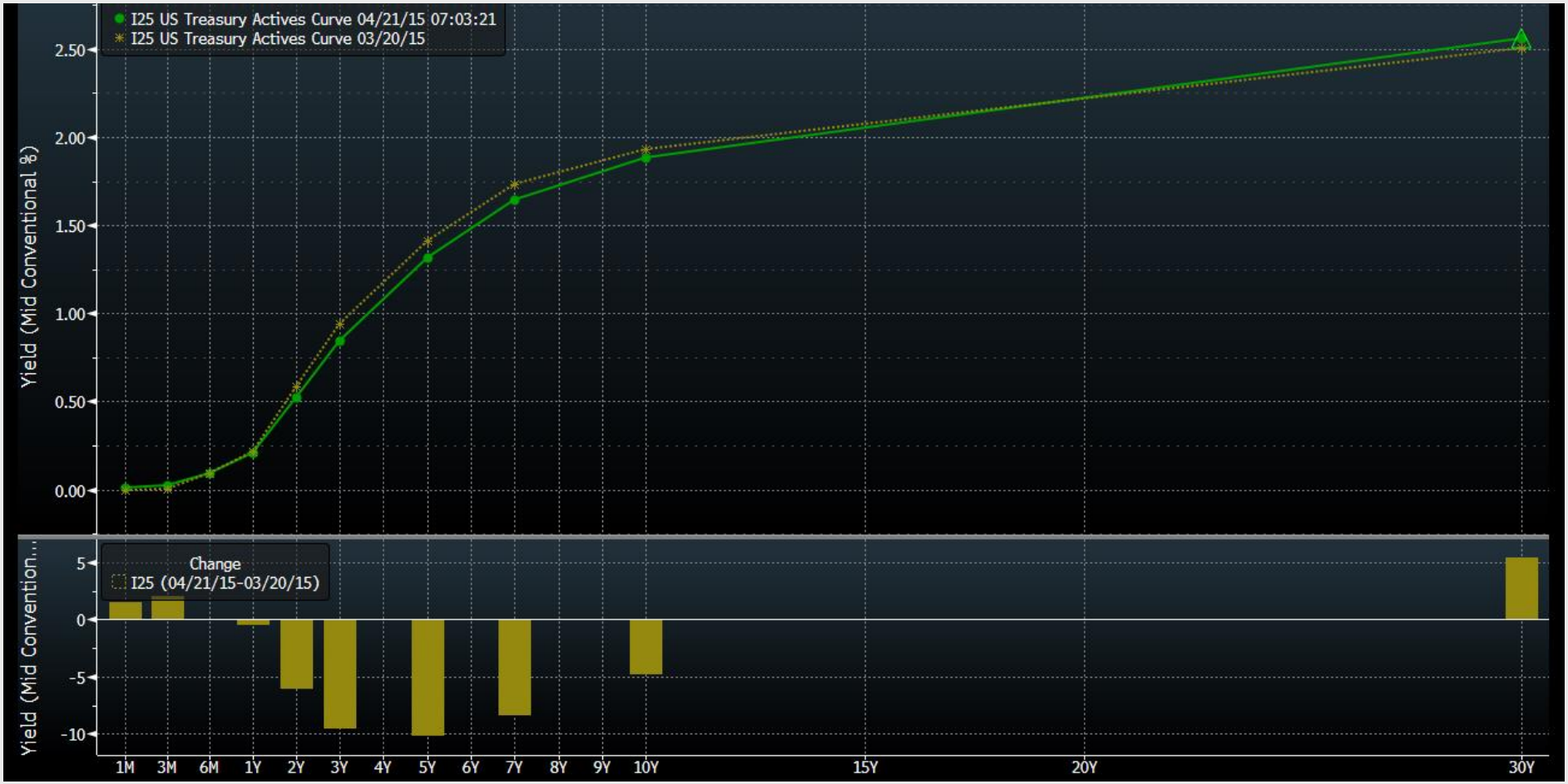
- Use the comps' β_A as an estimate the project's β_A.
- Use the estimated β_A to calculate the all-equity cost of capital r_A

$$r_A = r_f + \beta_A * \text{Market Risk Premium}$$

- Use r_A to discount the project's FCF.

