



Financial Statement Analysis and Equity Valuation Models

Topic 6

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Main Points

- Purpose—to use accounting data to estimate the intrinsic value of stocks
- Tools Used
 - Financial statements
 - Ratio analysis
- Limitations
 - Differences in accounting procedures



Accounting Vs. Economic Earnings

- Economic earnings—sustainable cash flow that can be paid out to stock holders without impairing the productive capacity of the firm
- Accounting earnings—affected by some conventions (inventories, depreciation); business cycles
- However, net income figure conveys considerable information regarding a firm's prospects



Ratio Analysis

- Uses
 - Trend analysis
 - Comparative analysis
- Type of financial ratios
 - Liquidity ratios
 - Turnover and asset utilization ratios
 - Leverage ratios
 - Profitability ratios
 - Market price ratios

Liquidity Ratios

Liquidity	
Current ratio	$\frac{\text{Current assets}}{\text{Current liabilities}}$
Quick ratio	$\frac{\text{Cash} + \text{marketable securities} + \text{receivables}}{\text{Current liabilities}}$
Cash ratio	$\frac{\text{Cash} + \text{marketable securities}}{\text{Current liabilities}}$

Turnover and Asset Utilization

- Total asset turnover: sales / total assets
- Total asset turnover measures how efficient a firm uses its assets (for every dollar of assets, how many sales the firm generates)
- The higher, the better

Turnover and Asset Utilization

- Inventory turnover: cost of goods sold / inventory
- Inventory turnover measures the speed with which inventory is turned over
- We use COG not sales because inventory is valued at cost
- Whenever a ratio includes one item from Income Statement and one from Balance Sheet, take the average of the beginning and end-of-year balance sheet figures

Turnover and Asset Utilization

- Accounts receivable ratio: average accounts receivable/sales*365 (days receivables)
- It shows the average lag between the date of sale and the date payment is received
- The lower, the better

Turnover and Asset Utilization

Asset utilization	
Total asset turnover	$\frac{\text{Sales}}{\text{Average total assets}}$
Fixed asset turnover	$\frac{\text{Sales}}{\text{Average fixed assets}}$
Inventory turnover	$\frac{\text{Cost of goods sold}}{\text{Average inventories}}$
Days receivables	$\frac{\text{Average accounts receivable}}{\text{Annual sales}} \times 365$

Leverage Ratios

Leverage	
Interest burden	$\frac{\text{EBIT} - \text{Interest expense}}{\text{EBIT}}$
Interest coverage (Times interest earned)	$\frac{\text{EBIT}}{\text{Interest expense}}$
Leverage	$\frac{\text{Assets}}{\text{Equity}} = 1 + \frac{\text{Debt}}{\text{Equity}}$
Compound leverage factor	$\text{Interest burden} \times \text{Leverage}$

Leverage Ratios

- Interest coverage ratio: EBIT/interest expense
- A high coverage ratio shows the likelihood of bankruptcy is low because annual earnings are significantly greater than annual interest obligations
- It is used to determine the firm's debt capacity and firm's bond rating

Profitability Ratios

Profitability	
Return on assets	$\frac{\text{EBIT}}{\text{Average total assets}}$
Return on equity	$\frac{\text{Net income}}{\text{Average stockholders' equity}}$
Return on sales (Profit margin)	$\frac{\text{EBIT}}{\text{Sales}}$

ROE

- ROE is a basic factor in determining a firm's growth rate of earnings
- Growth rate (g) = ROE * (1-dividend payout ratio) = ROE * Plowback ratio
- Expectations of **future** dividends and earnings determine the intrinsic value of a firm's stock

Financial Leverage and ROE

- ROE depends on debt-equity mix and the relationship between interest rate and ROA

$$\begin{aligned}
 \text{ROE} &= \frac{\text{Net Profit}}{\text{Equity}} = \frac{\text{EBIT} - \text{Interest} - \text{Taxes}}{\text{Equity}} \\
 &= \frac{(1 - \text{Tax rate})(\text{EBIT} - \text{Interest})}{\text{Equity}} \\
 &= (1 - \text{Tax rate}) \left[\frac{(\text{ROA} * \text{Assets}) - (\text{Interest rate} * \text{Debt})}{\text{Equity}} \right] \\
 &= (1 - \text{Tax rate}) \left[\text{ROA} * \frac{\text{Equity} + \text{Debt}}{\text{Equity}} - \text{Interest rate} * \frac{\text{Debt}}{\text{Equity}} \right] \\
 &= (1 - \text{Tax rate}) \left[\text{ROA} + (\text{ROA} - \text{Interest rate}) \frac{\text{Debt}}{\text{Equity}} \right]
 \end{aligned}$$

