Financial Statement Analysis (22E00100)

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Profitability Analysis
- Ratio Analysis

Learning objectives

After studying this topic, you will understand:

- The important role **ratio analysis** serves in **profitability analysis**
- To acknowledge underlying assumptions and technical issues in ratio analysis
- How **profitability ratios** provide valuable information regarding a firm's **performance and asset utilization**
- How **return on assets (ROA)** can be used to analyze a company's profitability, and what insights are gained from **disaggregating ROA** into its *profit margin* and *asset turnover components*
- The difference between **ROA** and **return on equity (ROE)**
- The interrelatedness of **ROIC, ROE and WACC**

Why ratios?

Why ratios?

- Financial data are usually summarized in a **ratio form**

o Financial statement numbers are divided by other financial statement numbers

- Financial ratios **control for the effect of firm size** across firms and over time

o Financial statement numbers are **combarable** across firms and years

Why ratios?

- Consider following example of summarizing financial data in the ratio form:

	Firm A	Firm B
Earnings:	10 milj.	2 milj.
Sales:	100 milj.	8 milj.
Profit margin (Earnings/Sales):	10%	25%

- Earnings of Firm A are higher than those of Firm B
- However, Profit margin reveals the **true profitability**

Proportionality

Proportionality

- An important assumption in using financial ratios is the so-called **proportionality** between the numerator and denominator

- **Strict proportionality** implicates that
  1. there should exist a **linear** relationship between the numerator and denominator of the ratio
  2. this relationship should not contain any **constant term**

- Empirical evidence indicates that the proportionality assumption is usually fulfilled

Strict proportionality

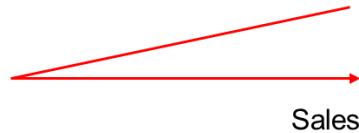- E = Earnings, S = Sales and r is the ratio of Earnins-to-Sales:

$$\frac{E}{S} = r$$
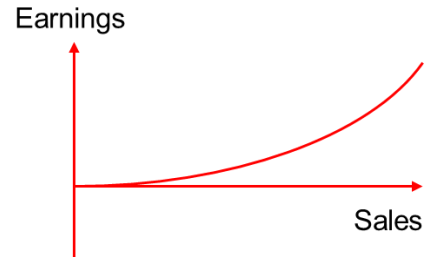
$$\Rightarrow E = r \times S$$

- Under strict proportionality assumption, the relationship between the numerator and denominator is **linear** and there is **no constant term** in the relationship
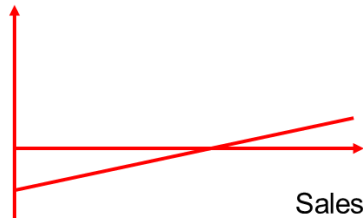
Deviations from strict proportionality assumption

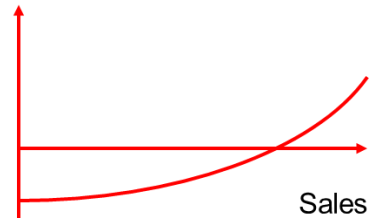### 1. Proportionality without constant

Earnings

Sales

3. Non-proportionality without constant

Earnings

Sales

2. Proportionality with constant

Earnings

Sales

4. Non-proportionality with constant

Earnings

Sales

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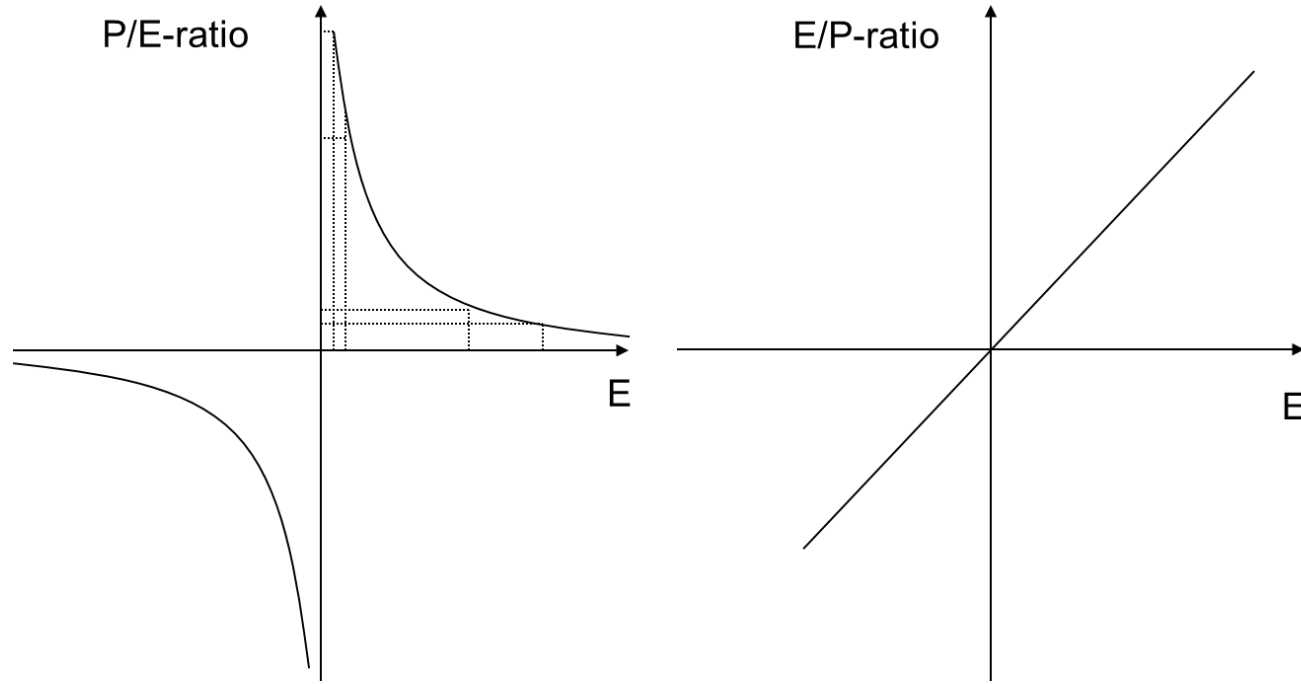# Technical issues in calculating financial ratios

Technical issues in calculating financial ratios: Small or zero denominators

- **Small or zero denominators**
  - If the denominator of the financial ratio is equal to zero, the ratio cannot be calculated
  - If the value of the denominator is close to zero, the ratio is close to infinity
  - If the denominator fluctuates a lot across years or firms, the values of ratio fluctuate a lot, too

- Following example of P/E- and E/P-ratios illustrates the problem of small or zero denominators

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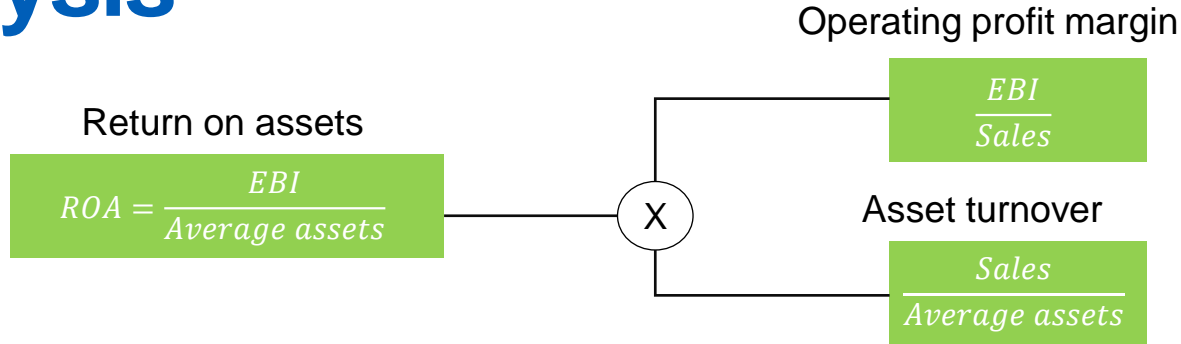# Example: Small or zero denominators

Technical issues in calculating financial ratios: Outliers

- **Outliers** refer to the extreme values of a given financial ratio
  - Outliers are inconsistent with the remaining data
- There may be several reasons for outlier observations
  - Data recording errors
  - Technical issues such as close to zero denominators
  - True indication of the extreme state of the underlying firm characteristic (e.g. bankcuptcy firms)
- Outlier observations are usually deleted from the data, but one should be **very careful** when doing so
  - Important information may be lost, if the outlier reflects the true economic state of the firm

Ratio analysis: ROA, ROCE, ROIC, ROE and profit margins

Financial ratios and profitability analysis

Return on assets

$$ROA = \frac{EBI}{Average\ assets}$$

X

Operating profit margin

$$\frac{EBI}{Sales}$$

Asset turnover

$$\frac{Sales}{Average\ assets}$$

Analysts do not always use the reported earnings, sales and asset figures. Instead, they often consider three types of adjustments to the reported numbers:

1. Remove non-operating and nonrecurring items to isolate sustainable operating profits.
2. Eliminate after-tax interest expense to avoid financial structure distortions.
3. Eliminate any accounting quality distortions (e.g., off-balance operating leases).

