FINM 3401: Corporate Finance Course Summary Notes

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Lecture 1 – Introduction and Review of Capital Budgeting

What Assets / Projects to Invest in?

- The primary goal of a firm is to maximise shareholders wealth.
- A firm should invest in projects and assets that increase shareholder value.
- This involves evaluating projects and assets based on their cash flows and risk.

To compare among alternative investments, we utilise the process of Capital Budgeting.

Capital Budgeting

- Capital budgeting is the process through which management analyses alternative projects and investments.
- It is the decision process utilised to evaluate alternative investments by taking into account the impact on *Free Cash Flows* and riskiness of the project.
- NPV is the most widely used tool in evaluating capital budgeting scenarios.

Three steps of capital budgeting:

1. Project Free Cash Flows (Lecture 1)
2. Determine the appropriate discount rate (Lecture 2)
3. Calculate NPV and apply the NPV Rule

Free Cash Flows

- FCF's are the incremental effect of a project on the firms available cash.
- *Incremental earnings* are the amount by which the firms earnings are expected to change as a result of the investment decision.
- FCF's only materialise if the project is accepted.
- Examples of FCF's include Capital Expenditure, Corporate Tax, Sunk Costs, Gross Revenue, COGS etc.

Free Cash Flow = (Revenues – Costs – Depreciation) x (1 – Tc) + Depreciation - Cap Exp - ΔNWC

Tc x Depn = Depreciation Tax Shield (the tax saving that results from the ability to deduct depreciation as a non-cash "accounting" expense)

1. Step 1: Determine Unlevered Net Income.
2. Step 2: Determine Free Cash Flow to firm.

Step 1: Determine Unlevered Net Income

- Unlevered Net Income is NI that excludes calculation of interest expenses associated with debt (*see below*).
- To calculate UNI, we must ascertain revenue and cost estimates of the firm.
- Eg Sales, COGS, Other Expenses, Opportunity Cost, Side Effects/Project Externalities, Depreciation and Taxes.

Interest expenses are not included in Capital Budgeting. They are instead related to the firm's decision regarding how to finance the project.

Taxes: Include the firms marginal corporate tax rate (1 – Tc).

Opportunity Costs: The opportunity cost of using a resource is the value it could have provided in its best alternative use. Eg opportunity cost of refurbishing land in one manner, forgoing an alternative.

Project Externalities: Indirect effects of the project that may increase or decrease the profits of other business activities of the firm.

- Eg **cannibalisation:** when sales of a new product displace sales of an existing product.

Sunk Costs: Unrecoverable costs for which the firm is already liable and have been or will be paid irrespective of the investment decision.

Fixed Overhead Expenses: Fixed overhead expenses are *not included* in capital budgeting decisions. Only additional overhead expenses that arises solely because of the decision to take on a project are considered.

Unavoidable Competitive Effects: If sales are likely to decline due to increased market competition, the lost sales are a sunk cost and we should not include them in our projections.

Step 2: Determine Free Cash Flow to Firm

Free Cash Flow = Unlevered NI + Depn/Amortisation – Cap Exp – Change in NWC + (After tax cash flow from Asset Sale)

Depreciation: Not a cash expense, therefore must be added back to ascertain FCF

Net Working Capital: = Currents Assets – Current Liabilities.

- Changes (ie increases) in NWC must be deducted from Unlevered Net Income to obtain FCF to the firm.

After Tax Cash Flow From Asset Sale:

- Book Value = Purchase Price – Accumulated Depreciation
    - Depreciation is Straight Line (= Purchase Price / Useful Life)
- Gain (loss) on Sale of Asset = Sale Price – Book Value
- *After Tax Cash Flow From Asset Sale = Sale Price – Tax on Gain*

Calculate NPV / Apply Rule

NPV = FCF / $(1 + r)^t$

- Consider that projects may be mutually exclusive, and that there may be constraints on the gravity of resources available.

Mutually Exclusive Projects:

1. Once off projects
    - Choose the project with the highest NPV.
2. Replaceable (project will be replaced)
    - If projects have the same life, choose the one with the highest NPV.
    - If projects have different lives, use the Equivalent Annual Benefit formula (EAB).