Financial Leverage and ROE

- $\text{ROE} = (1 - \text{tax rate})[\text{ROA} + (\text{ROA} - \text{interest rate}) * (\text{debt}/\text{equity})]$
- If no debt or $\text{ROA} = \text{the interest rate}$, $\text{ROE} = (1 - \text{tax rate}) * \text{ROA}$
- The increased debt will increase ROE only if $\text{ROA} > \text{interest rate}$

Financial Leverage and ROE

- If $\text{ROA} > \text{borrowing rate}$, a firm earns more on its money than it pays out to creditors, the surplus earnings are available to the firm's owners (shareholders), which increases ROE
- If $\text{ROA} < \text{borrowing rate}$, ROE will decline by an amount that depends on the debt-to-equity ratio

Financial Leverage and ROE

■ Example:

A firm pays 40% tax, its ROA is 10%, interest rate is 8% and debt/equity is 2/3

$$ROE = (1-.4) [0.1 + (0.1-0.08)*2/3] = 6.8\%$$

- Financial leverage increases risk of equity as well as it raises the expected ROE

Decomposition of ROE

$$ROE = \frac{\text{Net Profit}}{\text{Pretax Profit}} \times \frac{\text{Pretax Profit}}{\text{EBIT}} \times \frac{\text{EBIT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}}$$

(1) x (2) x (3) x (4) x (5)

Tax x Interest x ROS x Turnover x Leverage
Burden Burden

Decomposition of ROE

- Factor 3 is profit margin or return on sales, showing operating profit per dollar of sales
- Factor 4 is asset turnover, indicating the efficiency of the firm's use of assets since it measures the annual sales generated by each dollar of assets
- The product of factors 3 and 4 is ROA

Decomposition of ROE

- Factor 1 is the tax-burden ratio. It reflects both the government's tax code and the policies pursued by the firm in trying to minimize its tax burden
- Factors 1, 3 and 4 are not affected by a firm's capital structure, while factors 2 and 5 are

Decomposition of ROE

- Factor 2 is the ratio of pretax profits to EBIT, the interest-burden ratio (IB)
- $\text{Pretax profits} / \text{EBIT} = (\text{EBIT} - \text{Interest expense}) / \text{EBIT}$
- If a firm has no financial leverage, it takes on its highest possible value, 1.
- Higher financial leverage, lower the IB ratio

Decomposition of ROE

- Factor 5, the ratio of assets to equity measures the firm's degree of financial leverage, called leverage ratio
- To measure the full impact of leverage, we must take product of IB and leverage ratio, called compound leverage factor

Decomposition of ROE

- In summary
 $\text{ROE} = \text{Tax burden} * \text{Interest burden} * \text{Margin} * \text{Turnover} * \text{Leverage}$
*Since $\text{ROA} = \text{Margin} * \text{Turnover}$*
*Compound leverage factor = Interest burden * Leverage*
 $\text{ROE} = \text{Tax burden} * \text{ROA} * \text{Compound leverage factor}$

Market Price Ratios

- Market-book-value ratio (P/B) equals the market price of a share divided by its book value, i.e. shareholder's equity per share
 - A low P/B ratio stock can be a safer investment, since the book value can be a floor supporting the market price
 - However, sometimes book value doesn't necessarily represent liquidation value
 - A high P/B ratio is an indication that investors think a firm has chance of earning a return on investment > market capitalization rate (K)

Market Price Ratios

- Price-earnings ratio equals to price of a share divided by earnings per share
 - Low P/E ratio stocks may be good bargains since you can acquire a claim on a dollar of earnings more cheaply if the P/E ratio is low
 - Current earnings may differ from future earnings, so high P/E stocks may still be bargain if their earnings and dividends are expected to grow faster

