

CHE374 Midterm 2 Cheatsheet

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Interest

The compound interest rate is given by

$$F = P \left(1 + \frac{r}{m}\right)^m = P(1 + r_{\text{eff}})$$

where r is the nominal interest rate for 1 period (usually for 1 year), and m is the number of times compounded per period.

Equivalence Factors

- $(F/P, i, N) = (1 + i)^N$
- $(P/A, i, N) = \frac{(i+1)^N - 1}{i(1+i)^N}$
- $(P/G, i, N) = \frac{1}{i^2} \left(1 - \frac{1+iN}{(1+i)^N}\right)$
- $(P/Geom, i, g, N) = \frac{1}{i-g} \left(1 - \left(\frac{1+g}{1+i}\right)^N\right)$

For geometric, $P = A(P/Geom, i, g, N)$. For linear, $P = G(P/G, i, N)$.

Comparison 1

The internal rate of return IRR is the discount rate at which $PW = 0$. For simple investments where benefits come later than investments, $IRR > MARR$ means it is worthwhile and $IRR < MARR$ means it is not worthwhile.

The payback period is the time T such that the investment is recouped. There are two types:

- Payback period: Time such that \sum revenue is equal to initial investment.
- Discounted Payback period. Time such that $\sum PW$ until it is equal to initial investment.

Note: not standard engineering practice as it disregards benefits after payback period.

Comparison 2

The incremental IRR is used to quantify the efficiency of switching between projects. Switching from project A to B will have

$$\Delta IRR_{A \rightarrow B} = i^*, -\Delta FC + \Delta AC(P/A, i^*, N) = 0,$$

where $\Delta FC = FC_B - FC_A$. Algorithm for comparisons:

1. Order in increasing order of FC

2. Start with “do nothing”
3. 1 by 1, evaluate each against the best alternative found so far. If $\Delta_{A \rightarrow B} IRR > MARR$, then select the new alternative B over A . Repeat this step until all alternatives are evaluated.

Depreciation

In general, $B = BV_0$ and $BV_t = BV_{t-1} - D_t$,

We have models:

- Straight line: $D_t = \frac{B-S}{N}$ and $BV_t = B - t \frac{B-S}{N}$
- Declining Balance (DB): $D_t = BV_{t-1}d$, $BV_t = B(1-d)^t$, $d = 1 - \sqrt[N]{S/B}$
- Double declining: If N is known, then set $d = 2/N$ and apply DB.
- SOYD: $SOYD_N = 1 + \dots + N = \frac{N(N+1)}{2}$. Then $D_t = \frac{N-t+1}{SOYD_N}(B-S)$ and it can be derived,

$$BV_t = B - \frac{k}{2} \cdot \frac{B-S}{SOYD} (2N+1-k)$$

- Unit of production: $D_t = \frac{\text{production in year } t}{\text{lifetime production}} (B-S)$

Accounting Transactions

Transactions and their impact on account:

- Purchase inventory on account: +inventory, +account payable
- Paid employees for current month: -Cash, +SG&A
- Sold goods for cash: +Cash, -Revenue
- Expenses paid in cash: -Cash, +SG&A
- Collection of accounts receivable: +Cash, -Acc. Receivable
- Paid accounts payable: -Cash, -Acc. Payable
- Inventory sold: -Inventory, +COGS
- Depreciation: -Plant/Equip, +Depreciation Expense
- Tax Expense (to be paid later): +Tax Payable, +Tax Expense
- Paid Dividend: -Cash, +Dividend
- Paid rent for NEXT month: -Cash, +Prepaid Expenses
- Bought stocks (short term): -Cash, +Investment
- Bought in a partner for [money]: +Cash, +Paid-in Capital Others

- Borrowed from bank (5-year loan): +Cash, +Long term Debt
- Performed services and paid full in cash: +Cash, +Revenue
- Performed services on account and invoiced for 3k: +Acc Receivable, +Revenue
- Interest on Loan: +Interest Expense, +Interest Payable

Liquidity Ratios

- Current ratio: Measures the company's ability to meet short-term debt obligations; paying current liabilities w/ current assets

$$\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

The higher the ratio, the more current assets available to pay off current debt. Numbers below 1 could be sign of concern.