- How much is the risk-free rate?
  - Short-term or long-term for r_f?
  - Historical average or forward looking r_f?

Risk-Free Rate



Equity Risk Premium

- Historical Equity Risk Premium
  - There are plenty of estimates of risk premium of market over Treasury Bonds. Historically 6%.
  - Ibbotson & Associates (2000): Realized average risk premium over treasuries in 1999 was 9.32%.
- Implied Equity Risk Premium
  - Fama & French (2001): Risk premium implied by fundamentals and stock prices over the 1872-2000 time period was between 2.55% and 4.32%.
  - Kaplan and Ruback (1996): Risk premium implied by sample of MBOs was 7.8%
- Equity Risk Premium – Survey Estimates
  - Graham and Harvey (2001) survey of CFOs: 10-year risk premium ranges between 3.6% and 4.7%.
  - Welch (2001) survey of finance professors: 1-year risk premium averaged 3.4%, 30-year premium averaged 5.5%.

Detour on the Discount Rate (1)

- Best check on the discount rate:
  - Sensitivity Analysis.
  - This applies to any of the estimated inputs of a model.

- Getting "fancy" with the discount rate is a low payoff activity.
  - Using "term structure" (different risk-free rates for each period) adds very little.
  - Using Fama-French (three-factor or four-factor) model instead of CAPM may not be easy.
  - Calibration can be helpful.
    - How do we proceed with calibration?

Detour on the Discount Rate (2)

Three Basic Steps on Calibration

- Value Company as it is.
  - Use current forecasts.
  - Find the discount rates.

- Is estimated value close to the market value?
  - No? Try to understand why.
  - Make adjustments to get the market value.

- Apply discount rate/growth rate to:
  - Other companies/investments.
  - Check whether assumptions seem sensible in other valuations.

Terminal Values

There are generally three ways to proceed to compute TV

- If project is liquidated or sold at the end of the horizon, we calculate its *salvage value* → "Liquidation method"
  - Make sure you account for any taxes on capital gains or TS on capital losses.

- Take cash flow (that presumably you already calculated earlier) and calculate the *continuation value* → "Perpetuity method"

- Assume that you can sell the firm using a simple rule involving earnings multiples → "Exit Multiples method"

Terminal Values: Perpetuity Calculation (1)

- For the Perpetuity Method, we assume the firm is in steady state.
  - May not be appropriate with high-growing companies, cyclical industries.
- Use the last free cash flow, grow it by one period (recall PV formula), and divide it by r_A - g.

$$TV_T = \frac{FCF_T(1+g)}{r_A - g}$$

- Where do we get g?

Terminal Values: Perpetuity Calculation (2)

- To get PV(TV), need to discount back: $PV(TV) = TV_T / (1 + r_A)^T$
- Make sure FCF_T used to get TV reflects *g*:
  - Adjust capital expenditures and depreciation.
  - Adjust change in net working capital.
- Ask yourself: are depreciation, NWC and other flows you have in the cash flow estimate consistent with the *g* that you choose?

Terminal Values: Multiples of Earnings

- If you use a multiple of earnings to calculate the sale price, then you need to calculate earnings – not free cash flows.

- Where do you get the multiple from?
  - Pick the multiple using comparable firms.
  - Be sure to perform sensitivity analysis.
  - More on Valuation with Multiples later.

Step 2: Add PV[Tax Shield of Debt]

- Need to account for the debt tax shields, including any associated with the terminal value and discount these at the appropriate interest rate.

- Interest payments are tax deductible. Reduce tax payments by:

$$\tau_c * interest$$

- These deductions depend on the interest payments and the tax rate.
  - If the interest payments will appear on the financial statements, use them.
  - If only the debt levels appear, you need to translate them into implied levels of interest payments.

Important Caveats

- We only consider corporate taxation
  - We could also consider our investors' tax rates, but we rarely do so

- Debt Tax Shield is only valuable when we pay taxes
  - Otherwise, must keep track of NOLs and carrybacks, but this becomes messy

Discounting the Tax Shield (1)

- The choice of the discount rate depends on the risk. What is the risk of the tax shield?