How can ROA be increased?

There are just two ways:
1. Increase the operating profit margin, or
2. Increase the intensity of asset utilization (turnover rate).

$$ROA = \frac{EBI}{Average\ assets} \quad = \quad \frac{EBI}{Sales} \quad \times \quad \frac{Sales}{Average\ assets}$$

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ROA and competitive advantage:
Four hypothetical restaurant firms

- Competition works to drive down ROA toward the competitive floor.

- Companies that consistently earn an ROA above the floor are said to have a competitive advantage.

- However, a high ROA attracts more competition which can lead to an erosion of profitability and advantage.

- Firm A and B earn the same ROA, but Firm A follows a differentiation strategy while Firm B is a low-cost leader.

- Differences in business strategies give rise to economic differences that are reflected in differences in operating margin, asset utilization, and profitability (ROA).

Competitive ROA floor

$ROA = Margin \times Turnover = (EBI/Sales) \times (Sales/Assets)$
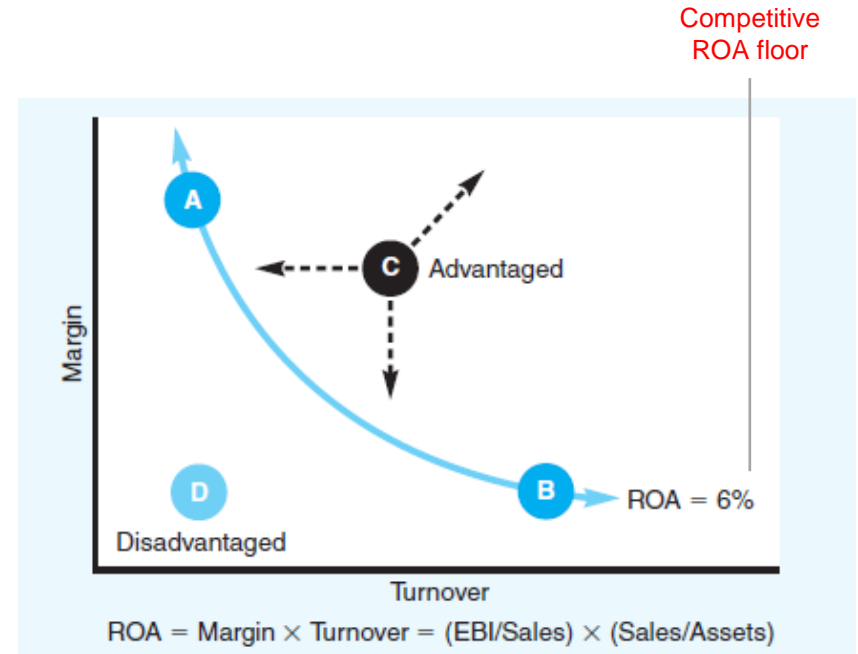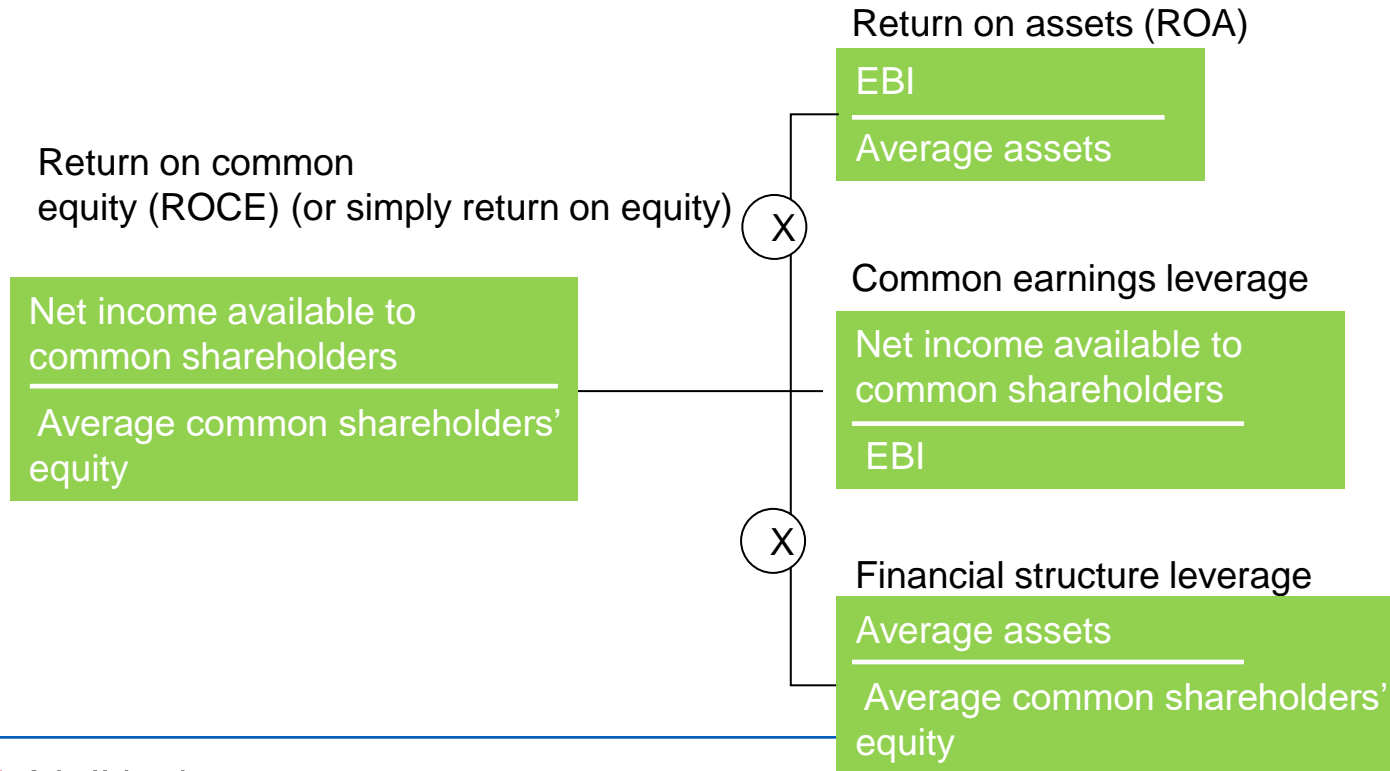
Return on equity and financial leverage

- 2011: No debt, so all the earnings belong to shareholders.

- 2012: $1 million borrowed at 10% interest, but ROCE climbs to 20%.

- 2013: Another $1 million borrowed at 20% interest, and ROCE falls to only 15%.

Financial Leverage

	Earnings before Interest*	Assets	Common Shareholders' Equity	Return on Assets (ROA)	Interest Charges	Net Income Available to Common Stockholders	Return on Common Equity (ROCE)
2011	$150,000	$1 million	$1 million	15%	—	$150,000	15%
2012	300,000	2 million	1 million	15	$100,000	200,000	20
2013	450,000	3 million	1 million	15	300,000	150,000	15

* Earnings are before interest but after taxes, and they are distributed to lenders (as interest) and shareholders (as dividends) each year.