Market Price Ratios

- The relationship among P/B, P/E and ROE

$$\begin{aligned}
 \text{ROE} &= \text{Earnings} / \text{Book Value} \\
 &= (\text{Market price} / \text{Book value}) / \\
 &\quad (\text{Market price} / \text{Earnings}) \\
 &= (\text{P/B ratio}) / (\text{P/E ratio})
 \end{aligned}$$

Market Price Ratios

- A firm's earning's yield is equal to its ROE divided by the market-book-value:

$$E/P = \text{ROE} / (P/B)$$
- A firm with a high ROE can have a relatively low earnings yield if its P/B is high
- A high ROE doesn't mean a good buy, since price may already reflect attractive ROE

Market Price Ratios

Market price	
Market-to-book	$\frac{\text{Price per share}}{\text{Book value per share}}$
Price-earnings ratio	$\frac{\text{Price per share}}{\text{Earnings per share}}$
Earnings yield	$\frac{\text{Earnings per share}}{\text{Price per share}}$



Comparability Problems

- There is more than one acceptable way to represent various items of revenue and expense according to generally accepted accounting principles (GAAP)
- Interpreting one firm's performance over time is hard since inflation will change income differently due to different inventories and depreciation record methods
- Other factors: capitalization of leases and other expenses; treatment of pension costs



Comparability Problems

- Inventory valuation--LIFO vs. FIFO
 - LIFO assumes that goods are valued at today's cost
 - FIFO assumes that goods are valued at original cost
- Suppose company A has a constant inventory of 1 million units of goods; the inventory turns over once a year
- If the price of good has been constant, say \$1, what will happen? How about if the price of goods rises by 10 cents per unit due to inflation?



Comparability Problems

- LIFO: cost of goods sold (COGS) of \$1.1 million, the end-of-year balance sheet value of the 1 million units in inventory remains \$1 million
- FIFO: COGS of \$1 million, the end-of-year balance sheet value of the inventory would be \$1.1 million
- LIFO firm has both a lower reported profit and a lower balance sheet value of inventories than the FIFO firm
- LIFO is preferred in computing economic earnings since it uses up-to-date prices to evaluate the COGS



Comparability Problems

- Depreciation
 - Different methods of depreciation result in different earnings (accelerated vs. straight-line methods)
 - There are differences across firms in their estimates of the depreciable life of assets
 - Measured depreciation in periods of inflation is understated relative to replacement cost and real economic income (sustainable cash flow) is correspondingly overstated

Comparability Problems

■ Depreciation

- For example, company A has a machine with a 3-year useful life and the original cost of 3 million. Annual straight-line depreciation is \$1 million.
- Suppose the inflation in the first year is 10%. Then the true annual depreciation expense is \$1.1 million in current terms, whereas conventionally measured depreciation remains fixed at \$1 million per year.
- Accounting income overstates real economic income by \$0.1 million.

Example--1

- A company's current ratio is 2.0. If the company uses cash to retire notes payable due within a year, would this transaction increase or decrease the current ratio and asset turnover ratio?

	Current ratio	Asset Turnover ratio
a.	Increase	Increase
b.	Increase	Decrease
c.	Decrease	Increase
d.	Decrease	Decrease

Example--2

- During a period of rising prices, the financial statements of a firm using FIFO reporting instead of LIFO reporting would show:
 - a. Higher total assets and higher net income
 - b. Higher total assets and lower net income
 - c. Lower total assets and higher net income
 - d. Lower total assets and lower net income

Example--3

- All other things being equal, what effect will the payment of a cash dividend have on the following ratios?

	Times Interest Earned	Debt/Equity Ratio
a.	Increase	Increase
b.	No effect	Increase
c.	No effect	No effect
d.	Decrease	Decrease

Main Points

- Balance Sheet Models
- Finding Intrinsic Values
 - Dividend Discount Models
 - Estimating growth rates and opportunities
 - Price/Earning Ratios
 - Free Cash Flow Approach

Balance Sheet Models

- Balance sheet information for valuation
 - Book value of equity: Is book value a 'floor' for the stock's price?
 - Liquidation value (value after breaking up the firm, selling assets, repaying debt & distributing the remainder to shareholders)
 - Replacement cost of assets less liabilities
 - Tobin's q (ratio of market price to replacement cost): tends toward 1 in the long-run, otherwise competitors would try to replicate the firm

Intrinsic Value and Market Price

- Intrinsic Value
 - Self assigned value
 - Variety of models are used for estimation
- Market Price
 - Consensus value of all potential traders
- Trading Signal
 - $IV > MP$ Buy or long
 - $IV < MP$ Sell or Short
 - $IV = MP$ Hold or Fairly Priced

Intrinsic Value and Market Price

- Example

ABC stock has an expected dividend per share of \$4. The current price is \$48 and the expected price one year later is \$52.

