Fin 601 – Wharton's Intro to Finance

- defn
  - arbitrage opportunities ~ "money machine"
  - forward rate agreement = agree to lend money in future [$f_t = DF_1 / DF_y - 1$ ***where t = lend date; y = repay date***]
  - spot rate -

I Measures of Performance

- (Expanded) Dupont System
  - **A)** ROA ***= Margin x AT = Income / Assets*** (i.e., P&L relative to BS)
    - Margin = ROS = Income / Sales
      - strategies for raising margin = raise P, lower Costs, increase sales, increase avg margins through bundling
    - AT = Sales / Assets
    - strategies for raising ROA – outsource (but lower margins (from increased costs) may offset)
    - driven by - Operations

  - **B)** ROE ***= ROS x AT x Leverage***
    - ROS = Income / Sales
    - Leverage = Assets /Equity
    - **Benchmarks**
      - risk free = 5% risk free RoR on US Treasuries
      - risky (avg US company) = 5% (ROS) x 1.0 (AT) x 2.5 (Levg) = 12.5%
    - strategies for raising ROE – raise ROA (see strategy above) or increase levg
    - driven by – Finance
    - company's way of showing how made money in the past
    - 3 problems = timing (all amounts are historic) + risk (no quantification of risk incurred to get that level of ROE) + value (can't buy equity @ BV → MV may be better)
    - solution = Return on Invested Capital (ROIC) [= Return on Net Assets (RONA)] ~ return on total capital (ignoring whether debt / equity) ~ fundamental earning power

  - **C)** Growth in Equity ***= ROS x AT x Levg x Retention = Income Retention / Equity = sustain. internal growth rate***
    - Retention = Income Retained (not dividended out) / Income
    - Internal Growth Rate = RE / Net assets = "plowback" ration x ROE x (equity / net assets)
      - ~ growth rate achievable w/o using external funds (i.e., growth solely from ops))
      - plowback ratio = % of earnings t/b re-invested in firm ops
    - Sustainable Growth Rate = plowback ratio x ROE

  - **D)** P/E =
    - high P/E ~ low earnings = liked by marklet
    - low P/E ~ high earnings = not liked by market

  - **E)** Value = ***ROS x AT x Levg x P/E = ROE x P/E = Market / Book = Market / Equity***
    - perceived value for every $1 invested in past

  - for every $1 invested → mgmt has returned X in value
  - market's way of evaluating the way made money in past
  - problems – **(i)** difficult to identify how op decisions affect stock P + **(ii)** mgmt knows more re company than market + **(iii)** stock P depends on many extraneous factors

- Alternate Metrics
  - ROI = Margins x T/O
  - Market Value Added ***= Market – Book***
    - MV of capital – BV of capital
    - problem – driven by current perceived value (and all bubbles burst)
  - Economic Value Added (EVA)
- Dividend Policy
  - Payout Ratio = Div / Income
  - Retention Ratio = Income Retained / Income
- Ratio Analysis
  - compare company ratios to (i) PY ratios + (ii) industry avgs + (iii) ROT
- Financial Forecasting & Planning
  - **A)** Forecasting
    - % of sales forecasting – based on tendency of variable costs / current assets / current liab to vary with sales
    - I/S - operating exec focuses on b/c measures π
    - B/S – fin exec focuses on b/c addresses financing
  - **B)** Planning
- Remember
  - cash – mitigates risk (but earns no return)
  - leverage – levers benes and risks
  - interest tax deduction = gov't subsidy
  - focus = financial implication of non-financial decisions

II. PV

- Compounding
  - $FVF_t = (1+r/m)^{mt}$
    - more frequent compounding increases the effective yield
  - $FV_{Continuous} = Ce^{rt}$
  - Effective Annual Rate (r^) = $(1+r/m)^m - 1$
    - $1+r^ = (1+r/m)^m$
- Discounting
  - $DF_t = 1 / (1+r)^t$
  - Perpetuities
    - in arrears = C / r (I.1.29)
    - in advance = $[C(1+r)] / r$
  - Growing Perpetuities
    - in arrears = $C / (r-g)$ (I.1.34)
      - amount paid each yr = $C(1+g)^{t-1}$
    - in advance = $c / (r-g)$
  - Annuities

- in arrears (a_{Tr}) = ***C/r * [1 - 1/(1+r)^t]*** (~ PV of Perpetuity$_1$ – PV of Perpetuity$_2$)
  - ♦ pays fixed sum at <u>end of yr</u> for fixed number of yrs
  - ♦ key – CF = difference b/w two perpetuities
- in advance ($\ddot{a}_{Tr}$) = ***[C(1+r)]/r * [1 - 1/(1+r)^t]***

➢ <u>Growing Annuity</u>
- in arrears = ***C/(r-g)*[1-[(1+g)/(1+r)]^t]***
- in advance = ***[C(1+r)]/(r-g)*[1-[(1+g)/(1+r)]^t]***

➢ <u>Annuity Factors</u>
- a_{Tr} (annuity in arrears) = ***1/r * [1-1/(1+r)^t]***
- $\ddot{a}_{Tr}$ (annuity in advance) = ***(1+r)/r * [1-1/(1+r)^t]***