EAB = NPV / (1/r) x (1-(1/(1+ r)^t)) where:

- NPV = NPV of the project under consideration.
- r = cost of capital.
- t = life of the project.

The EAB formula assumes that projects can be replaced at identical terms over time.

Investment Decision Rules

There are various investment decision rules. These include:

- NPV.
- IRR.
- Incremental IRR.
- Payback Rule.
- Profitability Index.

NPV

- NPV is the most widely used and reliable rule in evaluating investment decisions.
- It involves evaluating a project's free cash flows (FCF).
- It takes into account the predominant consideration of whether the project creates value for shareholders.
- It also takes into account the risk of the project, and time value of money.

NPV Decision Rule: Invest in projects with a positive NPV. If mutually exclusive alternatives, invest in the project with the highest NPV.

Internal Rate of Return

- The IRR is the average return earned by taking on an investment opportunity.
- If the average return on the investment is superior to other equivalent alternatives in the market (risk/maturity), accept the investment.

Pitfalls of IRR:

1. Delayed investments
2. Multiple IRR's
3. Nonexistent IRR

Ie Differences in scale of investment, timing of investment, and risk.

IRR Decision Rule: Accept any investment opportunity where the IRR exceeds the opportunity cost of capital (and reject vice versa).

Incremental IRR

- The Incremental IRR is the IRR of incremental cash flows that would result from replacing one project with the other.
- It tells us the discount rate at which it becomes profitable to switch from one project to another.

Pitfalls of Incremental IRR:

1. Like IRR, it still does not indicate whether either project has a positive NPV on its own.
2. If the individual projects has different costs of capital, it is unclear what cost of capital the project should be compared to.

Decision Rule: Accept project with highest incremental IRR.

Payback Rule

- The *Payback Rule* states that you should only accept an investment if its FCF's pay back the initial investment within a pre-specified period.
- Payback Period = Time it takes to pay back initial investment.
- This is the only investment decision rule that does not take into account the Cost of Capital, and is thus considered weak.

Decision Rule: Accept investment if the payback period is less than a pre-specified period.

Pitfalls of Payback Rule:

1. It ignores the project's cost of capital and time value of money
2. It ignores cash flows after the payback period
3. It relies on an ad hoc decision criterion

Profitability Index

- The Profitability Index identifies the optimal combination of projects to undertake.
- It is utilised in situations replete with projects and resources.
- Profitability Index = NPV / Resource consumed.

Decision Rule: Accept project/s that rank highest on the Profitability Index and are within the resources consumable.

Pitfalls of the Profitability Index:

1. The set of projects taken following the PI ranking completely exhausts available resources.
2. There is only a single resource constraint.

Further Investment Analysis

Break Even Analysis

- Involves determining the break-even level of an input for which the level of investment has an NPV = 0.

Sensitivity Analysis

- Sensitivity analysis decomposes the NPV calculation into its different assumptions.
- It identifies how the NPV varies as component assumptions change (ceteris paribus other assumptions).
- It allows managers to explore the effects of errors in NPV estimates on the project.

Scenario Analysis

- Scenario analysis involves an evaluation of the effect on NPV of multiple assumptions changing simultaneously.
- It is most useful where large macroeconomic changes are predicted to occur (ie changes in market/economy condition such as a recession).
- This will affect a number of CB inputs such as Gross Income, COGS, Cost of Capital etc.

Lecture 2 – Cost of Capital

Appropriate Discount Rate

- Step 2 of Capital Budgeting involves finding the appropriate discount rate to discount Free Cash Flows to calculate NPV.
- The discount rate should reflect the riskiness of the project, the time value of money and the return demanded by investors.

- The discount rate should also be consistent with the type of cash flows discounted.

Why?

- The discount rate is necessary to calculate NPV, IRR, Incremental IRR and the Profitability Index.

Capital Asset Pricing Model

- The CAPM model can be utilised to calculate the expected return on any Asset eg: share, project, firm.
- The cost of capital is the best expected return available in the market on investments with similar risk.
- E(ri) = rf + Beta(i) x (E(Rmkt) – rf))
- Risk premium = Beta(i) x (E(rmkt) – rf)
- Beta = Systematic risk

Beta / Risk

- There are two types of Asset risk faced by firms: systematic and non-systematic risk (diversifiable risk)
    1. Systematic/market/non-diversifiable) risk: Market risk that cannot be avoided. Therefore, investors demand compensation for bearing this risk, and this is reflected in the market risk premium of the security.
    2. Non-systematic / diversifiable / idiosyncratic / firm specific risk: Risk that can be avoided by firms. Therefore, there is no risk premium for bearing non-systematic risk.

