Lecture notes, lectures 1-10 - Finance Formula Sheets

Financial Management (University of Ottawa)

Chapter 5 – Time Value of Money

	Single cash flow or payment	Ordinary Annuity – More than 1 equal cash flow	Annuity Due – More than 1 equal cash flow (beginning of period)	More than 1 cash flow where the cash flows are unequal	n = number of time periods k = interest rate/rate of return PMT = payment (cash flow) **Ordinary Annuity** = The payments (PMT) or cash flows that occur during or at the end of the period) **Annuity Due** = The payments (PMT) or cash flows that occur at the beginning of the period.
Future Value (FV)	$FV_n = PV_0(1+k)^n$	$FV_n = PMT\left[\frac{(1+k)^n - 1}{k}\right]$	$FV_n = PMT\left[\frac{(1+k)^n - 1}{k}\right] \times (1+k)$	$FV_n = \sum_{i=n}^{i=1} CF_i(1+k)^i$	
Present Value (PV)	$PV_0 = \frac{FV_n}{(1+k)^n}$	$PV_0 = PMT\left[\frac{1 - \frac{1}{(1+k)^n}}{k}\right]$	$PV_0 = PMT\left[\frac{1 - \frac{1}{(1+k)^n}}{k}\right] \times (1+k)$	$PV_0 = \sum_{i=n}^{i=1} \frac{CF_i}{(1+k)^i}$	

Perpetuity = An ordinary annuity that lasts forever. Can only be measured by PV.	$PV_0 = \frac{PMT}{k}$	**Effective Annual Rate**	$k = \left(1 + \frac{QR}{m}\right)^m - 1$	QR = Quoted rate m = compounding frequency or number of times it compounds in a year n = number of payments per year
Perpetuity Due = An annuity due that lasts forever. Can only be measured by PV.	$PV_0 = \frac{PMT}{k} \times (1+k)^n$	**Effective Rate for any period**	$k = \left(1 + \frac{QR}{m}\right)^{m/n} - 1$	

Chapter 6 – Bond Valuation & Interest Rates

Bond Valuation – Can only be measured by PV	If no tax rate then ammit Bond Price (PV) $= I \times (1-T) \times \left[\frac{1 - \frac{1}{(1+k)^n}}{k}\right] + \frac{F}{(1+k)^n}$	I = dollar amount of coupon payment (coupon rate x 1000) F (face) or FV or par value = usually 1000 unless stated otherwise n = number of periods until maturity k = interest rate B = Bond price C = Call price	**Yield –to-Maturity**	$YTM = \frac{\left[I + \left(\frac{(F-B)}{n}\right)\right]}{\left[\frac{(2B+F)}{3}\right]}$
Perpetual Bond	Bond Price or PV $= \frac{I}{k}$			
Zero Coupon	Bond Price or PV $= \frac{FV}{(1+k)^n}$		**Yield-to -call**	$YTC = \frac{\left[I + \left(\frac{(C-B)}{n}\right)\right]}{\left[\frac{(2B+C)}{3}\right]}$

Chapter 7 – Equity Valuation

Dividend Discount Model (7-4)

$$PV_0 = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \ldots + \frac{D_n + P_n}{(1+k)^n}$$

P_n = Price of shares

When price is not given, the question may say dividends grow at a constant rate into future → to calculate share price in this case go to next box→→

Calculating prices of shares based upon dividends growing constantly (which could be 0) into the future:

$$P_0 = \frac{D_0(1+g)}{k_e - g} = \frac{D_1}{k_e - g}$$

D1 = next years dividend or expected dividend

$D_1 = D_0(1+g)$.

Other Equations

1. Gordon Constant Growth: $k_e = \frac{D_1}{P_0} + g$
2. Capital Gain Yield (Chapter 8): $= \frac{P_1 - P_0}{P_0}$
3. Dividend Yield (Chapter 8): $\frac{D_1}{P_0}$
4. Total return (Ke) = Capital Gain Yield + Dividend Yield

Chapter 9 – Capital Asset Pricing Model (CAPM)

Security Market Line (SML)	
$k_e = RF + \beta(ER_M - RF)$	RF = risk free rate β = beta of company, industry or market ER_M = market rate of return $(ER_M - RF)$ = market risk premium

Portfolio Beta	
$\beta_P = w_1 \beta_1 + w_2 \beta_2 + w_3 \beta_3 \ldots + w_n \beta_n$	Weighted average total of amount invested per security multiplied by its beta.