- NPV = ***C_0 + [C_t / (1+r)^t]***
  - ➢ <u>Rule</u> - accept project if NPV > 0

- RoR = π / C_0
  - ➢ <u>Rule</u> – accept project if RoR > discount rate (~ Opportunity Cost of Capital ~ return on alt investment w/ identical risk)

- Real interest rate (R) = ***(1+r) / (1+i) – 1*** (NOT R-i)
  - ➢ nominal return – actual return that will be had
  - ➢ real return – equivalent value of actual return after inflation

- Term Structure of Interest Rates – relationship among interest rates for different maturities
  - ➢ captured by using different DF b/w periods
  - ➢ <u>calculation</u> - use bond prices to estimate the current term structure (b/c bond P are driven by term structure)
    - **i)** solve for DF
    - **ii)** solve for r that gives DF
  - ➢ ROE / ROA = accy + income / BS + historic
  - ➢ IRR = C/F (but based on assumptions) + accts for when
  - ➢ it's OK to be wrong in financial projection (this is why use lower rate to acct for risk)
  - ➢ not OK to be biased (i.e., if repeated action, results would always be below rejection) b/c discount rate <> account for this

- Remember –
  - ➢ capital markets allow trade b/w today $$ and tomorrow $$ (thereby allowing investors w/ different patterns of income / consumption to agree on investment projects)
  - ➢ financial mgmt role = increasing the value of each S/H stake in firm
  - ➢ limits on mgmt = law, K, reputation
  - ➢ if NPV is positive → earning RoR above discount rate
  - ➢ IRR = RoR – sets discount rate = to rate that discounts future CF to current investment (w/o calculator, this is T & E)

III. Valuing Bonds and Stocks

- Bonds (~ safe C/F)
  - F:
    - V = sum of $C_t / (1+r)^t$
    - V_0 = sum of $[I / (1+y)^t] + [F / (1 + y)^m]$
  - relevant terms
    - coupon bond – pays stated int rate (~ "coupon") + face value at maturity
    - zero coupon bond (ZCB) – sold at discount to face value + pays face value at maturity
    - Treasury Bills – 3, 6, 12 mos
    - T Notes – b/w 2 & 10 years
    - T Bonds (~ ZCB) – 10 yrs +
  - US Treasuries
    - quote: ***P = F [1-d (N / 360)]*** [d = quoted discount rate %; N = maturity; F = face value]
      - quotation ~ % of face value (w/ decimal in terms of 1/32)
      - no direct relation to PV
    - yield = F / purchase P
  - Corporate Bonds
    - determining term structure = most difficult part
- Consul (perpetuity w/ no maturity)
  - F: ***C / y*** (assumes C is same every year)
- P/S –
  - F: ***D / r***
  - note accy confusion – is it equity or is it liability
    - accy → equity (called "div")
    - finance → liability (more like debt than equity)
  - note – P driven more by change in interest rate
- C/S
  - F: $\mathbf{P_M / (1 + K)^M}$ [where P_M = PV of Div expected at that time]
  - **i)** constant dividends – D / K (assumes dividends do not grow – but this is too simplistic)
  - **ii)** constant growth – (just special case of constant growth)
    - F:
      - $V_0 = \mathbf{D_1 / (k – g)}$ [**where D1 = next year's Div**]
      - $k = \mathbf{(D_1 / V_0) + g}$
    - assumes k > g - if k < g – 2 problems: (i) mathematically + (ii) logically b/c can't buy something that will grow t/b larger than the available population
    - ***key*** – this formula forces one to recognize the limits of growth (b/c constant high growth <> possible)
  - **iii)** Limited growth –
    - F: $\boldsymbol{sum\ of\ [D_0(1+g_s)t] / (1+k)^t + sum\ of\ [D_m(1+g_n)^{(t-m)}] / (1+k)^t}$ [where g_s = super growth; g_n = normal growth]
      > = simple DCF + $(D_m / k) / (1+k)^m$
- solving for the term structure
  - process -
    - **i)** solve for DCF for all payments
      - a) identify timing of payments

        - ♦ b) calculate DF consistent w/ payment timing and bond P (~ where P = CF * DF and DF = 1 / (1+r))
    - **ii)** obtain r from DF ~

- key – knowing term structure allows to price any riskless bond (knowing yield of bond only tells re P of that bond

- yield to maturity
  - bonds
    - process - solve for y where P = $^{T}sum_{t=1}$ of [C / $(1+y)^{t}$ + F / $(1+y)^{T}$] by trial and error
    - problem – often involves solving for root of polynomial degree T
    - zero-coupon bond w/ maturity T → y = r_T
  - treasuries (known as the "equivalent annual rate compounded semi-annually (y^)
    - F: $(1+y^{\wedge}/2)^2 = 1+ y$

IV. Capital Budgeting

- capital budgeting – financial evaluation of investment proposals
  - Rule – undertake the bundle of investments generating the highest total NPV

- TVoM – future $ worth less b/c of **(i)** inflation + **(ii)** uncertainty + **(iii)** opportunity costs

- (risk adjusted) discount rate – (Ch. ?? + B&M 9)

  - defined as - either **(a)** RoR c/h earned on alt investments (if have cash on hand) ~ opportunity cost of capital or **(b)** RoR expected by investors in the firms securities (if has to raise cash)