Expected holding-period return = $(52 + 4 - 48) / 48 = 16.7\%$

Suppose risk-free rate is 6%, market premium is 5%, the beta of ABC is 1.2

Required rate of return (k) = $6 + 1.2 \cdot 5 = 12\%$

ABC is underpriced---buy

Intrinsic Value and Market Price

■ Example (con't)

Another way is to find the intrinsic value and compare it with the market value.

$$V_0 = [E(D_1) + E(P_1)] / (1+k) \\ = (4+52) / (1+0.12) = \$50$$

Intrinsic value \$50 is higher than current price \$48, so ABC is underpriced, and we should buy.

Dividend Discount Models

■ We know that for today's intrinsic value

$$V_0 = (D_1 + P_1) / (1+k)$$

■ So the year-end intrinsic value will be

$$V_1 = (D_2 + P_2) / (1+k)$$

■ If we assume the stock will be selling for its intrinsic value next year, then $V_1 = P_1$

■ Then $V_0 = D_1/(1+k) + (D_2+P_2)/(1+k)^2$

Dividend Discount Models

$$V_0 = \sum_{t=1}^n \frac{D_t}{(1+k)^t} + \frac{P_n}{(1+k)^n} = \sum_{t=1}^{\infty} \frac{D_t}{(1+k)^t}$$

V_0 = Today's value of stock

D_t = Dividend

P_n = Terminal price

k = Required return

Dividend Discount Models

■ We can simplify the formula if g is constant

$$V_0 = \frac{D_1}{1+k} + \frac{D_1(1+g)}{(1+k)^2} + \frac{D_1(1+g)^2}{(1+k)^3} + \dots$$

$$\frac{1+k}{1+g} V_0 = \frac{D_1}{1+g} + \frac{D_1}{1+k} + \frac{D_1(1+g)}{(1+k)^2} + \dots$$

$$\frac{1+k}{1+g} V_0 - V_0 = \frac{D_1}{1+g}$$

$$\frac{k-g}{1+g} V_0 = \frac{D_1}{1+g}$$

$$V_0 = \frac{D_1}{k-g}$$

Constant Growth Model

$$V_o = \frac{D_o(1+g)}{k-g}$$

Example: $E_0 = \$5.00$ $PB = 40\%$ $g = 8\%$
 $r_f = 6\%$ $\text{beta} = 1$ $\text{market risk premium} = 8\%$
 $D_0 = 5 \cdot (1 - .4) = 3.00$
 $K = 6 + 1 \cdot 8 = 14\%$
 $V_0 = 3 \cdot 1.08 / (.14 - .08) = \54

Exception: No Growth Model

$$V_o = \frac{D}{k}$$

- To value the stocks that have dividends that are expected to remain constant, i.e. preferred stock

Exception: No Growth Model

$$V_o = \frac{D}{k}$$

Example:
 $D = \$5.00$ $k = .15$
 $V_0 = \$5.00 / 0.15 = \33.33

Constant-growth DDM

- Constant-growth DDM is valid only if $g < k$
- Constant-growth DDM implies that a stock's value will be greater when:
 - ☐ D_1 is higher
 - ☐ k is lower
 - ☐ g is higher
- However, the three variables sometimes change together, i.e. when dividend increases, growth of a firm will be sacrificed

Constant-growth DDM

- Another implication of the constant-growth model is that the stock price is expected to grow at the same rate as dividends

$$P_1 = \frac{D_2}{k-g} = \frac{D_1(1+g)}{k-g} = \frac{D_1}{(k-g)}(1+g) = P_0(1+g)$$

Constant-growth DDM

- For a stock whose market price equals its intrinsic value ($P_0 = V_0$), the expected holding-period return would be:

$$\begin{aligned} E(r) &= \text{Dividend yield} + \text{capital gains yield} \\ &= \frac{D_1}{P_0} + \frac{P_1 - P_0}{P_0} = \frac{D_1}{P_0} + g \end{aligned}$$

- If a stock's market price equals to its intrinsic value ($P_0 = V_0$), then $E(r) = k$, so $k = D_1/P_0 + g$ (we can infer k)
- What happens if g increases?