- In general the tax shield will have its own risk, which will depend also on the probability that the government will change its tax policy, and similar issues.

- Precisely estimating the risk of the tax shield could be very difficult (and not worthwhile), thus typically we choose among two assumptions: the risk of the tax shield is equal to the *risk of the debt* or the *risk of the assets*.
  - Since these are assumptions there is no absolute right or wrong answer. However, one may claim that one criteria will probably be closer to the truth, depending on circumstances.

Discounting the Tax Shield (2)

- If debt is predetermined or has a low level, risk of tax shields equal to risk of repayments to debtholders; so r_D is correct discount rate.

- For example, when there is a permanent debt D, we write the tax shield as t_CD , which is obtained by discounting with r_D

- If
  a. high level of debt (e.g. LBOs), or
  b. level of debt varies with firm value,

  then riskiness of tax shields similar to that of operating assets and tax shields should be discounted at r_A

Discounting the Tax Shield (3)

- For example, in the article by Kaplan and Ruback, several LBOs are considered. The level of debt is very high.

- When leverage is 80-90% of the value of the firm, the risk of the debt is close to the risk of the assets.
  - Then assume that the risk of the tax shield is also equal to the risk of the assets for firms with very high leverage.

Discounting the Tax Shield (4)

- Whatever assumption you make about the risk of the tax shield, you have to take care to be **consistent** throughout the valuation.

- In particular, remember that the assumption you make about the risk of the tax shield also affects the equation you will use to **lever** and **unlever** the beta.

- Cooper & Nyborg (2007 JACF) provide an excellent discussion.

Two Possible Scenarios: r_A or r_D? (1)

SCENARIO 1 – Using r_A

- Debt in the future is not fixed.
  - Debt and interest expense are tied to FCF.

- Works well when big changes in capital structure,
  - LBOs (more highly leveraged transactions).
  - Bankruptcy.

- In those cases, the ability to use tax shields has more systematic risk than the ability to pay debt.

$$TS = \text{Tax Rate} * \left[\frac{\text{Int}_1}{(1+r_A)} + \frac{\text{Int}_2}{(1+r_A)^2} + \ldots + \frac{\text{Int}_T}{(1+r_A)^T} \right]$$

- Int_t comes from debt repayment schedule and interest rates.

Two Possible Scenarios: r_A or r_D? (2)

SCENARIO 2 – Using r_D

- You expect a predictable, stable, and low level of debt.

- Ability to use tax shield has the same systematic risk as the ability to pay debt.
  - Best suited in lower-leverage situations.

$$TS = \text{Tax Rate} * \left[\frac{\text{Int}_1}{(1+r_D)} + \frac{\text{Int}_2}{(1+r_D)^2} + \ldots + \frac{\text{Int}_T}{(1+r_D)^T} \right]$$

- For permanent (fixed *amount*) debt with the same risk as interest:

$$TS = \text{Permanent Debt} * \text{Tax Rate} = t * D$$

Summary of Tax Shield Discount Rates

- **Remark 1:** If debt is predetermined (D is constant) and has a low level, risk of tax shield is similar to risk of payments to debt holders; so r_D is the correct discount rate.

- **Remark 2:** If high level of debt or if level of debt varies with firm value (D/V is constant), then the risk of the tax shield is similar to that of operating assets and tax shields should be discounted at r_A.

- **Remark 3:** Some firms have high leverage or maintain a target leverage ratio while maintaining an investment grade rating on their debt. For these firms, the correct discount rate is probably closer to $r_{D.}$

Tax Shield and the Betas

- Whatever assumption you make about the risk of the tax shield, you have to take care to be **consistent** throughout the valuation.
  - In particular, remember that the assumption you make about the risk of the tax shield also affects the equation you will use to lever and unlever the beta.

- If the risk of the tax shield is equal to the risk of the *debt* (D is constant), then such equation is:

$$\beta_A = \beta_D \frac{D(1-t_C)}{E + D(1-t_C)} + \beta_E \frac{E}{E + D(1-t_C)}$$

- If instead the risk of the tax shield is equal to the risk of the *assets* (D/V is constant), then such equation is:

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

What About the TS Associated with the TV?