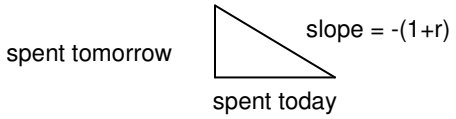
  - calculation -
    - WACC – see below
    - $K_E = r_f + Beta(r_m-r_f)$
    - if can't calculate Beta →
      - ♦ avoid fudge factors in estimate – these are often diversifiable + "need" often arises from insufficient CF analysis (~ most likely CF is unbiased CF) + have to think through CF anyway to calc the fudge factor (might as well get it right)
      - ♦ consider determinants of Beta to identify whether high / low Beta applies –
        - > cyclicality (~ unique / diversifiable risk) – examine Accy / C/F Betas as sub for security returns
        - > operating levg – adds to Beta of a capital project → higher proportion of FC = higher project Beta
  - problem = changing risk during project (BM 239)
    - solution = certainty equivalents (~ guaranteed cash out P for project at end)
    - required total return = ***total investment (@ T_0) – discounted certainty equivalent***
    - value of getting rid of risk = ***total investment (@ T_0) – undiscounted certainty equivalent***

- equivalence – present value is equivalent to future cash flows

- capital rationing – fixed investment budget limits the amount investable (investments m/b ranked)

- efficient capital markets –
  - equalize investment opportunities
  - allows for (i) spend it all now + (ii) spend some now / invest some now / have more later + (iii) spend nothing now / invest everything now / have the most later
  - requires – no access barriers + no distorting taxes / friction + individuals borrow / lend at same rate

- investment opportunity line
  - F: -(1+r) [where r = RoR of the marginal investment]
  - tells how many more $$ can have tomorrow for an additional $ investment today



- real investment opportunities – opportunities beyond capital markets
  - individual can use capital markets (~ borrowing / lending) to achieve other consumption patterns
  - increase in current wealth from a real investment project = NPV of the project

- Evaluation Methods -
  - **i)** Payback Period = ***Investment / Annual CF***

  - **ii)** Accy RoR = ***Annual Avg C/F / Total Cash outflow***

  - **iii)** NPV = ***PV of cash inflows – PV of cash outflows***
    - superior to IRR b/c – (i) NPV focuses on the increasing $ value of the investment (??) + (ii) NPV measures efficiency of investment and amount invested
    - assumes re-investment at constant discount rate (but company should have many of these opportunities)

  - **iv)** Benefit Cost Ration (BCR) = ***PV cash inflows / PV Cash outflows***
    - Rule – BCR should > 1
    - if BCR and IRR provide different result → follow BCR

  - **v)** IRR – ***discount rate at which NPV equals zero*** (~ yield to maturity)
    - ~ B/E return
    - ~ rate at which money remaining in an investment grows / compounds
    - ~ comparable to interest on bank loan
    - how – T & E
    - generally – quicker returns yields higher IRR
    - inferior to NPV – b/c **(i)** only measures efficiency of investment (ignores amount of return) **+ (ii)** difficult to solve (especially if interim investments required)
    - assumes re-investment at project RoR (which may be unique)

- Cash Flow Issues
  - C/F =
    - = Net Income + Depreciation
    - ***= (R – E)(1-t) + Dt*** [~ after tax pre depreciation net profit + depreciation tax shield]
  - principles
    - **i)** cash flow principle – record investment when cash flows (ignore accrual)
    - **ii)** with – without principle – ignore C/F that are same whether invest or not
  - Depreciation – only CF issue to extent tax effect occurs
  - working capital ~ spontaneous sources of cash (~ A/P) ~ arise in natural course of a project with no explicit cost
  - sunk costs – ignore these for C/F → s/b expensed
  - allocated costs – issue = do O/C costs / savings vary with the size of the business (ignore if a pure allocation)\
  - using excess capacity –
    - if division has no alternative use for excess capacity now or in future → no C/F + idle capacity = zero cost
    - if division has alt uses (or likely will need capacity in future) → costs exist
  - acquiring excess capacity – only current project unless company plans to utilize w/ other investments

  - finance costs – may be reflected in Opp Cost of Capital (~ generally, reflect cost of money in OCoC and ignore financing C/F)

  - consider –
    - **i)** are projects mutually exclusive – money is available but company cannot invest in both for tech reasons
    - **ii)** do competing projects have differing lives – need common investment horizons (~ and possible tech developments during such period)
    - **iii)** capital rationing – money is not available for both projects
      - key = getting most bang for buck invested
      - don't rank investments by NPV consider – are projects mutually exclusive + do competing projects have differing lives
      - compare current opps w/ future opps
  - Pitfalls of CF analysis
    - **i)** entity v. equity perspective
      - entity = company –
      - equity = owners – after accounting for paying off debt

        - should return same result – just don't confuse
    - **ii)** inflation – often excluded from CF but included in discount rate (~ makes analysis too conservative)
        - CoC for D & E include premium for inflation
    - **iii)** real options – ability to alter plans as project progresses
        - value = difference b/w NPV w/ and w/o option
    - **iv)** excessive risk adjustment – often ignore fact that high risk initially subsides in later periods
        - constant risk adjusted discount rate = appropriate only if risk grows continuously
        - O/W compounding effect of risk factor in discount multiplies in future periods
        - solution = ID multi-risk phases