Constant-growth DDM

- Example:
 $g = 5\%$, $k = 12\%$, $D_1 = \$4$
 $P_0 = 4 / (0.12 - 0.05) = \57.14
 If g becomes 6% , $P_0 = 4 / (0.12 - 0.06) = 66.67$
 So increasing g is a good news for investors, since it increases share price
 However, k remains the same, since the risk of the firm remains the same
 $E(r) = D_1/P_0 + g = 4/66.67 + 0.06 = 12\%$

Price and Investment Opportunities

- If two companies both have earnings of \$5, and they pay out all earnings as dividends, and their market capitalization rates (k) are 12.5% , then $P_0 = 5/0.125 = \$40$
- The firms will not grow in value, because with all earnings paid out as dividends, and no earnings reinvested in the firm, their capital stock and earnings capacity will remain unchanged over time

Price and Investment Opportunities

- If one of them has a project that generates a return of 15%, which is greater than k (12.5%), it is better for the firm to reinvest some earnings to the firm and have a lower dividend payout ratio
- If dividend payout ratio is 40%, D_1 will be \$2 (5×0.4). What happens to share price?
- Although dividends initially fall, reinvestment profits will generate growth in future dividends, which will be reflected in today's share price

Price and Investment Opportunities

$$g = ROE \times b$$

g = growth rate in dividends

ROE = Return on Equity for the firm

b = plowback or retention percentage rate
(1- dividend payout percentage rate)

Price and Investment Opportunities

- Example (con't)
The company starts with plant and equipment of \$100m, and is all equity financed. ROE = 15%, total earning = \$15m, shares outstanding = 3m, EPS = \$5, $b = 60\%$,
Then the value of the firm's capital stock will rise by $0.6 \times 15m = 9m$, or by 9%
 $g = 0.15 \times 0.6 = 0.09$
 $P_0 = 5 \times 0.4 / (0.125 - 0.09) = \57.14 (with growth)
> \$40 (no growth)

Price and Investment Opportunities

- The increase in price reflects that the planned investments provide an expected rate of return (15%) greater than the required rate (12.5%)
- The value of the firm rises by the positive NPV of the investment opportunities
- This net present value is called Present Value of Growth Opportunities (PVGO)

Price and Investment Opportunities

$$V_o = \frac{E_1}{k} + PVGO$$

$$PVGO = \frac{D_o(1+g)}{(k-g)} - \frac{E_1}{k}$$

PVGO = Present Value of Growth Opportunities

E_1 = Earnings Per Share for period 1

Price and Investment Opportunities

Example:

ROE = 20% dividend payout = 60% $b = 40\%$

$E_1 = \$5.00$ $D_1 = \$3.00$ $k = 15\%$

$g = .20 \times .40 = .08$ or 8%

$$V_o = \frac{D_1}{(k-g)} = \frac{3}{(.15-.08)} = \$42.86$$

$$NoGrowthValue = \frac{E_1}{k} = \frac{5}{.15} = \$33.33$$

$$PVGO = \$42.86 - \$33.33 = \$9.53$$

Multistage Growth Model

- In reality, the situation can be more complex than that in constant-growth DDM
- Firms may have higher growth rate at the beginning and then the growth rate will drop to a normal rate and continue

Multistage Growth Model

■ Example

$D_1 = 0.8$ $D_2 = 0.93$ $D_3 = 1.06$ $D_4 = 1.2$

After year 4, the estimated dividend payout is 0.3 and ROE is 13%

$g = 0.13 \times 0.7 = 9.1\%$

We can find k by using CAPM

If $\beta = 0.8$, $r_f = 5\%$ market return = 13%

$k = 5 + 0.8 \times (13 - 5) = 11.4\%$

$P_4 = 1.2 \times (1 + 0.091) / (0.114 - 0.091) = 56.92$

Multistage Growth Model

$$V_0 = \sum_{t=1}^n \frac{D_t}{(1+k)^t} + \frac{P_n}{(1+k)^n}$$

V_0 = Today's value of stock; D_t = Dividend

P_n = Terminal price; k = Required return

$$V_0 = \frac{.8}{1.114} + \frac{.93}{1.114^2} + \frac{1.06}{1.114^3} + \frac{(1.2 + 56.92)}{1.114^4} = 39.97$$