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Components of ROCE (or simply ROE)

Return on assets (ROA)

$$\frac{\text{EBI}}{\text{Average assets}}$$

Return on common equity (ROCE) (or simply return on equity)

$$\frac{\text{Net income available to common shareholders}}{\text{Average common shareholders' equity}}$$

X

Common earnings leverage

$$\frac{\text{Net income available to common shareholders}}{\text{EBI}}$$

X

Financial structure leverage

$$\frac{\text{Average assets}}{\text{Average common shareholders' equity}}$$

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Profitability and financial leverage:
Nodebt and Hidebt example

Profitability and Financial Leverage

	Total Assets	Shareholders' Equity	Earnings before Interest (EBI)*	After-Tax Interest	Available to Common Shareholders	ROA	ROCE
Good earnings year							
HiDebt	$2 million	$1 million	$240,000	$60,000	$180,000	12.0%	18.0%
NoDebt	2 million	2 million	240,000	—	240,000	12.0	12.0
Neutral earnings year							
HiDebt	2 million	1 million	120,000	60,000	60,000	6.0	6.0
NoDebt	2 million	2 million	120,000	—	120,000	6.0	6.0
Bad earnings year							
HiDebt	2 million	1 million	60,000	60,000	—	3.0	0.0
NoDebt	2 million	2 million	60,000	—	60,000	3.0	3.0

* Earnings are before interest but after taxes. HiDebt has after-tax interest charges of $60,000—that is, $1 million $\times$ 10% $\times$ (1 − 40%)—each year.

Profit margins

The first level of profitability is *Gross margin:*

$$Gross\ margin = \frac{Sales - Cost\ of\ goods\ sold\ (COGS)}{Sales}$$

EBITDA margin gives earnings before interest, taxes, depreciation, and amortization as a proportion of sales:

$$EBITDA\ margin = \frac{Sales - COGS - R\&D\ Expense - SG\&A\ Expense}{Sales}$$

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Profit margins

EBIT margin provides a useful summary of operating performance:

$$EBIT\ margin = \frac{Earnings\ before\ interest\ and\ taxes}{Sales}$$

Net operating margin:

$$Net\ operating\ margin = \frac{Net\ operating\ income}{Sales}$$

Return on invested capital, ROIC

- Note that **ROIC** is **very important**!
- Financial assets and liabilities are typically close to market values, but operating assets and liabilities are not
- $ROIC_t = \dfrac{NOPAT_t}{(\text{Invested capital}_t + \text{Invested capital}_{t-1})/2}$

Invested capital:
- Closing or beginning balance sheet?
- Or their average?

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Case: Reported ROCE of Tieto, 2018

- On Page 126 of the financial report, Tieto show how they calculate Return on Capital Employed (ROCE):

$$\text{Return on capital employed, 12-month rolling, \%} = \frac{\text{Profit before taxes and non-controlling interests + interest and other financial expenses}}{\text{Total assets – non-interest-bearing liabilities (12-month average)}}$$

- On Page 92, Tieto reports that **ROCE = 20.9%**
- This number differs slightly from our ROIC, because
  - Numerator is **reported income** rather than NOPAT
  - Denominator **includes financial assets**
- Note that financial ratios can be calculated in many ways
  - ROI, ROIC, RONA, ROCE, ROA, ROTA…
  - **Sometimes ROCE even refers to Return on Common Equity!**

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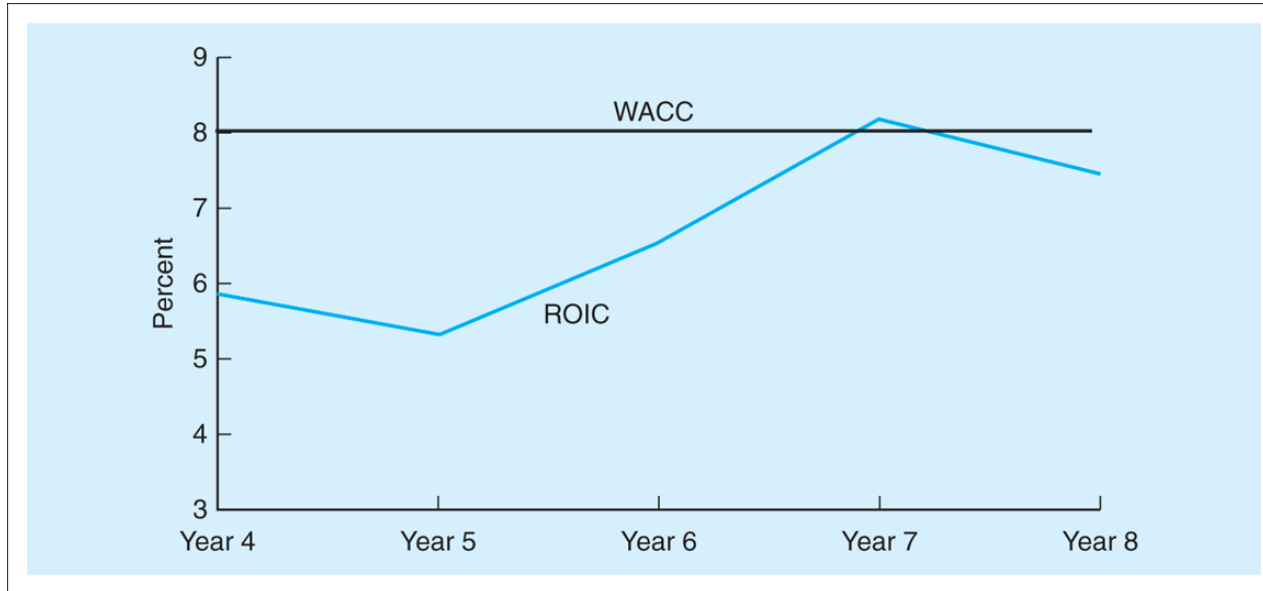School of Business**

More on interpreting ROIC

The level of ROIC

- A comparison with the required rate of return (WACC)
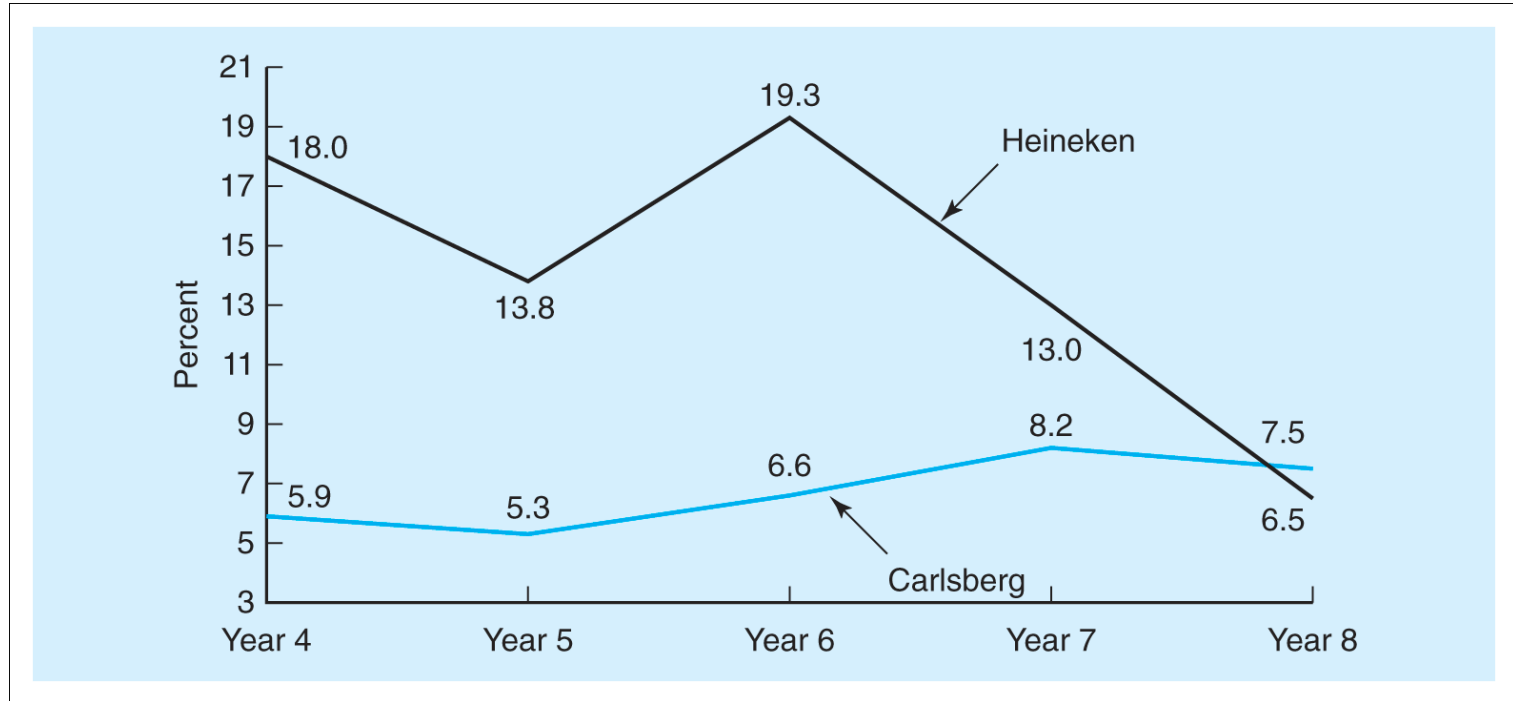- A comparison with competitors (benchmarking)