- You have to add any debt tax shields on NPV that accrue beyond the terminal date.

- Let's see 2 different ways…
  - If D stabilizes at a permanent (and low) level, D_T.

$$TV(TS) = \frac{\tau_C * r_D * D_T}{r_D} = \tau_C * D_T$$

  - If (D/V) stabilizes at some level, λ ($D_T = \lambda * V_T$):

$$TV(TS) = \frac{\tau_C * r_D * D_T}{r_A - g}$$

Extending the APV Method

- Other potential financing effects are loan guarantees, subsidized loans, costs of issuing securities, etc.

- You could also add the PV of the costs of financial distress, agency costs, etc. How?
  - Write scenarios and include costs of distress in bad scenarios.
  - Often people omit PV(costs of distress) and PV(agency costs) because they are very difficult to quantify.

- If you want to include any of these costs, simply calculate the present value and add or subtract it.

APV vs. WACC

Comparing Methods: APV

- **Pros:**
  - Implicit assumptions are very clear. No contamination.
  - Works even if debt is not permanent.
  - Is very easy if the level of future debt is known.
  - Clearer: Puts the spotlight on what is creating value. Easier to track down where value comes from.
  - Assists in the decision of how to structure financing for projects.
  - More flexible:
    - Just add other effects as separate terms.
    - Allows to use different discount rates for different components

- **Cons:**
  - Requires explicitly deriving schedule of future debt levels and interest payments
  - It is increasingly used, but still less than WACC.

Comparing Methods: WACC (1)

Pros:

- Most widely used.
- The inputs are usually relatively easy to get.
- If you have a precise target debt-to-value policy, then it is easy and relative accurate.
  - this can be be highly restrictive.
- Requires fewer, often simpler computations.

Comparing Methods: WACC (2)

Cons:

- Mixes up the effects of assets and liabilities.
  - Errors/approximations in effect of liabilities contaminate the whole valuation.
  - Does not reveal where the value is coming from.
- Not very flexible. Cannot easily allow for changes in:
  - Other effects of financing (e.g., costs of distress, issue costs)
  - Non-constant debt ratios
  - Changes in tax rates

Practical Implications (1)

- In principle, we can always use either WACC or APV. As long as you follow all the steps and you are careful in making the same assumptions you should obtain (approximately) the same solution.

- In practice, however, one of the two will be much simpler to use depending on the situation.
  - For example: complex, changing or highly leveraged capital structure (i.e. LBOs), APV is much better.

- Let's consider two cases:
  - Debt is rebalanced.
  - Debt is predetermined.

Practical Implications (2)

- If debt is rebalanced (*i.e.* the firm has a target debt/asset ratio):
  - Computing WACC is much easier.
  - APV becomes more complex since you do not know *D*.
  - **Bottom Line**: often prefer WACC.

- If debt is predetermined (*i.e.* firm knows the evolution of *D*):
  - APV is easy to compute by discounting future expected interest payments.
  - WACC instead has a problem, because if the debt is not rebalanced then D/V changes over time and so does WACC.
    - you can always forecast D/V values, re-compute a different WACC for each year and discount. Lots of opportunities for errors.
  - **Bottom Line:** prefer APV.

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Other DCF Valuation Methods

Three Cash Flow Valuation Methods

- The names for the three methods correspond to the type of cash flow that is used in the valuation:
  - Free Cash Flow (FCF) – Provides *Enterprise* Value.
  - Capital Cash Flow (CCF) – Provides *Enterprise* Value.
  - Equity Cash Flow (ECF) – Provides *Equity* Value.
- The three methods differ in their measure of cash flows and the discount rate applied to those cash flows.
- The three methods provide consistent valuations when applied correctly.

Free Cash Flow and Capital Cash Flow (1)

- FCF and CCF both
  - value the entire firm and not just the debt or the equity.
  - are measures of cash flow to all suppliers of capital
    - Equity holders *and* debt holders.