- Beta is a measure of systematic risk
- Expected return is determined by beta
    - E(ri) = rf + Beta(i) x (E(Rmkt) – rf))

Beta

- Covariance of the return of the asset with the market determines the Beta of an asset/investment
- B(i) = Cov (ri,rmkt) / Var (rmkt)
- Higher covariance implies higher beta, which implies higher systematic risk, which implies higher market risk premium, which implies higher expected return.

Estimating Beta from historical returns:

- Run a regression.
- Beta corresponds to the slope of the best fitting line of the graph of the Asset's excess returns versus the market excess return.

Different Betas / Project Cost of Capital:

- To calculate equity/debt/asset cost of capitals a prudent analyst must utilise different betas (equity, debt and asset betas).

- A projects cost of capital should be estimated by utilising a project specific beta UNLESS the project and firms risk are comparable.

<u>Can also estimate project cost of capital using:</u>

1. all equity comparables:
   - Find an all equity financed firm in a single line of business that is comparable to the project.
   - Use the comparable firms equity beta and cost of capital as estimates.
2. Levered firms as comparables:
   - Assets of levered firms are financed by debt or equity.
   - To estimate these firms as comparables, an analyst must find asset and debt betas.

Asset Beta

- Measures systematic risk of firms assets.
- Borrowing increases systematic risk to equity holders.
- Operating leverage (the relative proportion of fixed v variable costs) also increases risk to equity holders.
- Bu = (E / E + D) bE + (D / D + E) bD.
- bE = Equity Beta.
- bD = Debt Beta.
- E and D are the market value of Equity and Debt respectively.

Debt Beta

- Measures systematic risk to debt holders.
- Can estimate from historical returns and debt comparables.
- Debt Yields:
  - YTM is the return an investor will earn from holding the bond to maturity and receiving promised payments.
  - If there is little firm default risk, YTM is a reasonable estimate of investors required return.
  - If there is significant risk of default, YTM will overstate investors the required return.

<u>Rd = YTM – (Prob. Default x Expected Loss Rate)</u>

Market Portfolio / Market Risk Premium

- To apply CAPM, we must ascertain the market portfolio.
- Common proxies are used to represent the market portfolio.

<u>Examples of common market proxies:</u>

- *S&P500*: Value weighted portfolio of 500 largest US stocks.
- *Wilshire* 500: Value weighted index of all US stocks listed on the major stock exchanges.
- *Dow Jones Industrial Average (DJI*A): A price weighted portfolio of 30 large US industrial stocks.

- Can also use the historical market return
    - Estimate the (E(rmkt) – rf) by utilising the historical average excess return of the market over the risk free interest rate.

Two drawbacks of using historical market return approach:

1. The standard errors of estimates are large.
2. The approach is backward looking and thus may be non-reflective of current market expectations.

Fundamental Approach to Estimating the Market Risk Premium

- Given an assessment of firms' future cash flows, we can estimate the expected return of the market by solving for the discount rate consistent with the current level of the index
- r(mkt) = Div1 / Po + g = Dividend Yield + Expected Dividend Growth Rate
- *Market Risk Premium* = Div1 / Po + g - rf

Risk Free Rate

- Should be consistent with time horizon of investment.
- For example, the Yield on Treasury securities is often used as the risk free rate:
    - Yield on T-Bills would be utilised for short term projects.
    - Yield on T-Bonds would be utilised for longer term projects (with appropriate maturity).

Firm Cost of Capital

WACC:

- r(WACC) = (E / E + D) rE + (D / E + D) rD (1 – Tc)
- Due to the existence of tax, the return required by investors are more than the actual cost of capital to a levered firm.