The trend of ROIC over time

- Stable
- Increasing
- Decreasing
- Fluctuating

Level/trend of ROIC:
ROIC vs. WACC of Carlsberg

Is Carlsberg's ROIC at a satisfactory level?

Level/trend of ROIC: Carlsberg's ROIC vs. Heineken's ROIC

Decomposing ROIC

ROIC as such does not explain whether profitability (and value creation) is driven by

- High margins or
- An effective use of invested capital

We can address this issue by decomposing ROIC into the profit margin and the turnover rate of invested capital:

$$\text{ROIC} = \frac{\text{Nopat}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Invested capital}}$$

Profit Margin (PM)   **Invested Capital Turnover rate (ICTO)**

This is also called as 'Asset Turnover Rate' (ATO). You can clearly see why…

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Decomposing ROIC: Profit margin

NOPAT/Sales known as a profit margin
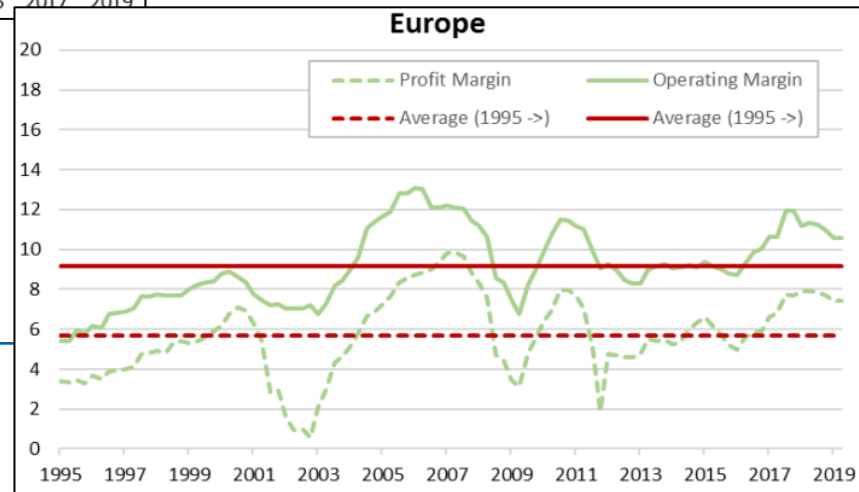
High profit margin indicates

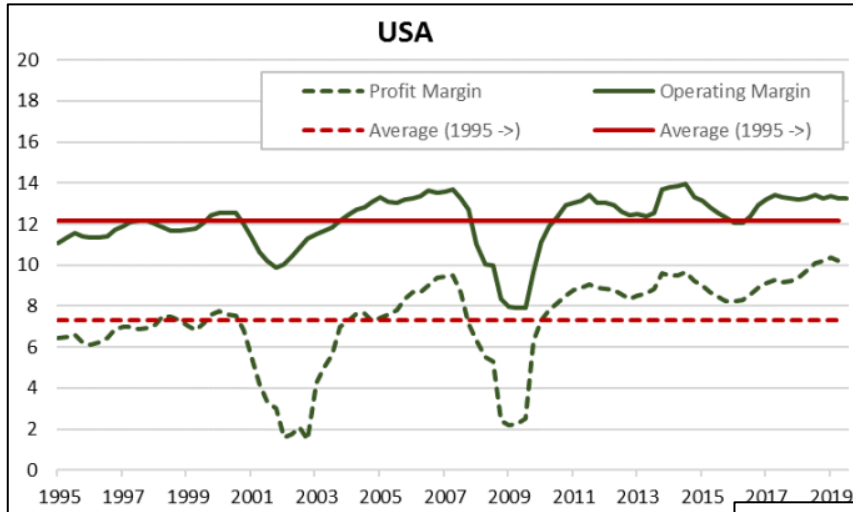- Strong pricing power and/or
- Good cost control

Other profit margins can also be calculated in a similar way

- Net income/Sales
- EBIT/Sales

Interpretations are similar to NOPAT/Sales, but different levels in I/S allow focusing on different cost items

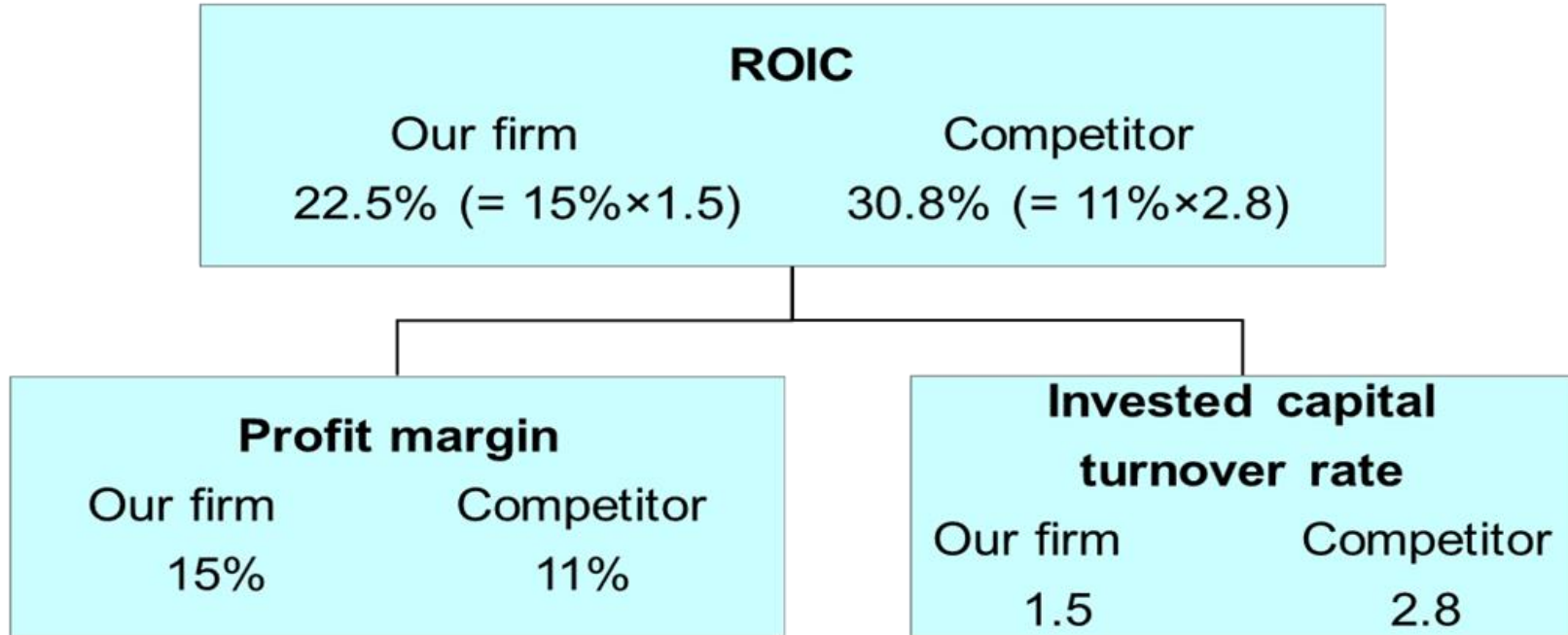# Profit margins globally, September 2019