- The *difference* between CCF and FCF is the treatment of the tax benefits of deductible interest payments (interest tax shield).

Capital Cash Flow = FCF + Interest Tax Shield

- CCF uses all cash flows that are paid/payable to investors:
  - CCF = Net after-tax income (NI) + Interest Expense (I)
    + Depreciation – Capx – Change in NWC
- When they are applied correctly, the two methods provide equivalent valuations.

Free Cash Flow and Capital Cash Flow (2)

- CCF method includes the benefits of the tax shields as cash flows.
  - The more the tax advantages, the higher the capital cash flow.
  - The discount rate for this method often uses the return on assets.

- FCF method includes the tax benefits either by
  - Reducing the discount rate (WACC)
    - The more the tax advantages, the lower the discount rate.
  - Separately adding the PV of the tax shield (APV)
    - In fact, when we use r_A as the discount rate of both terms:

$$APV = \frac{FCF}{r_A} + \frac{t_C r_D D}{r_A} = \frac{FCF}{r_A} + \frac{ITS}{r_A} = \frac{CCF}{r_A}$$

    - Thus, APV = NPV(CCF) discounted at r_A
      - Sometimes called “Compressed APV”.

When Should We Use CCF?

- CCF valuation is generally useful for similar situations as APV:
  - Highly Leveraged Transactions.
  - Firms in Financial Distress.
  - Bankruptcy.

Equity Cash Flow (1)

- ECF measure the cash flow available to stockholders after payment to debt holders are deducted from operating cash flows.

- Payment to debt holders are sometimes called “Debt Cash Flows”(DebtCF), and they include interest and principal payments.

$$ECF = CCF – DebtCF$$

- As DebtCF are paid out of operating cash flows before equity cash flows, debt cash flows are safer than equity cash flows.

- ECF are riskier than cash flow measures that combine DCF and ECF, which implies higher discount rates.

Equity Cash Flow (2)

- ECF are calculated by subtracting taxes, interest and debt repayments from operating cash flows and adding debt additions.

  ECF = Net Income + Depreciation – Capx – Change in NWC
  + Change in Debt

- The discount rate used in the ECF is the *return on equity* and the value we obtain is the *equity value* of the firm.

- Requires that a new equity cost of capital be calculated each year of the forecast when leverage is changing.
  - Lots of unlevering and levering beta

Overall Comparing Methods

- In general, we typically prefer both APV and WACC to ECF.

- APV is preferred to the ECF for many of the same reasons that APV is superior to WACC.
  - The use of one discount rate for ECF requires that the firm have a constant debt to total capital ratio.
    - If the debt to total capital ratio varies over time, we need to calculate a different discount rate for the equity for each year.
  - It is much easier to make mistakes using the ECF.
    - In particular, it is critical to include increases in debt in the cash flows, particularly in the terminal value calculation.

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Valuation Using Multiples

Valuation Using Multiples

- The main idea is to value the target asset (firm) by using information on the pricing of other similar assets.
  - Also called “Relative” or “Comparables” Valuation

$$[\text{Value Measure/Key Characteristic}]_{\text{Ind.Average}} * \text{Key Characteristic}_{\text{Firm}}$$

- Numerator of multiple is typically the total value of the firm
  - e.g., price, enterprise value.
- Denominator of multiple is the characteristic that is important for that firm, often industry-specific:
  - clicks or subscribers for web site
  - paid miles flown for airlines
  - number of patents for a hi-tech firm.

Valuation by Multiples: Implicit Assumptions

1. Comparable companies assumed to have expected cash flows growing at the same rate and have the same level of risk as the company being valued.
2. The value of the company is assumed to vary in direct proportion with changes in the performance measure; i.e. if expected EBITDA increases by 8%, expected firm value also increases by 8%.

$\Rightarrow$ If these assumptions are valid, valuing by multiples will likely be *more* accurate than the DCF approach because it incorporates current market expectations of cash flows and discount rates.

Motivation for Multiples

- Firms in the same business should have similar multiples.