Lecture 3 – Financial Options

Options

Call option: is a contract that gives the buyer the right, but not the obligation, to buy the underlying asset at its pre-specified strike/exercise price within a pre-specified period of time

Put option: is a contract that gives the buyer the right, but not the obligation, to sell the underlying asset at its pre-specified strike/exercise price within a pre-specified period of time

- European options (both calls and puts) may only be exercised on their expiration date.
- American options (both calls and puts) may be exercised at any date prior to expiration of the option.
- The names of these options have nothing to do with their origin/terms. It is only their exercisability that differs.

Exercising an option: Where an option holder enforces an agreement, buys/sells the underlying asset at the strike price

Strike price: The price at which an option holder buys/sells the underlying asset when the option is exercised

Option buyer/holder: Has the right to exercise the option, and therefore has a long position in the contract

Option seller/writer: Writes and sells the option, and therefore has a short position in the contract. Because the buyer has the right to exercise the contract, the option writer has the obligation to fulfil the contract if it is exercised.

Option Terminology

At the Money (ATM): An option whose exercise price is equal to the current stock price

In The Money (ITM): An option whose value if immediately exercised would be positive (eg: a call whose strike price X is LESS than its intrinsic value (max(0,St-x)

Out of The Money (OTM): An option whose value if immediately exercised would be negative (eg: A call whose strike price X is GREATER than its intrinsic value (max(0, St-X)

Underlying Financial Assets

Include:

- Stocks.
- S&P 100.
- S&P 500
- DJIA.
- NYSE Index.
- Commodity Options.
- Crude Oil Options.
- Iron Ore Options.

- FOREX Options.

Market Use of Options

Options can be used for various strategies:

- **To hedge:** To reduce risk by holding securities or contracts whose payoffs are negatively correlated (ie make money) with the underlying price risk (ie risk exposure).
- **To speculate:** To essentially 'place a bet' on the direction in which the investor believes the market is likely to move (ie the price of the underlying asset – such as St).

Put Call Parity

- The relationship between the value of the stock, the bond, and call and put options is known as put-call parity.
  - C=P+S-PV(K)
  - OR C = S-K (intrinsic value) + dis(K) +P (Time Value)
  - K = Strike price, C = Call price, P = Put price (of equivalent terms/maturity), and S = Stock price
  - This formula can be utilised to ascertain the no-arbitrage price of a European call option, assuming the stock does NOT pay dividends
  - Dividends decrease the value of call options (they indicate that the share price is likely to decrease). Therefore, if a stock pays a dividend put-call parity equals:
  - C = P + S – PV(K) – PV(D)
  - OR C = S – K (intrinsic value) + dis (K) + P – PV(D)

Factors Affecting Option Prices

Strike Price:

- The value of a call option increases (decreases) as the strike price decreases (increases), ceteris paribus.
- Call payoff: Max (0, St-x).
- The value of a put option increases (decreases) as the strike price increases (decreases) ceteris paribus.
- Put payoff: Max (0, X-St).

Stock Price:

- The value of a call option increases (decreases) as the stock price increases (decreases), ceteris paribus.
- The value of a put option increases (decreases) as the stock price decreases (increases), ceteris paribus.

Exercise Date:

- For American options, which can be exercised at any time prior to the expiration date of the option, the option becomes more valuable as its time to expiry increases. An American option with a later exercise date cannot be worth less than an equivalent American option with an earlier exercise date.
- European options with later exercise dates may be worth less than otherwise identical European options with earlier exercise dates (ie if liquidating dividend is paid in 6 months – 6 month call is worth more than 1 year call)

Volatility:

- The value of call and put options increases with the volatility of the stock / underlying asset.
- The increased volatility increases the return demanded by investors for the asset, and inflates both high and low returns.
- Because options holders face no downside risk and have the additional upside potential if stock prices change favourably in respect of their option positions (call or put), both call and put option values increase with the volatility of the stock.

Bounds on Option Prices

- An American option cannot be worth less than a European option.
- A call option cannot be worth more than the Share price.
- A put option cannot be worth more than its Strike price.
- An American option cannot trade for less than its intrinsic value (ie : the amount by which the option is ITM, or zero if OTM).
- An American option cannot have a negative time value (ie the difference between the options price, and its intrinsic value).
- European calls on non-dividend paying stock always have positive time value.
- The price of any call on a non-dividend paying stock always exceeds its intrinsic value prior to expiration.