- remember
    - 3 key financial relationships
        - 1) A = L + E [B/S]
        - 2) R- E = I [I/S]
        - 3) FV = $P_0(1+r)^t$ or PV = FV $[1/(1+r)^t]$
    - we would accept a higher $ return at a lower RoR if no capital rationing (this is why NPV is better than IRR)
    - Goal (in evaluating investment opps) = increasing wealth

V. Diversification & Risk Measurement

- value additivity – value of firm w/ two assets s/b = to combined investment in two separate assets ~ PV (AB) = PV(A) + PV(B)

- risk ~ distribution of possible returns around an investment's ER
    - measured by – σ
    - market = non-diversifiable
        - measured by R^2 – measures total proportion of variance in stock return explained by market movements
    - unique = diversifiable

- investment risk – range of possible outcomes from an investment (greater variance / volatility = greater risk)

    - measured by –
        - **i)** history – look at how corp performed w/ same project type previously
        - **ii)** sensitivity analysis – estimate how investment's figure of merit varies w/ changes
        - **iii)** scenario analysis – change uncertain variables in mutually consistent way to specific event
        - **iv)** simulations – assign prob to each uncertain factor + assign interdependence + computer calcs

    - reflected by – risk adjusted discount rate (or compare IRR to hurdle rate with risk factor)
        - bene – familiarity of execs + objectivity associated with CoC

- risk premium (B&M 7)–
    - risk premium of common stocks = $return_{market}$ – avg rate on gov't bonds
    - e.g., gov't bonds ~ 1.8%; corp bonds ~ 2.1%; S&P 500 C/S ~ 9.1%; Small Firm C/S ~ 13.4%
    - why might historical premium overstate today's premium? –
        - **i)** stock P outpaced div yield in last 75 years → declining yield added 2% / yr to return on stocks; if decline was expected → actual risk premium was about 7%
        - **ii)** US has uniquely benefited from civil / world unrest. Given our proven ability to avoid these → lower premium may be justifiable going forward
        - **iii)** 1990's boom ~ fall in risk premium demands of US equities (% LT growth in Div + % Div Yield) – assumes equity P is driven by % Div yield (but argument lost force after March 2000)

- Cost of Capital (COC) = r_{assets}
    - what is it
        - minimum return firm must earn on existing assets to meet expectations of capital providers
        - cost of sources of capital weighted by importance to firm's capital structure
        - return firm must earn on existing assets to keep it sh P constant
        - used to value new assets having same risk as existing assets
        - = T-Bill rate + risk premium

- capital structure change
  - effect on required returns -
    - no impact on overall required return (b/c no impact on operations or change in amt/risk of CF)
    - does effect required return on individual securities
  - financial leverage effect on beta –
    - $B_{assets} = B_{portfolio} = (D/V)\ B_{Debt} + (E/V)\ B_{Equity}$
    - more debt → B_{assets} remains same + B_{Debt} rises + B_{Equity} rises
    - effect = no effect on return on Firm's assets BUT increased risk for equity

- $K_E = \boldsymbol{r_f + Beta(r_m - r_f)}$
  - ~ noise tends to cancel out in portfolio

- $WACC = K_W = \dfrac{(1-t)K_D D + K_E E}{D + E}$
  - where D + E = V
  - where r_{debt} = yield – default risk = (int / MV) – default risk

- $PV = CE / (1+r_f)$
  - certainty equivalents – discount future risk free equivalent at the risk free rate
  - makes separate adjustments for risk and time

- weights (D+E) ~ use market value (not BV)
  - Debt – use after tax current yield * market value (often assumed = to BV)
  - Equity – different options
    - i) assume a perpetuity → K_E = dividend yield (D_1 / P)
    - ii) perpetual growth → K_E = d/P + g [note P = d / (K_E-g)]
    - iii) CAPM →
      - K_E = risk free rate + inflation rate + Risk Premium
      - K_E = rate on gov't bond + β_e (historical excess return on stocks)
      - ***historical excess return on stocks*** = 7.5%
    - iv) multiple hurdle rates depending on type of investment –
      - con - arbitrary
      - pro – use CoC of single product competitors as proxy

- relation to sh P – excess return attracts S/H (P rises); deficient return repulses S/H (P falls)

- remember –
  - CoC = limited use b/c only relevant if project = same risk profile as existing assets
  - assumes constant risk
  - marginal CoC = fallacy → as increase leverage, K_E rises

- risk aversion ~ preference for low risk alternatives ~ risk reduces investment value

- market line – combos of risk and ER one can anticipate in properly functioning economy

- expected return (E/R) **=** probability weighted avg of possible returns

- EVA = EBIT (1-t) - $K_W C$
  - PV of annual EVA stream = NPV of investment
  - annual OCoC = % cost of capital * BV of investment at beginning of each year
  - see Higgins p. 301-306

- Beta (β_e) – $\boldsymbol{covar_{im} / var_m}$
  - measures -
    - market risk = cov (stock, market portfolio) / var (market portfolio)
    - a security's sensitivity to market movements
  - Debt Betas – typically much lower than equity Betas (large blue chips = .1 to .3)