- If the firm's actual FCF is a perpetuity:

  MV firm = FCF/(WACC-g) => MV firm/FCF = 1/(WACC-g)

- Comparables will have a similar MV firm/FCF provided they:
  - Have the same WACC (requires similar D/(D+E)).
  - And are growing at a similar rate.

Types of Multiples

- Cash-flow-based *Value* multiples:
  - MV of firm/Earnings, MV of firm /EBITDA, MV of firm /FCF.
- Cash-flow-based *Price* multiples:
  - Price/Earnings (P/E), Price/EBITDA, Price/FCF.
- Asset-based *Value* multiples:
  - MV of firm/BV of assets, MV of equity/BV of equity.
- Industry-specific *Value* multiples:
  - MV of firm/Hospital Beds, MV of firm/Number of Customers.

Procedure

Implicit Assumption: Firms in the same business should have similar multiples.

- Step 1: Identify firms in same business as the firm you wish to value. Be careful not to induce a selection bias.
- Step 2: Calculate the multiple(s) for comparable firms.
- Step 3: Calculate average for the set of comparable firms.
  - E.g., value-weighting, equal-weighting, median, etc.
  - This gives an estimate of the multiple we can use in valuing our firm.
- Step 4: Apply the multiple on the firm you wish to value.
- Step 5: Often different multiples give you different answers:
  - Make judgment reflecting what is economically reasonable.

Remarks (1)

- When choosing comparable firms, you face a bias-variance trade-off:
  - too many firms leads to firms that are not truly comparable;
  - too few firms means that your average will reflect idiosyncrasies of those firms.

- For firms with no earnings or limited asset base (e.g. hi-tech),
  - Price-to-patents multiples.
  - Price-to-subscribers multiples.
  - Or even price-to-Ph.D. multiples!

Remarks (2)

- For transactions, can also use multiples for comparable transactions.
  - Similar transaction values.
  - But be aware, everyone might be over/underpaying.

- Multiples based on equity value (or stock price, e.g., P/E) as opposed to total firm value ignore effect of leverage on the cost of equity (or assume the firms have similar leverage)
  - Beware if comparables have very different leverage.

Pros and Cons of Multiples (1)

Pros:

- Incorporates simply a lot of information from other valuations in a simple way.
- Embodies market consensus about discount rate and growth rate.
- Free-ride on market's information.
- Can provide discipline in valuation process by ensuring that your valuation is in line with other valuations.
- Sometimes, what you care about is what the market will pay, not the fundamental value.

Pros and Cons of Multiples (2)

Cons:

- Difficult to find *true* comparables.
  - Implicitly assumes all comparables are alike in growth rates, cost of capital, and business composition.
- Hard to incorporate firm-specific information.
  - problematic if operating changes are going to be implemented.
- Relies on accounting measures being comparable.
- Differences in accounting practices can affect earnings and equity-based multiples.
  - Therefore better to use FCF and EBITDA multiples.
- Book values can vary across firms depending on age of PPE.
- If market is overpaying, you will too!

Bottom Line on Multiples (1)

- Multiples complement DCF methodology:
  - Check on valuation; market based perspective.
  - Extremely useful when you do not have cash flow projections.

- EBITDA or cash-flow multiples are preferable to (net) earnings multiples.
  - More consistent treatment of leverage.
    - Companies with different leverage will have different P/E multiples, even tough same business risk and growth.
  - Less ability to manipulate
    - Easier to manipulate net earnings through accountings than EBITDA or cash flow.

Bottom Line on Multiples (2)

- Because of the many limitations, never rely on just a single multiple or on valuation based only on multiples.

- Best to use multiples only as a check for the valuation based on discounted cash-flows.
  - After you have done a throughout valuation, you can compare your predicted multiples, such as P/E and market-to-book, to representative multiples of similar firms.
  - If your predicted multiples are out of line then you have to convince yourselves (and your clients) that your model is reasonable.

Bottom Line on Multiples (3)

- Because of accounting differences, be careful in using multiples to compare firms across industries, and especially, across countries.

- As a rule of thumb when choosing the basis for multiples, remember that:
  - The higher up the basis is in the income statement (e.g. sales) the less it is subject to changes in the accounting method.
  - On the other hand, the less it reflects differences in operating efficiency across firms (e.g. firm's pricing policies, production efficiency, etc.).