Decomposing ROIC:
Turnover of rate of invested capital

Sales/Invested Capital is known as a turnover rate of invested capital

- Also known as 'Asset turnover rate' (ATO)

High turnover rate of invested capital implies an effective use of capital received from both equity and debt holders

Example: Components of ROIC

ROIC	
Our firm	Competitor
22.5% (= 15%×1.5)	30.8% (= 11%×2.8)

Profit margin		Invested capital turnover rate	
Our firm	Competitor	Our firm	Competitor
15%	11%	1.5	2.8

Example: Components of ROIC

Our competitor is more profitable than we are (and can therefore create more value), but why?
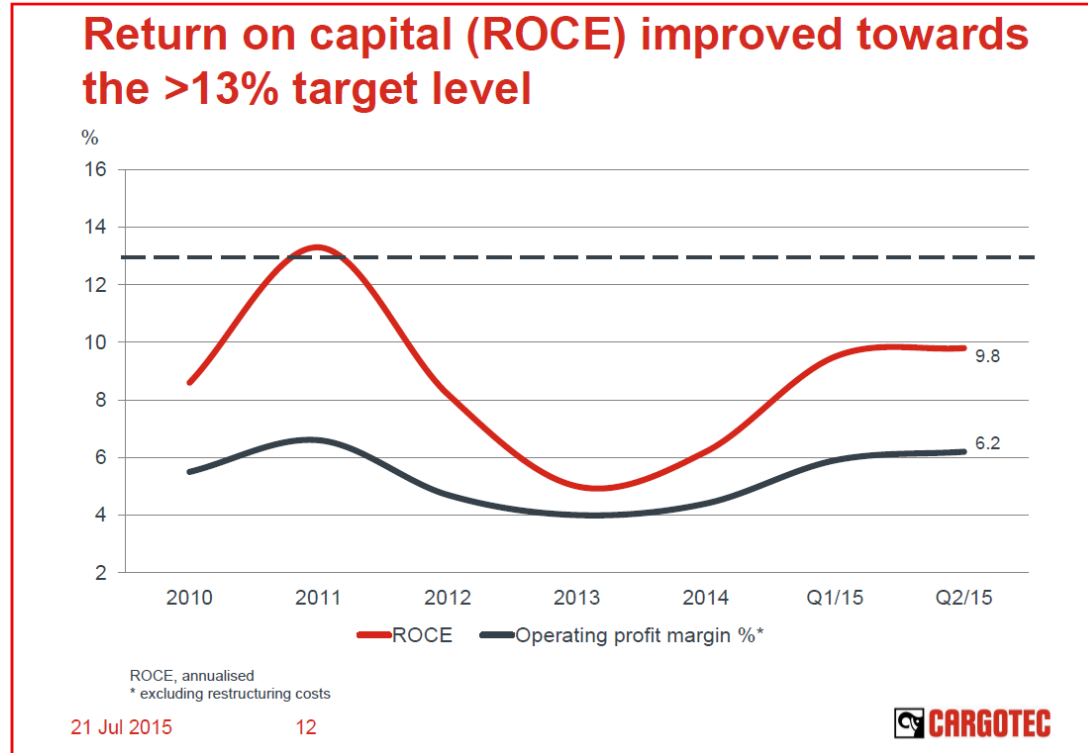
Our profit margin (15%) is actually greater than that of our competitor (11%)

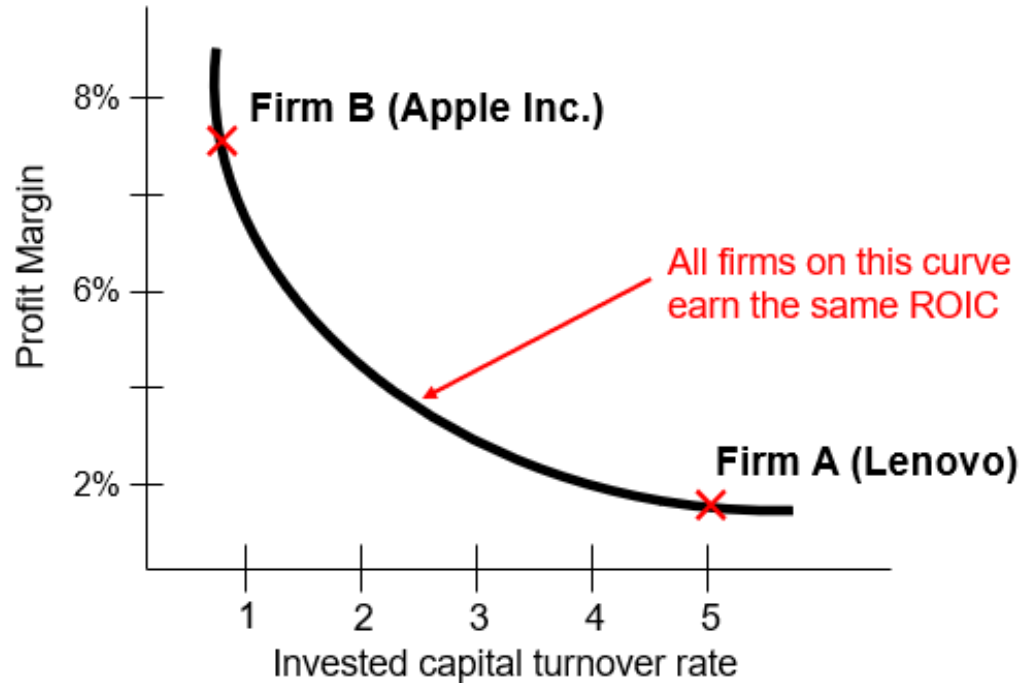- We are good at marketing/pricing/production etc.

The problem is that our Invested capital turnover rate is low, if compared to the competitor (1.5 vs. 1.8)

- We have poor working capital management, and/or
- We do not use wisely long-term capital obtained from investors