- measuring portfolio risk
  - uncertainty – more things can happen than will happen
  - tools -
    - Variance (σ^2)= ***actual return on portfolio – expected return on portfolio***
      - expected return – weighted avg of possible outcomes
      - proportional to time period over which return is measured (??)
    - Standard Deviation (σ) = $Var^{0.5}$
      - same units as rate of return
  - diversification
    - reduces variability → indiv stocks more variable than market indices
    - only need few stocks to get most bene of diversification
    - driven by – imperfect correlation b/w stocks
    - eliminates unique risk (no effect on market risk)
    - best with negative correlation (but this is rare)
    - limit – variability of well diversified portfolio depends on covariances (see proof bottom p. 171) – i.e., covariances becomes critical driver of diversity with more securities
    - investors can often do more easily than firms
  - calculation –
    - is NOT wghted avg of σ of stocks in portfolio (unless stocks are perfectly correlated)
    - calculated by
      - **i)** identify % in each portfolio (x_1 & x_2)
      - **ii)** find σ of individual stocks
      - **iii)** find covariance of individual stocks
        - covariance = either
          - **a)** correlation coefficient$_{12}$ X σ_1 σ_2 X x_1x_2
            - correlation coefficient ~
          - **b)** σ_{12} = expected value of (actual return$_1$ – exp return$_1$) X (act return$_2$ – exp return$_2$)
      - **iv)** weight covariance by proportion of holdings (x_1 & x_2)
      - **v)** multiply squared proportion of holding X variance (for x_1 & x_2 separately)
      - **vi)** portfolio variance = $\boldsymbol{x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + 2(\text{correlation coefficient}_{12}\,\sigma_1\,\sigma_2\,x_1x_2)}$
  - matrix

	Stock 1	**Stock 2**	**Stock 3**
Stock 1	$x^2_1\sigma^2_1$	$x_1x_2\sigma_{12}$ = $x_1x_2\,\boldsymbol{\rho_{12}}\,\sigma_1\sigma_2$	$x_1x_3\sigma_{13}$ = $x_1x_3\,\boldsymbol{\rho_{13}}\,\sigma_1\sigma_3$
Stock 2	$x_2x_1\sigma_{21}$ = $x_2x_1\,\boldsymbol{\rho_{21}}\,\sigma_2\sigma_1$	$x^2_2\sigma^2_2$	$x_2x_3\sigma_{23}$ = $x_2x_3\,\boldsymbol{\rho_{23}}\,\sigma_2\sigma_3$
Stock 3	$x_3x_1\sigma_{31}$ = $x_3x_1\,\boldsymbol{\rho_{31}}\,\sigma_3\sigma_1$	$x_3x_2\sigma_{32}$ = $x_3x_2\,\boldsymbol{\rho_{32}}\,\sigma_3\sigma_2$	$x^2_3\sigma^2_3$

- Portfolio Variance = sum of all boxes
- = variance terms
- = covariance terms

- multi-national projects
  - outside US
    - foreign B may be < 1 b/c of low correlation (BUT σ usually very high)
    - remember to distinguish b/w diversifiable and market risk
  - inside US (by foreign firms)
    - **i)** calc Beta of US industry relative to local (foreign) market index)
    - **ii)** identify expected risk premium on local (foreign) market index
    - **iii)** multiple (i) by (ii) = appropriate discount rate b/c Beta measures risk relative to investor's portfolio
  - question – do some countries have lower cost of capital? (p. 254)

  - fact that investors (e.g., Japanese) are willing to incur the cost of buying foreign is indicative of lower CoC in their home country

- consider –
  - random variables -
  - probability ~ relative frequency

- remember -
  - risk of well diversified portfolio depend son market risk of individual securities within portfolio
  - market risk explains most risk in well diversified portfolio
  - risk of well diversified portfolio = proportional to portfolio Beta (which = avg Beta of securities in portfolio)

VI. Balancing Risk / Return (Markowitz)

- Goal = find best portfolio with given # of stocks

- efficient portfolio – lies on efficient frontier + represents the highest expected return at lowest level of risk (σ)
  - found w/ quadratic programming
  - if lend / borrow at risk free rate → a best efficient portfolio lies on line b/w risk free rate and efficient frontier
    - lending = invest in US treasuries
    - best efficient portfolio = intersection of line and efficient frontier
  - finding best efficient portfolio = only two portfolios ~ risky portfolio S + r_f loan
    - i) find efficient frontier (stock only investments)
    - ii) find best portfolio (blend of stock and r_f investments)

- Security Market Line – line along which all portfolio's must lie in a competitive market (depending on their Beta)
  - since no stocks will lie below → none can lie above (since all must lie on line on avg)

- CAPM – calculating risk premium
  - risk premium varies in direct proportion to Beta
  - when examining stock → look at contribution to portfolio risk (not risk of stock in isolation)
  - testing of model – difficult b/c we can only observe actual results to compare against models expected results
  - limit to model –
    - CAPM requires that be able to invest in all risky investments (this is difficult beyond securities)
    - other models seem to predict returns (value return > growth return) – this is incompatible b/c CAPM requires that it is only one
  - assumes – but many are not crucial
    - US Treasuries = risk free
    - investors borrow / lend at same rate
    - investors only concerned re future wealth