After Valuation is Done…

- Three possible answers:
  - NPV >> 0 = GO!!
  - NPV << 0 = No Go*
  - NPV = $0 \pm \varepsilon$ = Think More*.

*Are there future options in project?

Takeaways (1)

- It is important to try to separate the value created by *underlying assets* and those coming from *financing*.

- APV does this directly and is a very flexible tool. Sometimes it can be difficult because you need to know the future levels of debt.

- APV is aesthetically cleaner in terms of the source of the value generation.
  - APV does not mix the valuation of operation with the effects of financing.

- Both WACC and APV force you to get the asset beta, so you have to be able to do this!

Takeaways (2)

- For APV we need to know the level of debt outstanding each year (very suitable for LBOs).
- For WACC we need to know the D/V ratio each year.
- You should understand the conceptual differences between these two methods and why in principle we prefer APV.
- Remember there are other cash flows methods you should bear in mind. Go through the examples and be sure you are capable of understanding each of the cash flows.
- Best to use multiples as a check for the valuation based on discounted cash flows.

Example

Alternative Cash Flow Valuation Techniques

Example – Constant (D/V)

Assumptions:

- Asset beta = 1
- Risk-free rate = 10%
- Risk premium = 8%
- Debt-to-value ratio = 40%
- Initial sales = 5,000
- Growth rate of sales = 5% in perpetuity
- EBIT margin = 40% of sales
- Depreciation = 10% of sales
- Capital Expenditures = depreciation + 10% * change in sales over the following year
- Working capital = 20% of sales
- Debt is risk free
- Tax rate = 40% (paid on net income).

Example – Operating Cash Flow

- The first step in any cash flow valuation (independently of the method used) is to rid accounting numbers of accounting tricks:
  - Let's start from the initial EBIT that is by assumption 40% of initial sales:

    Sales = 5,000

    EBIT = 2,000
  - We need to add depreciation and subtract capital expenditures (CAPX) and change in working capital (Ch.NWC):

    Depreciation = 500

    CAPX = 525

    Ch.NWC = 50
  - Hence,

    Operating CF = 2,000 + 500 – 525 – 50 = 1,925.

Example – WACC

- In the Free Cash Flow method, we use the hypothetical taxes:
  - FCF = Operating CF – HypTaxes,
  - Where HypTaxes = 0.4*EBIT = 800
- Hence:
  - FCF = 1,925 – 800 = 1,125
- Discount rate (using CAPM) is the WACC:
  - WACC = (D/V) * (1-0.4) * r_D + (E/V) * r_E
  - To find r_E, we need equity beta:
    - Equity beta = Asset beta / [1-(D/V)] = 1.0 / (1-0.4) = 1.67
    - r_E = 10% + 1.67 * 8% = 23.36%
  - Hence, WACC = (0.4)*(1-0.4)*10% + (0.6)* 23.36% = 16.4%
- Value of the firm (as a growing perpetuity):
  - V = FCF/(WACC – g) = 1,125/0.114 = 9,868.

Example – APV

- FCF = 1,125.
- Discount rate (using CAPM) is the r_A:
  - $r_A = 10\% + 1 * 8\% = 18\%$
- Recall: $V = V_U + PV(TS)$
  - $V_U = FCF / (r_A - g) = 1{,}125/0.13 = 8{,}654$
  - $PV(TS) = [t * \lambda * r_D / (r_A - g)]*V = [0.4 * 0.4 * 0.1 / 0.13]*V = 0.123*V$
  - $V = V_U + 0.123*V$
  - $V = V_U /(1 - 0.123) = 8{,}654 / 0.877 = 9{,}868.$
- In this case APV and WACC give identical results.