Chapter 20 – Weighted Average Cost of Capital

	Weighted Average Cost of Capital – Internal capital	Marginal Cost of Capital – Cost of raising new capital
Main Equation	$WACC = \frac{B}{V}k_i + \frac{P}{V}k_P + \frac{E}{V}k_e$ (and V = B + P + E)	$MCC = \frac{B}{V}k_i + \frac{P}{V}k_p + \frac{E}{V}k_{ne}$ (and V = B + P + E)
Cost of Preferred Shares - Kp	1.) Calculate cost of preferred shares: $k_p = \frac{D_p}{P_0}$ • only applied to debts + bonds (Kpbn) B = total amount of debt P = preffered shares E = total amount of equity	1.) Is there issuance of new preferred shares? 2.) If yes, subtract issuance costs from present value or price to get net proceeds = NP = PV – issuance costs 3.) Calculate cost of new preferred shares: $k_p = \frac{D_p}{NP_p}$
Cost of Common Equity - Ke	1.) Calculate cost of common equity with the Gordon constant growth formula: $k_e = \frac{D_1}{P_0} + g$ 2.) OR Calculate cost of common equity the SML way: $k_e = RF + \beta(ER_M - RF)$ If given information for both then you must solve both and average the two	1.) Is there issuance of new shares? 2.) If yes, subtract issuance costs from present value or price to get net proceeds = NP = PV – issuance costs 3.) Calculate cost of new common equity with the Gordon constant growth formula: $k_{ne} = \frac{D_1}{NP} + g$ → not 4.) OR Calculate cost of new common equity with SML: i) First: $k_e = RF + \beta(ER_M - RF)$ ii) Then: $k_{ne} = \left[\frac{P_0}{NP}\right]k_e$
Cost of Bond - Ki	1.) Calculate cost of debt with bond formula: $\text{Price (PV)} = I \times (1-T) \times \left[\frac{1 - \frac{1}{(1+k_i)^n}}{k_i}\right] + \frac{F}{(1+k_i)^n}$ Ki = I x (1-T) / NP	1.) Is there issuance of new bonds? 2.) If yes, subtract issuance costs from present value or price to get net proceeds = NP = PV – issuance costs 3). Calculate cost of debt with bond formula: $NP = I \times (1-T) \times \left[\frac{1 - \frac{1}{(1+k_i)^n}}{k_i}\right] + \frac{F}{(1+k_i)^n}$ 4.) OR if n is not given, then: $k_i = I \times (1-T) / NP$
Equation to determine how much a firm can invest (or spend) from internal funds before it needs to raise external equity (new shares)	→ $Break\ Point = Internal\ Funds\ Available / (E/V)$	

Chapter 13 – Capital Budgeting – Decision Criterion

Project Decision Criterion	Equations	Accept or Reject
Net Present Value (NPV)	Solve for NPV: $NPV = \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \frac{CF_3}{(1+k)^3} + \ldots - CF_0$	Accept if NPV is positive (PV of cash inflows is greater than cash outflows)
Internal Rate of Return (IRR)	Solve for IRR: $0 = \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3} + \ldots - CF_0$	Accept if IRR ≥ K
Profitability index (PI)	PI = (PV of cash inflows)/(PV of cash outflows)	Accept if PI ≥ 1.0
Payback period (PB)	1. Payback period calculation – Example 13-5 (p.525) 2. Discounted payback period calculation – Example 13-6 (p.526)	Not rated highly but tells us how long project revenues take to recover project costs
When comparing two projects of unequal lives	1. Calculate the **equivalent annual NPV (EANPV)** for each of the projects and choose the one with the higher EANPV $EANPV = Project\ NPV / \left[\frac{1-\frac{1}{(1+k)^n}}{k}\right]$ 2. **Chain Replication Approach** – Example 13-9 (p.531)	

k for present value when freq cashflows
Real = Nominal − inflation
1 + nominal = (1 + real)(1 + inflation)