- alternative theories –
  - consumption CAPM –
    - measures stocks' sensitivity to changes in investors consumption using consumption Betas
    - challenge = measuring consumption
  - arbitrage pricing theory –
    - assumes that stock return driven by separate macro-economic factors (b_1) + noise
    - risk premium depends on expected risk premium associated with each factor and stock's sensitivity to each factor
    - unique risk is diversified away (premium = only for market risk)
    - bene = no reliance on CAPM's market portfolio
    - con = difficult to identify factors
    - process
      - i) identify factors (**see p. 206 for how**) – Yield spread + int rate + exch rate + Real GNP + Inflation + residual factor for remaining unexplained difference from market
      - ii) estimate risk premium for each factor -
      - iii) estimate factor sensitivities -
  - Three Factor Model – Market factor (r = 5.2%) + size factor (r = 3.2%) + Book-to-market factor (5.4%)

VII. Debt Policy

- Firm Value (V) = Value Debt + Value Equity

- value additivity – value of firm w/ two assets s/b = to combined investment in two separate assets ~ PV (AB) = PV(A) + PV(B)
  - ~ law of conservation of value ~ value of asset is preserved regardless of nature of claims against it
  - combining / splitting assets <> affect value ***SLA*** does not affect investor choices

- General (B&M 17)
  - choice of capital structure = marketing problem (need to find security combo = greatest appeal to investors)
  - general proposition – maximizing firm value = best for S/H

- MM Prop I – ***capital structure has no effect on firm value***
  - homemade leverage - can acquire same return in unlevered / levered firms with similar ops
  - ~ value is determined on left hand side of B/S
  - only way capital structure is relevant → if insufficient supply of levered firms (which provide ltd liab to S/H)
  - capital structure also irrelevant if S/H holds fully diversified portfolio (does not care where C/F comes from)
  - investor can get same return as levered firm by borrowing / investing more in unlevered firm
  - firm borrowing <> anything that S/H cannot do on their own → T/F S/H will not pay more / less for this

  - leverage – increases expected earnings stream per share (but not sh P) b/c increased earnings are exactly offset by change in capitalization rate

  - expected return on Assets = $[D / (D+E)] * r_D + [E / (D+E)] * r_E$
    - = exp oper income / MV of all securities
    - borrowing decision <> effect either oper income nor MV

  - expected return on Equity = $r_A + D/E (r_A - r_D)$

  - violated – only if firm can offer unsatisfied clientele a fin instrument unavailable b/c of imperfect markets
    - gov't interactions – regulation of fin services
    - BUT – opportunity may be available only to first mover

- MM Prop II – ***exp ROR on C/S of levered firm increases in proportion to D/E ratio (expressed in MV)***
  - rate of increase – depends on spread b/w r_A and r_D (where r_A = wgted avg return of $r_D + r_E$)
  - as D rises → default risk rises + firm required to pay higher int rate on D (and rising return on E slows)
  - debt holders begin to bear business risk
  - any increase in expected return = offset by increase in risk + results in rising RoR by S/H
  - rising Debt <> effect $ risk to equity (b/c less equity O/S) = effect spread of required % returns
    - impacts Beta → $B_{assets} = [D / (D+E)] * B_D + [E / (D+E)] * B_E$
    - $B_E = B_A + (D/E) [B_A – B_D]$
    - Required return on equity (driven by B_E) simply rises to match increased risk

- Traditional Position – B&M 476
  - theory –
    - moderate leverage increases r_E while r_A decrease, but after some optimal amt of Debt → r_E rises faster than MM predicts
    - b/c markets are imperfect (unlike MM predictions)
    - consider EOS in borrowing → group individuals may do better by pooling resources and borrowing thru corp (But many levered firms already exist)
  - based on - WACC ***$= K_w = r_A = (D/V) r_D + (E/V) r_E$***
    - still assumes MM Prop I holds (or weighted avg would not work)
  - remember –
    - S/H want mgmt to increase firm value (not reduce WACC)
    - Debt drives up S/H ROR
  - problem
    - focuses on minimum WACC
    - assumes that K_E <> change as debt rises
    - r_A w/h/t decline as Debt rises b/c eventually at position w/ no assets → lenders become S/H (w/ same initial position as original S/H)

- How Much Debt (B&M 18)
  - tax shield = $[T_C (r_D D)] / r_D = T_C D$
    - raises the total amount available to pay out to D/H & S/H
    - ~ asset of value (depends on corp rate & level of N/I)
    - assumes
      - discount at interest rate (b/c risk is same as on debt + s/b discounted at low rate) ~ perpetuity
      - positive N/I
      - subject to T_C
    - impact on V_E - MMI
      - size of pie (Pre-tax) not influenced by how you slice it
      - BUT gov't = 3rd slice
      - reducing gov't slice raises V_E
    - problems -
      - can't think of Debt as perpetual in practice
      - need π to shield int
      - some firms tax rate varies below marginal rate

  - MMI w/ taxes – $V_{firm} = V_{\text{if all equity financed}} + PV(\text{tax shield})$
    - BUT – many large firms (Pfizer) thrive w/ no debt
    - doesn't seem realistic → optimal capital structure w/b 100% Debt