Example – Capital Cash Flow

- Now, in the Capital Cash Flow method, you want to subtract the actual taxes paid.
  - CCF = Operating CF – Taxes
    - Taxes = τ * (Income – Interest Payment)

      = 40% * (2000 – $r_d * Debt$)

      = 800 – 40% * ($r_d * \lambda * V$)

      = 800-(0.4) $*$ [(0.10*0.4) $*$ V]

      = 800-(0.4) $*$ [(0.04) $*$ V]
  - CCF = 1,925 – 800 + (0.016) $*$ V.
- Discount rate (using CAPM) is the expected return on assets:
  - Return on assets = 10% + 1 $*$ 8% = 18%.
- Value of the firm (as a growing perpetuity):
  - V = CCF/(r_A – g) = CCF*(1/0.13)
  - V = [1,925 – 800 + (0.016) $*$ V]*(1/0.13)
  - V = 1,125 / 0.114 = 9,868.

Example – Equity Cash Flow

- In the Equity Cash Flow method, you want to subtract from Operating CF the actual taxes paid, the interest expenses and the change in debt.
  - Taxes = 800 - (0.4) $*$ I = 800 - (0.4) $*$ (0.04) $*$ V
    - I = (0.04) $*$ V
  - For the change in debt, notice that debt increases at a rate g=5% since the value of the firm increases at that rate and (D/V) is constant. Hence, the change in debt is:
    - ΔD = g D = (0.05)D = (0.05) $*$ (0.4) $*$ V = (0.02) $*$ V
- Hence: ECF = 1,925 – 800 + (0.016)V – (0.04)V + (0.02)V.
- Discount rate (using CAPM) is the expected return on equity:
  - r_E = 10% + 1.67 $*$ 8% = 23.36%.
- Value of the equity (as a growing perpetuity):
  - E = ECF/(r_E – g) = [1,125 – (0.004) $*$ V]/0.1836
- Since E = (0.6) V, we have:
  - (0.6) $*$ V = [1,125 – (0.004) $*$ V]/0.1836
  - V = 1,125 / 0.114 = 9,868.

Appendix:
Computing Asset Betas

Computing Asset Betas (1)

How to Measure β_A?

- The value of the levered firm is given by $V_L = D + E$.
- Since, $V_L = V_U + PV(TS)$, then $V_U = D + E - PV(TS)$.
- And therefore:

$$V_U\beta_A = D\beta_D + E\beta_E - PV(TS)\beta_{TS}$$

- Which we can be re-written as:

$$\beta_A = \frac{D}{V_U}\beta_D + \frac{E}{V_U}\beta_E - \frac{PV(TS)}{V_U}\beta_{TS}$$

- Now we need to assume something about β_{TS}.

Computing Asset Betas (2)

$$\beta_A = \frac{D}{V_U}\beta_D + \frac{E}{V_U}\beta_E - \frac{PV(TS)}{V_U}\beta_{TS}$$

- **Assumption 1:** The risk of the tax savings is the same as the risk of the debt that generates it ($\beta_{TS} = \beta_D$).

- Then the previous equation becomes:

$$\beta_A = \frac{D}{V_U}\beta_D + \frac{E}{V_U}\beta_E - \frac{PV(TS)}{V_U}\beta_D$$

- And since $V_U = V - PV(TS)$, we have:

$$\beta_A = \frac{D - PV(TS)}{V - PV(TS)}\beta_D + \frac{E}{V - PV(TS)}\beta_E$$

Computing Asset Betas (3)

- This formula simplifies under some special cases.
  - If D is constant:

$$\beta_A = \frac{D\,(1-\tau_C)}{V-\tau_C D}\beta_D + \frac{E}{V-\tau_C D}\beta_E$$

  - If, in addition, the debt is riskless (β_D = 0):

$$\beta_A = \frac{\beta_E}{\left(1+(1-\tau_C)\frac{D}{E}\right)}$$

Computing Asset Betas (4)

$$V_U\beta_A = D\beta_D + E\beta_E - PV(TS)\beta_{TS}$$

- **Assumption 2:** The risk of the tax savings is the same as the risk of the existing assets ($\beta_{TS} = \beta_A$).

- Then we are left with,

$$\big(V_U + TV(TS)\big)\beta_A = D\beta_D + E\beta_E$$

- And since, $V_L = V_U + PV(TS)$ we have that:

$$\beta_A = \frac{D}{V}\beta_D + \frac{E}{V}\beta_E$$