Example: Cargotec, Interim report Q2/2015

Return on capital (ROCE) improved towards the >13% target level

Legend: ROCE, Operating profit margin %*

ROCE, annualised
* excluding restructuring costs

21 Jul 2015   12
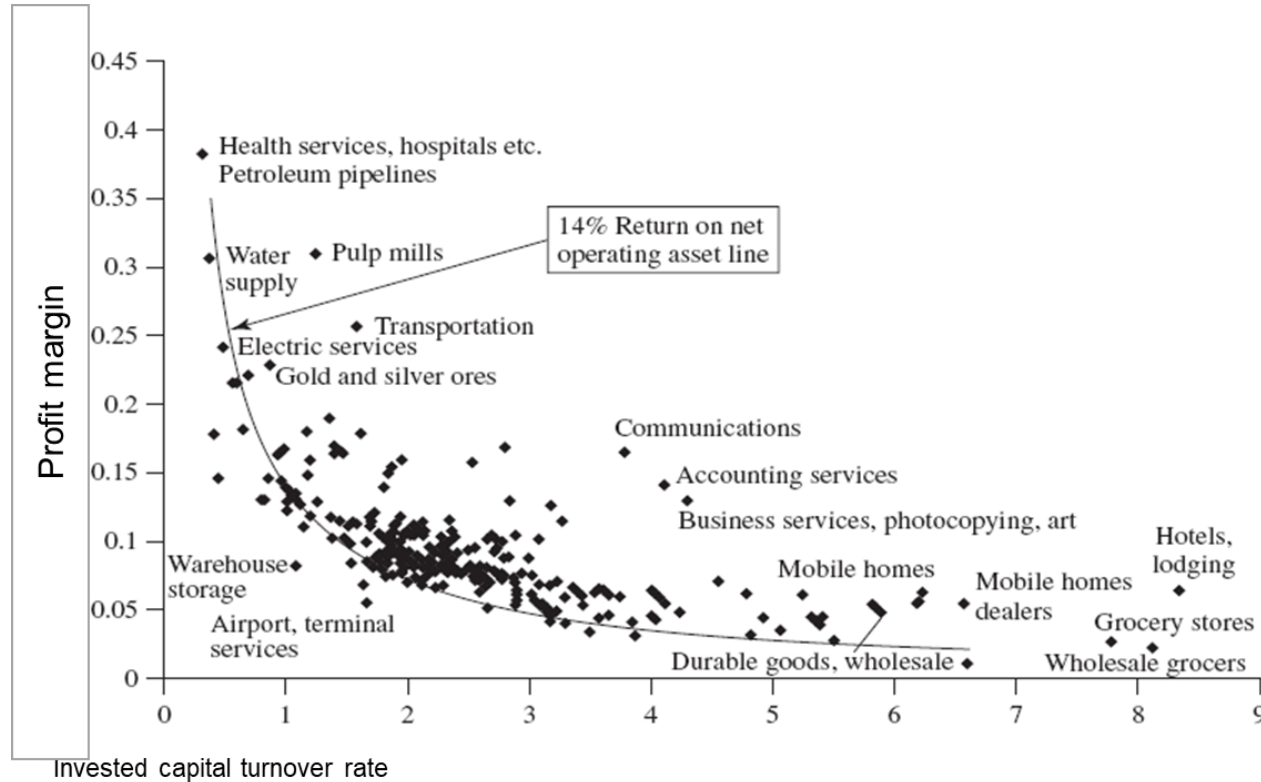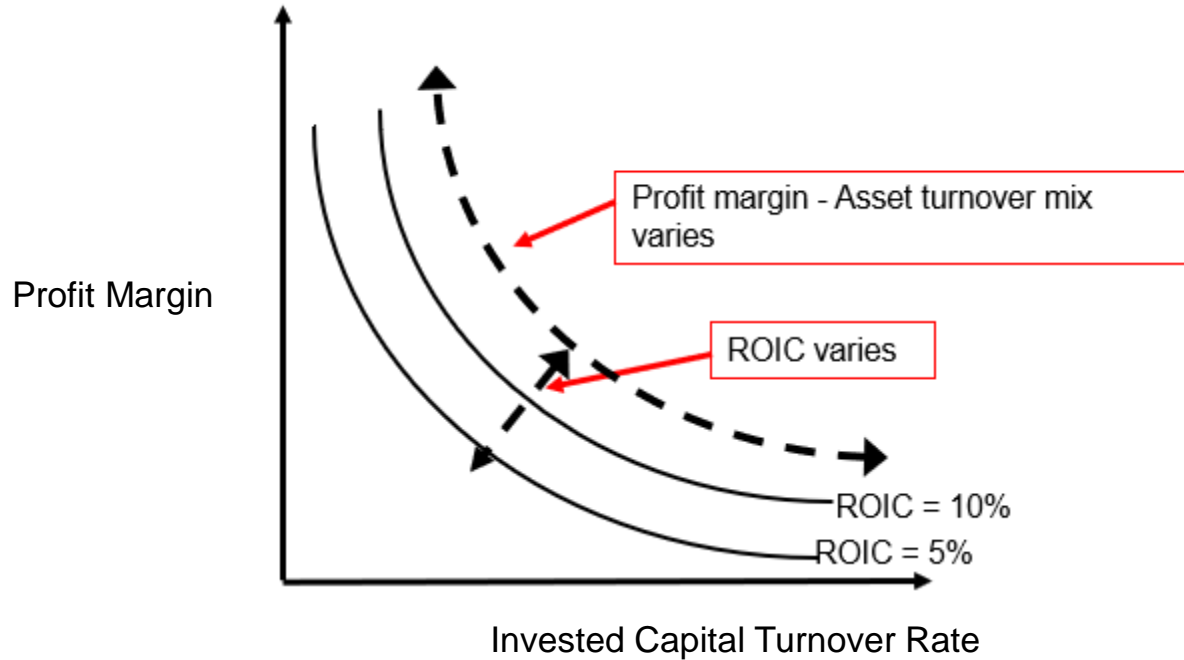
CARGOTEC

Decomposing ROIC to identify differentiation vs. cost leadership strategy

Example: ROIC decomposition of US firms

The scatter plot shows Profit margin (y-axis, ranging from 0 to 0.45) against Invested capital turnover rate (x-axis, ranging from 0 to 9). Labeled data points include: Health services, hospitals etc.; Petroleum pipelines; Water supply; Pulp mills; Transportation; Electric services; Gold and silver ores; Communications; Accounting services; Business services, photocopying, art; Warehouse storage; Airport, terminal services; Mobile homes; Mobile homes dealers; Hotels, lodging; Grocery stores; Durable goods, wholesale; Wholesale grocers. A curve labeled "14% Return on net operating asset line" is shown.

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Decomposing ROIC

Case: Components of ROIC of Tieto

$$\text{ROIC}_{2018} = \text{Profit margin}_{2018} \times \text{Invested capital turnover rate}_{2018}$$

$$= \frac{\text{NOPAT}_{2018}}{\text{Sales}_{2018}} \times \frac{\text{SALES}_{2018}}{(\text{Invested capital}_{2018} + \text{Invested capital}_{2017})/2}$$

$$= \frac{124.7}{1599.5} \times \frac{1599.5}{625.2}$$

$$= 0.07796 \times 2.55838$$

$$= 0.19945$$

$$= \mathbf{19.9\%}$$

Profit margins

EBIT margin provides a useful summary of operating performance:

$$EBIT\ margin = \frac{Earnings\ before\ interest\ and\ taxes}{Sales}$$

Net operating margin:

$$Net\ operating\ margin = \frac{Net\ operating\ income}{Sales}$$

Profit margin decomposition

- Profit margin can be decomposed to extract information on the cost structure of the firm

- Here is an example on how to do it:

$$\text{Profit margin} = \frac{\text{NOPAT}}{\text{Sales}}$$

$$= \frac{\text{Sales} - \text{Costs}}{\text{Sales}}$$

$$= \frac{\text{Sales} - \text{Materials and services} - \text{Employee expenses} -}{\text{Sales}}$$

$$\frac{\text{Depreciations etc.} - \text{Taxes} - \text{Other income and expenses}}{\text{Sales}}$$

Case: Profit margin decomposition, Tieto

$$\text{Profit margin} = \frac{\text{Sales} - \text{Materials and services} - \text{Employee expenses} -}{\text{Sales}}$$

$$\frac{\text{Depreciations etc.} - \text{Taxes} - \text{Other income and expenses}}{\text{Sales}}$$
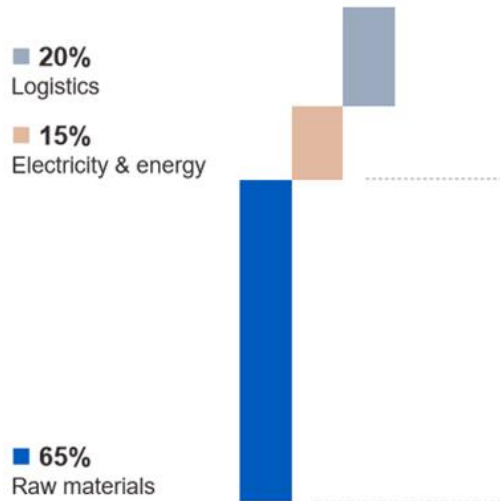
Numbers are from the analytical I/S of Tieto

$$= \frac{1599.5}{1599.5} - \frac{247.9}{1599.5} - \frac{905.0}{1599.5} - \frac{57.9}{1599.5} - \frac{30.0}{1599.5} - \frac{234.0}{1599.5}$$

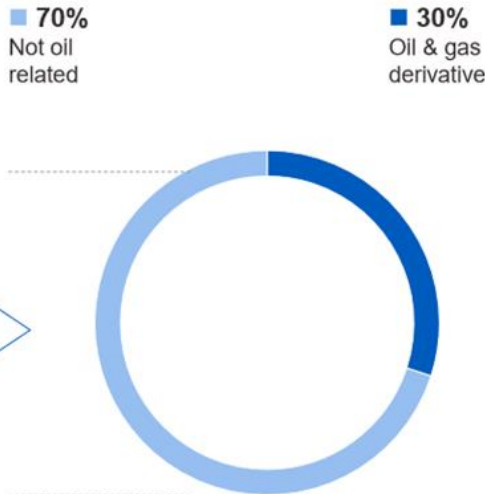$$= 100\% - 15.50\% - 56.59\% - 3.62\% - 1.88\% - 14.63\%$$

$$= \mathbf{7.8}\%$$

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Kemira's variable cost split and top raw materials