  - Corp Goal = s/b to minimize all taxes (corp & personal)
    - consider
      - tax on different forms of equity income (Div ~ marg rate; CG ~ c/b < 20%)
      - difficult to tax minimize at corp level for indiv S/H

    - relative tax advantage of Debt = $(1-T_p) / (1-T_{pE})(1-T_C)$

    - Value of Tax Shield – find tax rates of marginal investor (~ equally happy w/ equity or debt)
      - **i)** calculate difference in yield b/w T/E muni bonds and US treasuries (~ yield investors willing to give-up)
      - **ii)** at what tax rate would investor be willing to hold either investment
      - **iii)** calculate amt of corp income paid out in Div (~ 28% of earnings currently) w/ remainder = CG
      - **iv)** Advantage of Debt = difference in $1 in income of each interest and equity income
      - **BUT** – income may be tax shielded by other deductions
  - Costs of Financial Distress –
    - financial distress – when BV Debt > MV of assets
    - depend on type of asset – intangible asset hurt more than real estate (e.g.,)

    - $V_{firm} = V_{\text{if all equity financed}} + PV(\text{tax shield}) - PV(\text{costs of Fin Distress})$

    - **a)** Bankruptcy costs
      - right to default ~ valuable privilege conferred by ltd liab
      - bankruptcy ~ legal mechanism for transferring ownership rights from S/H to CR
      - **i)** direct costs ~ costs of using mechanism – legal transaction costs (atty, accy, bank fees) + additional ROR required by CR to cover possibility they will need bankruptcy mechanism
      - **ii)** indirect costs – reluctant suppliers / customers + admin oversight of courts +
    - **b)** conflicting int of S/H & B/H ~ agency costs
      - **i)** risk shifting – S/H gain w/ increased business risk (re: neg NPV projects)
      - **ii)** refuse to contribute capital – b/c first return goes to B/H (re: positive NPV projects)
      - **iii)** looting the company –
      - **iv)** delaying tactics –
      - **v)** bait and switch -
    - **c)** covenants – in response to agency costs → reduce oper flexibility + monitoring costs

- trade off theory of capital structure – cap structure is trade off b/w int tax shield and costs of financial distress
  - target debt raio varies from firm to firm
  - safe companies (lots of earnings) can rely on more Debt

- unprofitable companies – should rely on more Equity (pay off debt by selling assets / constraining Div)
- BUT – in practice – unprofitable companies are ones most often forced to rely on debt

- Pecking Order of Financial Choices
  - order = internal equity + issue Debt + issue equity
  - assumes asymmetric info b/w S/H & mgmt
  - issuing Equity → signals stock over valued BUT may need in order to avoid Fin Distress
  - issuing Debt → signals need cash to invest + stock is undervalued (or would have issued equity)
  - problem = educating investors
  - consider – industry may require conservative financing (~ prefer equity issuance)
  - Financial Slack –
    - having financial cushion available to invest while delaying / avoiding going down pecking order
    - c/b bad if allows mgmt to grow fat / lazy (solution = debt – forces timely payments)

- remember
  - expected return on share = Earnings / Price ratio
  - leverage – increases expected earnings stream (but not sh P) b/c increased earnings are exactly offset by change in capitalization rate

VIII. Financing and Valuation Using WACC (BM 19)

- MMI – Review
  - Firm Value = value of all equity financing + PV (tax shield)
  - w/o taxes or other market imperfections → CoC <> depend on financing
  - WACC = opportunity CoC (r) regardless of D/E (but cannot infer (r) – it m/b inferred from r_D, r_E, & D/E)
    - pre-tax WACC = r_D (D/V) + r_E (E/V)
    - post tax WACC = $r_D(1-t)(D/V) + r_E$ (E/V)
      - is less than (r) b/c of tax deduct for int
    - limit – ***WACC formula works for only avg projects that do not change firm's D/E ratio***
    - always – use MV (~ r_E = ER on current price of stock)
  - $Value_{Assets} = V_D + V_E$
  - ER_{Equity} = Expected equity income / equity value
    - Expected equity income = annual After Tax CF – After Tax Interest Payment [~ $C - (1-T_C)r_D D$]
  - assumptions (when discounting at WACC) ~ project business risks are same as corp's + project is same D/E

- WACC issues
  - multiple sources of financing – simply add other factor to equation [e.g., r_{PS} (PS / V)]
  - short term debt –
    - often zeroed out if net to zero w/ current assets (or will reverse in ST rather than simply being renewed)
    - exception – if ST debt is important source of financing (e.g., new / small firms) → show on right side as total capitalization
  - current liabilities – usually netted against current assets
  - calculating cost elements
    - r_E – stock market data
    - r_D – either market value if traded or look to traded debt with similar risk profile
    - D – look to books (MV ~ BV)
    - V – stock price
    - Convertible Debt – more difficult due to the option value
    - Junk Debt –
      - notional rate is promised and not the actual expected RoR (which avgs in losses expected to occur)
      - BUT – expected RoR ~ notional RoR IFF risk of default is small
      - solution – either (i) use CAPM if Betas known or (ii) adjust yield for probability of default
  - industry CoC – may be used instead

- Valuing Companies
  - WACC – treat company as if were one big project
    - WACC is correct discount rate if D/E expected to remain constant
    - remember –