Chapter 14 – Cash flow estimation and capital budgeting decisions

	Estimating and discounting cash flows	C_0 = cost of new asset which includes purchase price, shipping costs, installation costs. ΔNWC = change in net working capital CCA tax savings = (CCA)x(T) CCA calculation – Draw Table where CCA = UCC x CCA rate (Half-year convention for the first year)	Valuation by components – When operating CFs are equal
Initial after-tax cash flow (CF_0)	1. Cost of new $CF_0 = C_0 + \Delta NWC + OC$ Note: Subtract salvage value of old asset if it is sold.		1. $PV_0(Operating\ Cash\ Flows) = CFBT(1-T)\left[\frac{1-\frac{1}{(1+k)^n}}{k}\right]$
PV of expected annual after-tax cash flows	2. Before tax operating Income (revenues – costs) - Taxes payable on operating income After-tax operating income + CCA tax savings Net Cash Flow CFBT(1-T) + $CCA_n(T)$ 3. Find PV of these future cash flows		2. $PV(CCA\ Tax\ Shield) = \frac{(C_0)(d)(T)}{d+k} \times \frac{(1+.5k)}{(1+k)} - \frac{(UCC_n)(d)(T)}{(d+k)} \times \frac{1}{(1+k)^n}$ When the asset class is closed you include UCC if open do not use you then to 14-7
Ending after-tax cash flow (ECFn)	4. $ECF_n = SV_n + \Delta NWC$ 5. If $SV_n > C_0$ then subtract: $-(SV_n - C_0) \times T$ 6. If $SV_n \neq$ UCC then subtract: $-(SV_n - UCC_n) \times T$ Capital Gains Recapture 7. Find PV of ECFn		3. If SV_n > UCC then subtract: $-\frac{(SV_n - UCC_n)(T)}{(1+k)^n}$ not included when salvage value is 0 4. If 2. If $SV_n > C_0$ then subtract $PV(Capital\ Gains\ Taxes\ Paid): -\frac{(SV_n - C_0)(T)}{(1+k)^n}$
Add them all	8. $NPV = PV(Annual\ CFs) + PV(ECF) - CF_0$		$NPV = PV(Operating\ CFs) + PV(CCA\ Tax\ Shield) +$ 5. $PV(ECF) - PV(Capital\ Gains\ Taxes\ Paid) - CF_0$

Chapter 23 – Working Capital Management

Working Capital Ratios	Efficiency Ratios	Operating and Cash Conversion Cycle
1. Current Ratio = Current Assets (CA)/Current Liabilities (CL) 2. Quick Ratio = Cash (C) + Marketable Securities (MS) + Accounts Receivable (AR)	1. Receivables turnover (RT) = Revenue/AR 2. Average Collection Period (ACP) = AR/Average daily revenue (ADR) = AR /(Annual sales/365) = 365/RT	1. Operating Cycle (OC) = ADRI + ACP 2. Cash conversion cycle = OC – ADRP = ADRI +ACP - ADRP
Accounts payable management ratios		
1. Payables turnover (PT) = Revenue/Accounts payable 2. Average days of revenue in payables (ADRP) = Accounts payable/ADR = 365/PT	3. Inventory turnover (IT) = Cost of goods sold (CGS)/Inventory = Revenue/Inventory 4. Average days in inventory (ADRI) = Inventory/ADR = 365/IT	

Chapter 24 – Accounts Receivable

Income Statement Approach	NPV approach of the text book		Short-term Financing Considerations
Sales Less: Cost of goods sold Less: Discounts (if provided) Net sales Less: Production costs Π before taxes & credit costs Less: Cost to carry receivables Less: Collection expenses Less: Bad debt losses Profit before taxes Less: Taxes (40%) Net Income	1. Calculate ΔReceivables = New Receivables – Old Receivables 2. Calculate incremental before-tax annual CFs = [ΔSales - ΔProduction Costs - ΔCollection Expenses - ΔBad Debt Losses – Discount losses] 3. Calculate appropriate after-tax discount rate (k): = (given discount rate) x (1-T) 4. PV(Future CFs) = (After-tax incremental CFs)/k = (Answer from 2) x (1-T)/(k from 3) 5. NPV = PV(Future CFs) – CFo Examples 24-1, 24-2, and 24-3 illustrate this well.		1. Estimate the annual effective rate or return or cost (k) associated with any financing alternative: $k = \left(1 + \frac{n\text{-day financing cost}}{\text{Purchase price}}\right)^{365/n} - 1$ Note: (i) In case of Commercial Paper (CP), n-day financing costs include Standby Fees and any discounts given. (ii) In case of Bankers Acceptance (BA), n-day financing costs include Stamping Fees and discount given. (iii) You can also answer questions such as what is the cost of 3/15 net 60 trade credit? → Answer = cost k = $(1+3/97)^{365/45}$-1=28.03% annually. 2. Commercial Paper (CP) and Bankers Acceptance (BA) is usually quoted based on an approximate yield, calculated this way: $\textit{Approximate annual yield} = \frac{\text{Discount}}{\text{Market price}} \times \frac{365}{\text{Days to maturity}}$ 3. Calculating the approximate cost of giving a discount: APR or QR = [Disc.%/(100% - Disc.%)] x [365/(Credit period - Discount period)]
Note: When a firm offers 3/15 net 60 trade credit: →3/15 means 3% discount if customers pay in 15 days →net 60 means customers have 60 days to pay with no discount given.			