VARIABLE COST SPLIT
Last 12 months EUR 1.5 billion

- **20%** Logistics
- **15%** Electricity & energy
- **65%** Raw materials

EXPOSURE TO OIL RELATED RAW MATERIALS

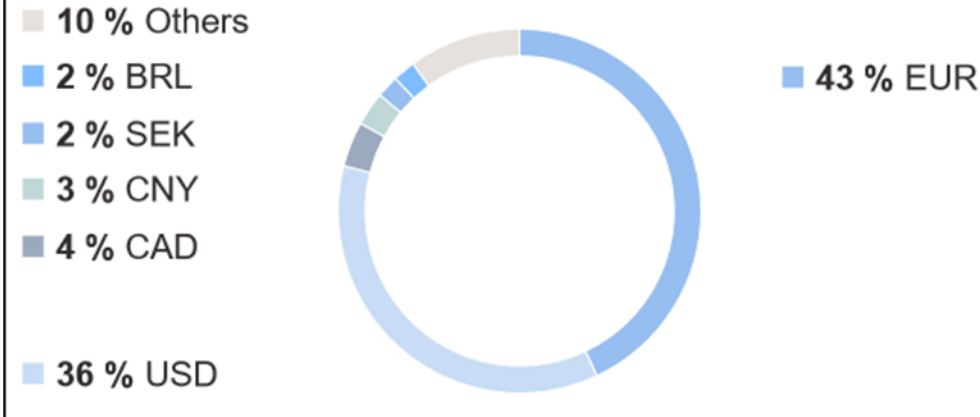- **70%** Not oil related
- **30%** Oil & gas derivative

TOP 10 RAW MATERIALS BY SPEND

1. Sodium hydroxide (caustic soda)
2. Acrylonitrile (OD)
3. Colloidal silica dispersion
4. Amines (OD)
5. Aluminum hydrate
6. Petroleum solvents
7. Acrylic acid (OD)
8. Acrylic ester (OD)
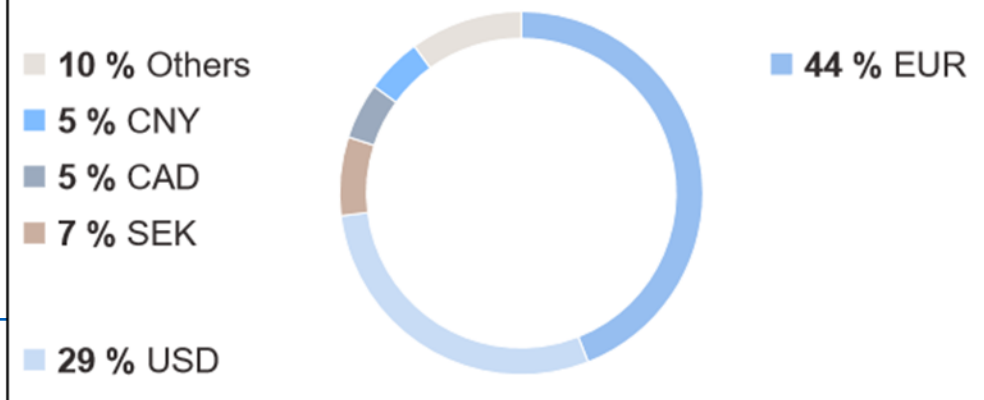9. Alpha olefin (OD)
10. Sodium chloride (salt)

Top 10 account for 45% of Kemira's raw material spend

OD = Oil & gas derivative

kemira   JULY 20, 2018   Q2 2018 RESULTS

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KEMIRA REVENUE DISTRIBUTION Q2 2018

- 10 % Others
- 2 % BRL
- 2 % SEK
- 3 % CNY
- 4 % CAD
- 36 % USD
- 43 % EUR

KEMIRA COST DISTRIBUTION Q2 2018

- 10 % Others
- 5 % CNY
- 5 % CAD
- 7 % SEK
- 29 % USD
- 44 % EUR

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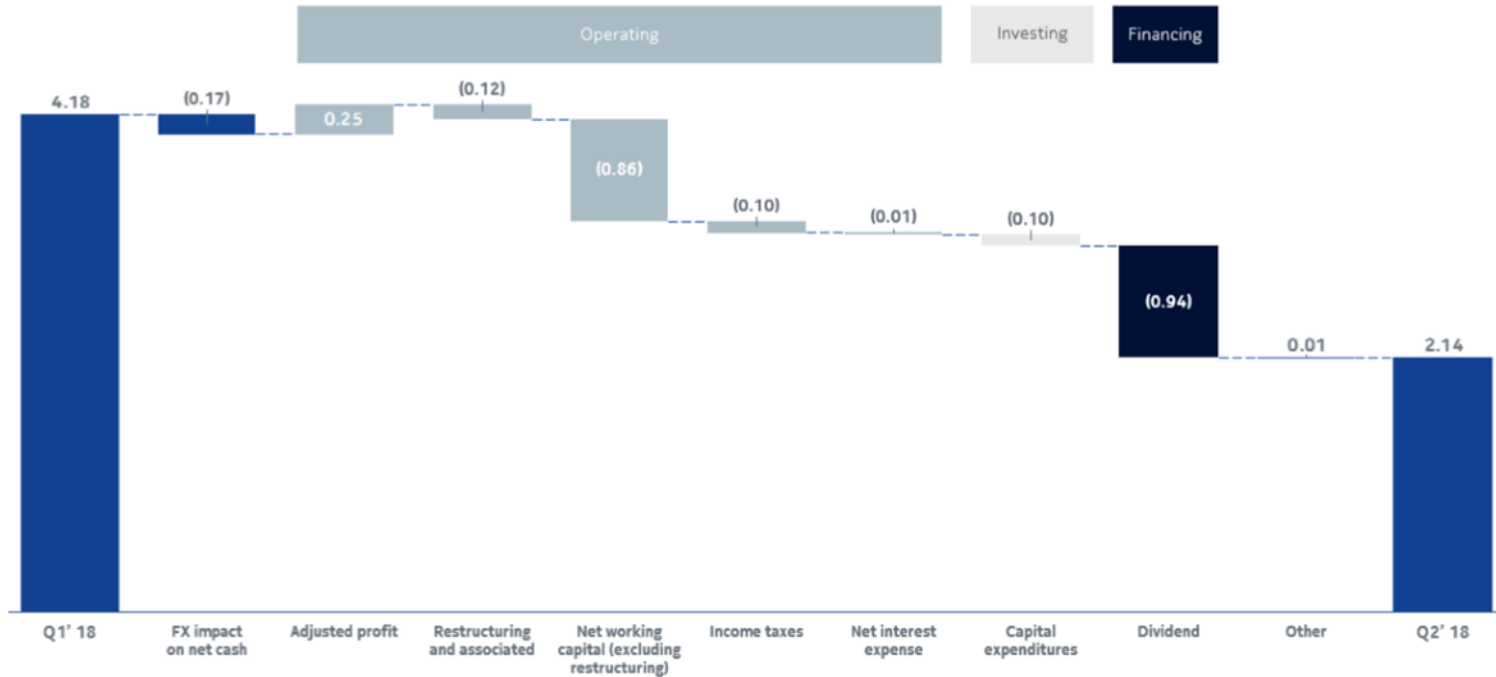
Cash and cash flow in Q2 2018

Nokia change in net cash and current financial investments (EUR billion)

Return on equity (ROE)

- ROIC measures operating profitability
- Return on equity (ROE) measures the profitability taking into account returns earned on operations *and* **the effect of financial leverage**:

$$\text{ROE}_t = \frac{\text{NOPAT}_t - \text{Net financial costs adjusted for taxes}_t}{(\text{Equity}_t + \text{Equity}_{t-1})/2}$$

Remember that NOPAT **excludes** financial items

$$= \frac{\text{Net income}_t}{(\text{Equity}_t + \text{Equity}_{t-1})/2}$$

Case: ROE of Tieto, 2018

$$\text{ROE}_{2018} = \frac{\text{NOPAT}_{2018} - \text{Net financial costs adjusted for taxes}_{2018}}{(\text{Equity}_{2018} + \text{Equity}_{2017})/2}$$

$$= \frac{124.7 - 1.5}{(482.5 + 476.1)/2}$$

$$= \frac{123.2}{479.3}$$

$$= 0.257$$

$$= \mathbf{26\%}$$

Case: Reported ROE of Tieto, 2018

- On Page 92 of its financial report, Tieto reports that its ROE based on the **reported Net Income** is 25,7%, calculated as follows:

Return on equity, 12-month rolling, %	=	Profit before taxes and non-controlling interests – income taxes
		Total equity (12-month average)

Net financial costs **are deducted** from Profit before taxes

- We can recalculate it as follows:

$$\text{ROE}_{2018, Reported} = \frac{152.8 - 29.6}{(482.5 + 476.1)/2} = \frac{123.2}{479.3}$$

$$= 0.257$$

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How are ROIC, ROE and WACC interrelated?