- do not deduct interest
- forecast to medium term horizon and add terminal value
- WACC values assets / ops of company (not equity → must subtract V_D)
- WACC only works for projects which are carbon copies of firm
- source of financing <> matter; contribution of project to firm debt capacity does matter (i.e., is project borrowing against existing assets / debt capacity)
- increasing D/E ratio increases financial risk to S/H and increasing K_E
- as D/E increases → WACC falls due to deduction of interest (not b/c of lower K_D)
- rebalancing – if does not occur → WACC does not work → use Adjusted PV instead (below)
  - B&M prefer to assume Debt rebalancing to assuming fixed debt levels (b/c project value will fluctuate)
  - effect ~ tax shields are no longer fixed

– if D/E changes – either
- **A)** recalc WACC
  - **i)** Calc opport CoC (r) ~ unlever WACC (***MMI***)
    - pre-tax WACC = $r_A = r_D(D/V) + r_E (E/V)$ ~ independent of leverage
  - **ii)** estimate K_D at new debt ration & calculate new K_E (***MMII***)
    - $r_E = r_A + (r_A - r_D)\ D/E$
  - **iii)** recalculate WACC
    - $WACC = r_D (1-T_C) (D/E) + r_E (E/V)$
- **B)** relever Betas
  - **i)** unlever Beta → $B_{asset} = B_{debt}(D/V) + B_{equity}(E/V)$
  - **ii)** relever Beta → $B_{equity} = B_{asset} + (B_{asset} - B_{debt})\ (D/E)$

➢ Flow to Equity Method – discounts CF to equity (after interest and taxes)
– simpler if D/E proportions remain constant over time
– discounting at one rate fails if – financial levg changes significantly over time (b/c K_E depends on financial risk + business risk)

➢ Adjusted PV –
– calculation -
- **i)** Base Case – value project as if a mini-firm financed solely w/ equity
- **ii)** adjust Base Case result for individual factors
  - issue costs – subtracted from base case
  - changed Debt capacity – Base Case NPV + PV (tax shield)
    - PV (tax shield) – only if pay taxes + gov't taxes income at both levels + debt capacity depends on how well a firm does

– RoT – accept projects w/ positive PV discounted at Adjusted CoC
- Adjusted CoC – opportunity CoC reflecting financial side effects of a project

• Discounting Safe C/F – consider if should use different rates for different Cash Flows
➢ vendor financing - discount rate = after tax, unsubsidized borrowing rate (b/c calculating the debt equivalent that c/b borrowed thru normal channels, using CF as debt service)
– safe – b/c company commits to pay if takes loan
– nominal – b/c amt is fixed regardless of inflation
– NPV of unsubsidized loan = Amt receieved$_{T0}$ – NPV of future payments
➢ Depreciation tax shield – maybe discount at different rate if fixed / safe

• remember –
➢ NPV effect of interest deduction → NOT recognized thru C/F → recognized in form of lower discount rate (i.e., C/F calc'ed as if all equity financed → r depends only on business risk)

IX. Dividend Policy (B&M 16)

- Issue – Does Div Policy affect firm value?

- M&M –
  - dividend policy is irrelevant in perfect capital markets because any affect of dividends is offset by an implicit effect on the eventual capital G/L realized by shareholders
  - investors do not need Div to get cash (they can sell stock) → they will not pay extra for shs in a company just b/c of its div policy
  - assumes –
    - firm's overall dividend and investment policies are not impacted by Div policy (i.e., cash for Div does not inhibit firm's ability to invest in positive NPV projects)
    - if capital constrained → firm simply recycles cash by issuing new stock to raise funds to pay Div
  - share repurchase – accomplishes the same thing (but may be taxed differently) – does not affect overall S/H wealth
  - remember – V_{firm} <> affected by share repurchase / Div decision

- Rightists –
  - favors large dividends – believes some investors pay higher sh P to receive Div
  - driven by – market imperfections → e.g., some investors legally required to invest in corps w/ long Div history + investors may not trust mgmt to re-invest earnings wisely

- Leftists – (BM 448)
  - prefers lower dividends b/c of tax differences (Ord inc v. Cap Gains; double v. single corp taxation)
  - goal – corp shifts from dividends (no tax deduction + higher ord inc tax rates for S/H) to repurchasing stock (no tax deduction but lower Cap Gain rates for S/H and S/H decide when to incur tax)
  - literal interpretation = don't pay any dividends at all
    - BUT – IRS may recast repurchase as Div
  - consider – OI / CG tax rate differential is lower today than in past

- Middle of the Roaders – (BM 452) – includes Miller / Black / Scholes
  - Div policy <> effect on company value
  - Key – No current benefit from div policy (any investor desire for high payout companies has already been met / is already being met by current high Div pay out companies)
  - Problem – Div incur higher taxes → so why do investors want Div
    - **i)** MOR claim that loopholes in tax system allow taxpayers to avoid this
    - **ii)** wealth signaling issues -
      - companies paying low Div are more attractive to highly taxed investors (these people prefer Capital Gains)
      - companies paying high Div tend to attract low taxed institutional investors (~ pensions, etc) who are more diligent in monitoring mgmt (thus high Div firms will be better run)