- Acid test ratio: Shows company's ability to pay off debts if all of them were due immediately. A higher acid test ratio means less risk and uncertainty over short term liabilities.

$$\text{Acid-Test Ratio} = \frac{\text{Cash} + \text{Short Term Investments} + \text{Net current receivables}}{\text{current liabilities}}$$

Efficiency Ratios

- Inventory Turnover: Measure of the number of times the average level of inventory is sold during the year

$$\text{inventory turnover} = \frac{\text{cost of good sold}}{\text{average inventory over period}}$$

A high number indicates an ability to quickly sell inventory. A lower turnover means it's less efficient.

- Day's inventory: Measures speed at which inventory is sold. Lower value indicates more efficient operation

$$\text{Days Inventory} = \frac{\text{Average Inventory}}{\text{cost of goods sold per 1 year period} / 365}$$

- Accounts receivable turnover: measures how quickly a company collects money from its customers; its ability to collect cash from credit customers

- accounts receivable turnover = (net credit sales == total sales) / average net accounts receivable

- Days receivables: number of days that an invoice is outstanding before payment is collected.

- days receivable = average receivables / (sales for 1 year period / 365)

Leverage Ratios

- Debt ratio: proportion of assets financed with debt
 - Debt ratio = total liabilities / total assets

- Debt Equity Ratio = Total Liabilities / Total Equity

- Equity Ratio = Equity / Total Assets

- A higher equity ratio means it has less debt and and less leverage, making it safer.

- Times-Interest-Earned: Measures the number of times that operating income can cover interest expense.

- times interest earned = (operating income OR EBIT) / interest expense

Profitability Ratios

- Profit Margin: percentage of each sales dollar earned as net income

- Net income / Net sales

- Return on Assets (ROA): Measures how well a company is making money based on all the finance resources committed to the firm

- assets = liabilities + equity

- ROA = net income / average assets

- ROA = [net income + interest(1-tax rate)] / average assets

- Return on shareholders' equity (ROE): Measures how much the company has earned on funds invested by shareholders

- ROE = Net income / average equity

- Earnings per Share (EPS): measures the profitability of a company on a per share basis

- EPS = Net income / total shares outstanding

Performance Ratios

- Price to Earnings (P/E): relates a company's share price to its EPS

- P/E = Share Price / EPS

High P/E could mean overvaluation or expectations of high growth rates. Not used for companies with no or negative earnings. Would expect higher P/E for company with more debt compared to equivalent company with less debt.

- Dividend yield: Shows how much a company pays out relative to its stock price

- Dividend Yield = Dividend per share / price per share

Mature and stable companies most likely to pay dividends. New and high-growth companies more likely to reinvest earnings instead.

- Dividend payout ratio:

- Dividend payout ratio = dividends/net income = (dividends/share)/EPS

- Market Capitalization: Total dollar market value of a company's outstanding shares of stock

- Market cap = price per share × shares outstanding

Collecting accounts payable and accounts receivable (in days) implies

- Collecting A/R faster indicates less risk and better leverage over customers

- If D pays bills faster than H, this indicates a more efficient cashflow and finances. However, this means less cash in hand to work with.

Also, tax rate = tax / income before taxes

Balance Sheet

- Paid-in Capital - Primary: contains common stock

- Paid-in Capital - Others: equity of everything that's not you

- Retained earnings = Net income + retained earnings at previous period (year) end

Balance Sheet as of October 31, 2010.

Misc

Assets		Liabilities	
Current Assets		Current Liabilities	
Cash	Accounts Receivables	Acc. Payable	Short Term Debt
Inventories	Prepaid Expenses	Accrued Liab.	Wages Payable
Investments	Total Current Assets	Taxes Payable	Total Current Liabilities
Noncurrent Assets	Land	Noncurrent Liabilities	Long term debt
Plant and Equip. at Cost	Less Depreciation	Total Noncurrent Liabilities	Total Liabilities
Plus Equip. Net	Total Noncurrent Assets	Equity	Paid-in Capital - Primary
Total Assets			Paid-in Capital - Others
			Retained Earnings
			Total Equity
			Total Liabilities and Equity

Income Statement for the Month of October.

Income Statement	
Revenue	Cost of sales
Gross margin	Selling and Admin (SG&A)
EBITDA	Depreciation
EBIT	Interest expense
Income before taxes	Income before taxes
Income for taxes	Net Income
Dividends	Addition to Equity