Price Earnings Ratios

- P/E Ratios are a function of two factors

- Required rates of return (k)
- Expected growth in dividends (g)

- Uses

- Relative valuation
- Extensive use in the industry

P/E Ratio: No Expected Growth

$$P_0 = \frac{E_1}{k}$$

$$\frac{P_0}{E_1} = \frac{1}{k}$$

- E_1 - expected earnings for next year
 - E_1 is equal to D_1 under no growth
- k - required rate of return

Numerical Example: No Growth

$$E_0 = \$2.50 \quad g = 0 \quad k = 12.5\%$$

$$P_0 = D/k = 2.50/.125 = \$20.00$$

$$P/E = 20/2.5 = 8$$

$$P/E = 1/k = 1/.125 = 8$$

P/E Ratio with Constant Growth

$$P_0 = \frac{D_1}{k - g} = \frac{E_1(1 - b)}{k - (b \times ROE)}$$

$$\frac{P_0}{E_1} = \frac{1 - b}{k - (b \times ROE)}$$

b = retention ratio; ROE = Return on Equity

k = required rate of return

- Implication: riskier firms have higher k, and lower P/E ratio

Numerical Example with Growth

b = 60% ROE = 15% (1-b) = 40%

k = 12.5% g = .6*15 = 9% E₀ = \$2.50

E₁ = \$2.50 (1 + .09) = \$2.73

D₁ = \$2.73 (1-.6) = \$1.09

P₀ = 1.09/(.125-.09) = \$31.14

P/E = 31.14/2.73 = 11.4

P/E = (1 - .60) / (.125 - .09) = 11.4

Pitfalls in P/E Analysis

- Use of accounting earnings
 - Subject to some manipulation
 - Choices on GAAP
 - Historical costs in depreciation and inventory (when inflation is high, historical cost will tend to over-represent true economic earnings)
- Reported earnings fluctuate around the business cycle

Other Valuation Ratios

- Price-to-Book
- Price-to-Cash Flow
 - Less affected by accounting decisions
- Price-to-Sales
 - Many start-up firms have no earnings
 - However, price-to-sales ratios vary markedly across industries

Free Cash Flow Approach 1

- Discount the free cash flow for the firm (FCFF)
- Discount rate is the firm's weighted-average cost of capital (WACC)
- Components of FCFF
 - After tax EBIT: $EBIT \cdot (1-t)$
 - + Depreciation
 - - Capital expenditures
 - - Increase in net working capital

Free Cash Flow Approach 1

- Firm value =

$$\sum_{t=1}^T \frac{FCFF_t}{(1+WACC)^t} + \frac{P_T}{(1+WACC)^T}$$

- Where

$$P_T = \frac{FCFF_{T+1}}{WACC - g}$$

Free Cash Flow Approach 2

- Discount the free cash flow to equity holders (FCFE)
- Discount rate is the cost of equity (K_E)
- Components of FCFE
 - FCFF
 - - Interest expense $\cdot (1-t)$
 - + Increases in net debt

Free Cash Flow Approach 2

- Market Value of Equity =

$$\sum_{t=1}^T \frac{FCFE_t}{(1+K_E)^t} + \frac{P_T}{(1+K_E)^T}$$

- Where

$$P_T = \frac{FCFE_{T+1}}{K_E - g}$$



Example--1

- A common stock pays an annual dividend per share of \$2.1. The risk-free rate is 7%, and the risk premium for this stock is 4%. If the annual dividend is expected to remain at \$2.1, the value of the stock is closest to:
 - a. \$19.09
 - b. \$30.00
 - c. \$52.50
 - d. \$70.00



Example--2

- Which of the following assumptions does the constant-growth dividend discount model require?
 - I. Dividends grow at a constant rate
 - II. The dividend growth rate continues indefinitely
 - III. The required rate of return is less than the dividend growth rate
 - a. I only
 - b. III only
 - c. I and II only
 - d. I, II, and III