Analysis of ROIC, ROE and cost of capital

- Importantly, ROIC, ROE and WACC are related
- Lets start from the definition of ROIC:

$$ROIC = \frac{NOPAT}{\text{Invested capital}} = \frac{NI + NFC}{D + E},$$

where:

NI = Net income (profit)

NFC = Net financial costs adjusted for taxes

D = Net interest bearing debt

E = Equity

Analysis of ROIC, ROE and cost of capital

- It follows that:

$$\text{ROIC} = \frac{\text{NI} + \text{NFC}}{\text{D} + \text{E}}$$

$$= \frac{\text{NI}}{\text{D} + \text{E}} + \frac{\text{NFC}}{\text{D} + \text{E}}$$

$$= \frac{\text{NI}}{\text{E}} \times \frac{\text{E}}{\text{D} + \text{E}} + \frac{\text{NFC}}{\text{D}} \times \frac{\text{D}}{\text{D} + \text{E}}$$

- Note that NI/Equity is ROE
- We can define NFC/Debt as a Net borrowing rate NBR

Analysis of ROIC, ROE and cost of capital

- Note the similarity between ROIC and WACC!

$$\text{ROIC} = \frac{E}{D + E} \times \text{ROE} + \frac{D}{D + E} \times \text{NBR}$$

$$\text{WACC} = \frac{E}{D + E} \times R_E + \frac{D}{D + E} \times R_D$$

- ROIC, ROE and NBR are **accounting rate of returns**
  - ROIC is a weighted average of ROE and NBR
- WACC, R_E and R_D are **market rate of returns**
  - WACC is a weighted average of R_E and R_D
- Weights can be based on book or market values

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Analysis of ROIC, ROE and cost of capital

We can express ROE as a function of ROIC, NBR and capital structure

This is called a spread analysis

And we can do the same for R_E, which again shows similarities between accounting and market rate of returns…

Recall that

- Accounting rate of returns show **a firm's actual performance**
- Market rate of returns show **a firm's required performance**, as required by investors

Analysis of ROIC, ROE and cost of capital

- Note that

$$WACC = \frac{E}{(E+D)} \times R_E + \frac{D}{(E+D)} \times R_D$$

$$\rightarrow R_E = WACC + (WACC - R_D) \times \frac{D}{E}$$

The famous Modigliani and Miller proposition

- In a similar way, we can derive ROE from ROIC:

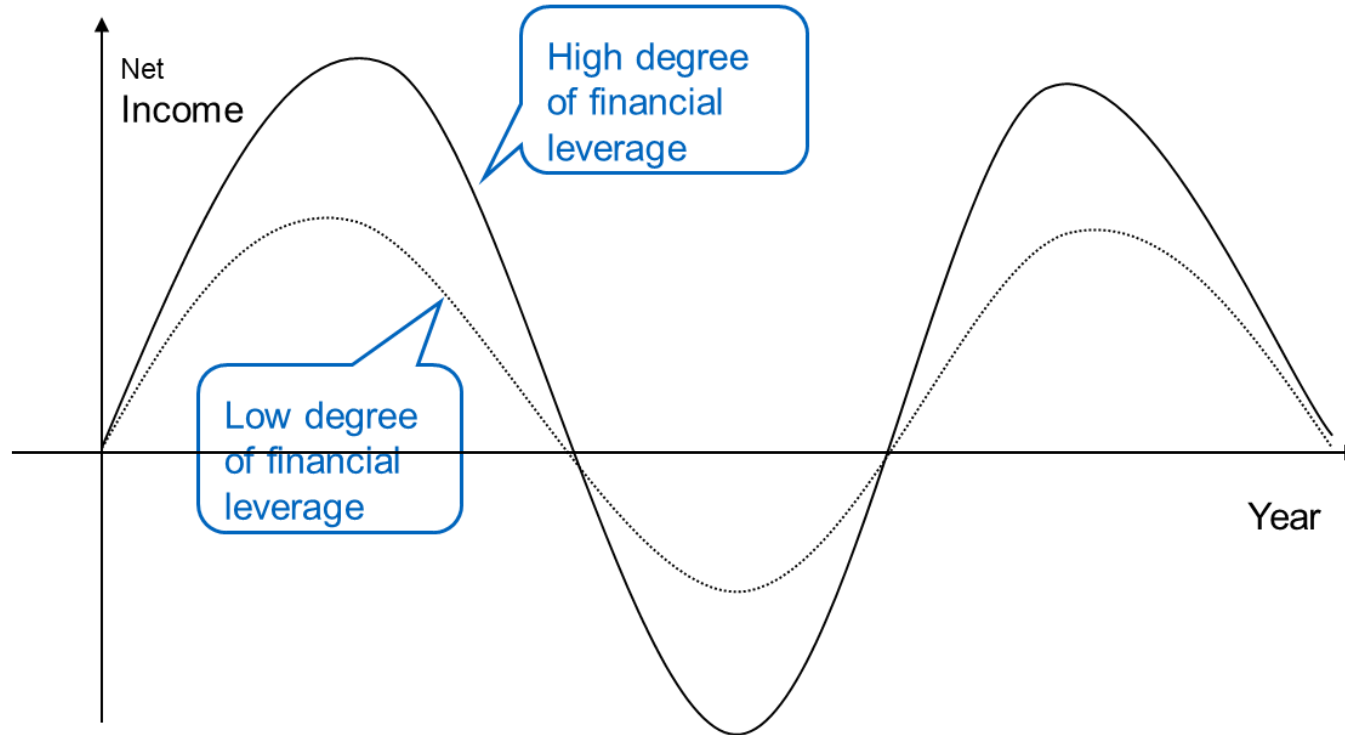$$ROIC = \frac{E}{(E+D)} \times ROE + \frac{D}{(E+D)} \times NBR$$

$$\rightarrow ROE = ROIC + (ROIC - NBR) \times \frac{D}{E}$$

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Analysis of ROIC, ROE and cost of capital

- We can now see the similarity between R_E and ROE:

Market rate of returns

$$R_E = WACC + (WACC - R_D) \times \frac{D}{E}$$

$$ROE = ROIC + (ROIC - NBR) \times \frac{D}{E}$$

Accounting rate of returns

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Impact of financial leverage on ROE

Case: ROE, ROIC and leverage of Tieto

$$\text{NBC}_{2018} = \cfrac{1.5}{\cfrac{136.9 + 155.2}{2}} = \frac{1.5}{146.0} = 0.01027 = 1.027\%$$

$$\text{ROE}_{2018} = \text{ROIC}_{2018} + \text{SPREAD}_{2018} \times \text{FLEV}_{2018}$$

Numbers are from the analytical I/S and balance sheet

$$= 0.199 + (0.199 - 0.01027) \times \frac{146.0}{479.3}$$
$$= 0.199 + 0.18873 \times 0.3046$$
$$= 0.256$$
$$= \mathbf{26\%}$$

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More on interpreting ROIC

- We can decompose ROE like we decomposed ROIC
- This decomposition is known as **the DuPont identity** (time subscripts omitted):

$$ROE = \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Invested capital}} \times \frac{\textbf{Invested capital}}{\textbf{Equity}}$$

Profit Margin   Invested Capital Turnover rate   **Financial Leverage**

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The big picture of profitability analysis

$$ROE = ROIC + (ROIC - NBC) \times \frac{D}{E}$$