Exercising Options Early

- It is NEVER optimal to exercise an American call option on a non-dividend paying stock early.
- You are ALWAYS better off selling the option.
- It may be optimal to exercise a put option on a non-dividend paying stock early.
    - P = K – S – Dis(k) + C

When the American put option is sufficiently deep ITM, dis (K) will be large relative to the value of the call, and the time value of a European put option will be negative. In this case, the European put will sell for less than its intrinsic value.

Options on Dividend Paying stocks:

- C = P + S – PV(K) – PV(D)
- OR C = S – K (intrinsic value) + dis (K) + P – PV(D)
- OR P = K – S(Intrinsic value) + C – Dis (K) + PV(D)

If PV(D) is large enough, the time value of a European call option may become negative. This implies that its price could sell for less than its intrinsic value. BUT, because an American option can never be worth less than intrinsic value, the price of an American option can exceed the price of a European option.

- With a dividend paying stock, it may be optimal to exercise an American call option early.
- A dividend signals to investors that the share price is likely to fall.
- This adversely affects the value of the call option, ceteris paribus. The option holder does not get the dividend as compensation.
- Therefore, the option holder exercises early, holds the stock and captures the dividend.

Black-Scholes Option Pricing Model

- Prices options on non-dividend paying stocks.
- C = S x N(d1) – PV(K) x N(d2)
- d 1 = ln(s / PV(K)/ Volatility x Sqr T + (Volatility x SqrT / 2)
- d 2 = d1 – (Volatility x SqrT)

S = Price of underlying asset, K = strike price, N = Cumulative Normal Distribution (the probability that an outcome from the standard normal distribution will be below a certain value)

Black Scholes price of European put option:

- = PV (K) (1- N(d2) – S(1 – N(d1)

Dividend paying stocks:

- S^x= s – PV(D)
- S^x is the price of the stock excluding dividends
- Because a European call is the right to buy a stock without dividends, it can be evaluated by using the Black Scholes formula with S^x

Options and Corporate Finance

- Options can be utilised as a tool of risk management to analyse the capital composition of companies.
- Equity as a call option:
  - A share of stock can be thought of as a call option on the Assets of a firm, with a strike price equal to the value of debt outstanding
  - If the firms value does not exceed the value of debt outstanding (ie st < x), than the firm must declare bankruptcy, and equity holders receive nothing
  - If the firms value exceeds value of debt outstanding, the stock holders receive the residue of the asset pool after debtors have been paid
  - This transaction (ie equity) has the same nature as a call option
  - Value of equity @ t =Max(0, At – X)
  - The value of equity today is the premium paid for the call option (ie utilising the Black-Scholes option pricing formula) = C
- Debt as an option portfolio:
  1. Debt as a call option:
     - Think of debt holders as owning the firm, having sold a call option with strike price equal to the current debt outstanding.
     - If the value of the firm exceeds the current debt outstanding, the debt holders will receive the strike price and 'give up' the firm
     - If the value of the firm does not exceed the required debt payment, the call will be worthless, the firm will declare bankruptcy, and the debt holders will be entitled to the firm's assets.

Thus, debt as a call option > Short equity call option and long the firm assets. As Assets are equivalent to Stock Price, and Equity is equivalent to call price, put call parity becomes:

- C = P + S – PV(K)
- C = P + A – PV(K)
- PV(K) = P + A – C
- A – C = PV(K) – P

Thus, we long the firm's Assets, and short an equity call option, to hold a portfolio equivalent to the firm debt!

2. Debt as a put option
    - Corporate debt is a portfolio of risk free debt and a short position in a put option on the firm's assets with a strike price equal to the required debt payment
    - Risky debt = Risk-free debt – put option on firms Assets
    - When the firms Assets are worth less than the required debt payment, the put is ITM, (x>St), the owner will exercise the option and receive the difference between the required debt payment and firm asset value. This leaves the debt holder with just the assets of the firm
    - If the firms value is greater than the required debt payment, the put is worthless, leaving the portfolio holder with the required debt payment

Thus, debt as a put option > Long risk free debt and short a put option on the firm's Assets. As Assets are equivalent to Stock price and Equity is equivalent to call price, put call parity becomes:

- C = P + A – PV(K)
- A = C + PV(K) – P
- Where A = L + OE, and PV(K) – P = debt
- Therefore, when analysing debt as a put option, we hold a portfolio of long the risk free debt (PV(K)), and short the put option (-P). (C = Equity, ie value of the call option)

Lecture 4 – Real Options

Real Vs Financial Options

- A real option refers to the right to make a particular business decision at a predetermined cost (exercise), such as a capital investment, for a predetermined period of time (time to expiration)
- A key distinction between real options and financial options is that the underlying asset of a real option CANNOT be traded in competitive markets
- The motivation behind real options is to increase the flexibility in managerial decision making by taking into account the provision of future decisions
  - Projects can be completed now or in the future
  - Projects can be adapted depending on contemporaneous information
  - Projects can create investment opportunities in follow up projects (R&D)

Types of Real Options

1. Timing Option: A timing option is an option to delay an investment opportunity
2. Expansion option: An expansion option is an option to grow or extend through follow up projects
3. Learning Option: A learning option is an option to abandon or scale down an investment opportunity

Lecture 5 – Capital Structure 1

Capital Structure

- Capital structure concerns the relative mix of debt, equity and other securities in a firm.
- It is important for firms to consider the optimal capital structure.
- A firm that utilises only equity in its capital structure is an *unlevered firm,* comprising of unlevered equity.
- A firm that utilises both equity and debt is a *levered* firm, comprising of levered equity and debt outstanding.

Modligliani-Miller [MM] PCM Theorem

- MM argue that with PCM, the total value of a firm is independent of capital structure.
- Leverage increases the risk of equity, even when there is no risk that the firm will default.
- Thus, while debt may be a cheaper funding source, investors must be compensated for leverage.
- Accordingly, levered equity holders receive a higher expected return ceteris paribus to compensate for risk (ie: ^ risk premium in CAPM).

<u>MM Proposition 1:</u>

- In PCM, the total value of the firm is equal to the market value of CF's generated by Assets and is not affected by choice of capital structure.
- **E + D = U = A**

Where: E: Mkt value of equity, D: Mkt value of debt, U: Mkt value of unlevered equity, A: Mkt value of Assets.

- Return of Re^u is related to the return on Re^L and Return on debt (Rd)
- $Re^u = (E/E + D)Re^L + (D/E+D)R(d)$
    a) $Re^L = Re^u + (D/E)(Re^u - Rd)$
    b) The return on levered equity equals the return on unlevered equity PLUS a premium to compensate for the additional risk of leverage
    c) The size of the premium is affected by the relative funding mix between D and E.

<u>Interpretation of MM 1:</u> Whilst debt has a lower cost of capital than equity, leverage does not affect firm WACC. As a result, the value of FCF's evaluated using WACC does not change, and MVA does not depend on financing choices.

<u>MM Proposition 2:</u>

- The cost of capital of levered equity increases with the firms Market Value Debt to Equity ratio (D/E).
    a) If a firm is levered, its R(A) is equal to its pretax WACC
    b) (E/E+D)Re + (D/D+E)Rd

With PCM's, a firms WACC is independent of its capital structure and equal to the equity cost of capital if unlevered which matches cost of capital of assets.

As firms borrow at the low debt cost of capital, the equity cost of capital rises, and WACC remains constant.

<u>Interpretation of MM 2:</u> With PCM, the addition of leverage has no effect on firm value or cost of capital (WACC).

Perfect CAPM's

MM argued that perfect CAPM's consisted of the following features:

- There are no transaction costs, taxes, or issuance costs associated with security trading
- Investors and firms can trade the same set of securities at competitive prices, equivalent to PV of FCF's.
- A firm's financing decisions [ie capital structure] does not change the CF's generated by investments, nor reveal any new information about them

By the Law of One Price, the total returns to Equity Holders must equal the CF's generated by the Firm Assets [MVA], in the absence of taxes, transaction costs and issuance costs.

Homemade Leverage

- Homemade leverage occurs when investors leverage within their own portfolios to adjust the leverage choice made by the firm
    a) Homemade leverage is the perfect substitute for the use of firm leverage if the individual investor can borrow/lend at the same rate as firms