ACCT 101, Session 9: Financial Statement Analysis

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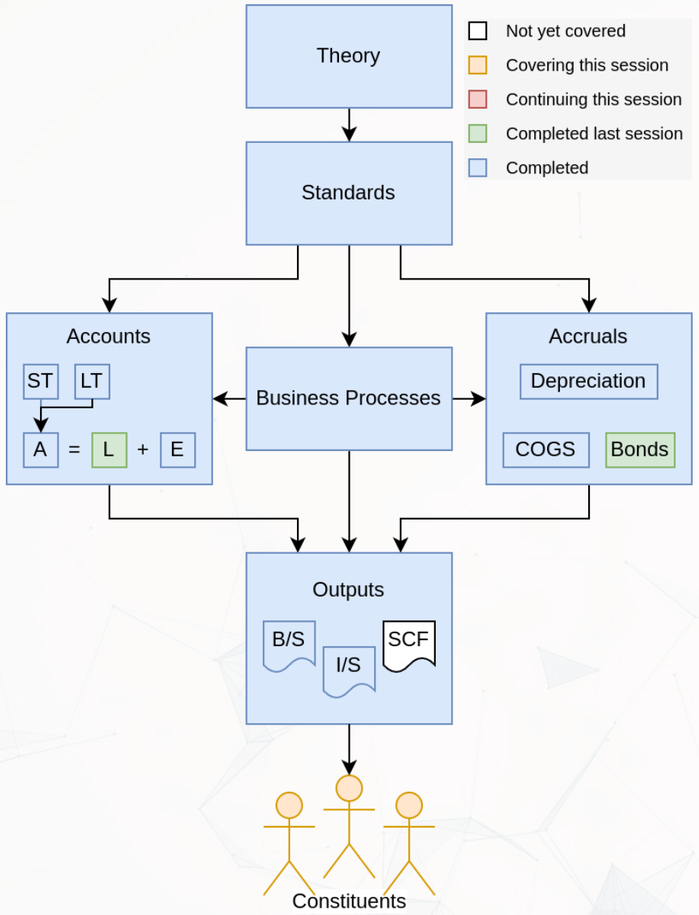
https://rmc.link/

Front matter

Learning objectives



1. Learn about financial statement analysis
2. Calculate and interpret financial ratios

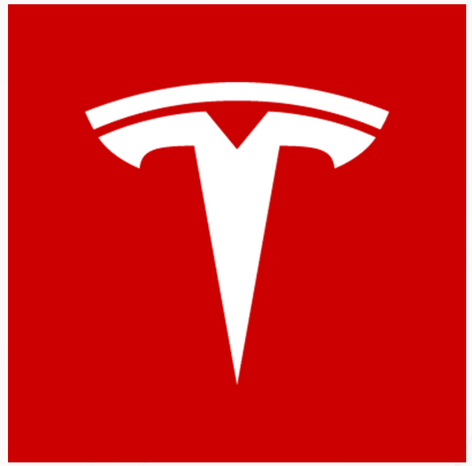
Financial statement analysis

What matters?

1. The business environment
    - Economy health
    - Other countries (particularly for multinational firms)
    - Industry demand
    - Resource scarcity or supplier concentration
    - Consumer concentration
2. Historical financials
    - Financial statements and notes
    - Competitors statements

What matters?

3. Historical non-financials
    - Governance
    - Risk disclosures
    - Audit report
    - Shareholders
    - supplier relationships



Predicting firm value

1. Trend analysis (a.k.a. Horizontal analysis)
    - Compare dollar and percent changes across years
2. Common size financial statements (a.k.a. Vertical analysis)
    - Compare financials across years or firms
    - A subset of ratio analysis
3. *Ratio analysis*
4. Analytics

> *Only ratio analysis is on the final* – we'll cover the others briefly.

Trend analysis

What is it?

- Comparing different years or quarters of data to see the *trend* in measures.
- Examples:
  - Revenue grew by 3% this year
  - Net income grew by 4% this quarter
  - Quarterly revenue decreased 2% year over year

Examples

- How extreme weather worries are driving revenue growth at data giant MSCI

> But the *13 per cent growth rate* for ESG and climate tools outstripped MSCI's overall organic *increase in operating revenues* in the second quarter, which was *10 per cent*.
>
> — **FT**

- Grab's revenue grows 17 percent year-on-year in second quarter

> Singapore-based superapp Grab announced Thursday that its *revenue grew 17 percent year-over-year* to $664 million in the second quarter of 2024, driven by revenue growth across all segments.
>
> — **TN Global**

How to do it

1. Get 2 financial statements from the same company (typically the income statement)
2. Find the percentage change from the old figures to the new figures

Microsoft
Partial Income Statement
In Millions of USD

Year ended June 30,	2017	2016	
Revenue			
Product	51,190	61,502	⇨ 17% decrease
Service	32,760	23,818	⇨ 38% increase
Total revenue	89,950	85,320	⇨ 5.4% increase
Total cost of revenue	34,261	32,780	⇨ 4.5% increase
Gross profit	55,689	52,540	⇨ 6.0% increase
Research and development	13,037	11,988	⇨ 8.8% increase
Sales and marketing	15,539	14,697	⇨ 5.7% increase
Net income	21,204	16,798	⇨ 26% increase

Common-size financial statements

What is it?

- Standardizing figures in a financial statement by dividing by another figure.
- Allows for comparing financial statements across companies
- Ex.:
  - Divide an income statement by revenue
    - $\frac{Gross\ profit}{Revenue} = Gross\ Margin$
    - $\frac{Net\ income}{Revenue} = Profit\ Margin$
  - Divide financial statements by total assets

Examples

- Tesla profit margin worst in five years as price cuts, incentives weigh on bottom line

> “Tesla on July 23 reported its lowest *profit margin* in more than five years and missed Wall Street earnings targets in the second quarter, as the electric vehicle (EV) maker cut prices to revive demand while it increased spending on artificial intelligence (AI) projects.
>
> **— Straits Times**

- Nike Inc (NKE) Q1 2025 Earnings Call Transcript Highlights: Revenue Decline Amidst Gross Margin

> “Nike Inc (NYSE:NKE) reported *gross margin* expansion of 120 basis points to *45.4%*, driven by lower product costs and strategic pricing actions.
>
> **— Yahoo! Finance**

How to do it

1. Get a financial statement
2. Divide every number by the same amount (sales, total assets, etc.) to get the percent (of sales, of assets, etc.)

Microsoft Partial Income Statement In Millions of USD		Percent of sales
Year ended June 30,	2017	
Total revenue	89,950	100%
Total cost of revenue	34,261	38.1%
Gross profit	55,689	61.9%
Research and development	13,037	14.5%
Sales and marketing	20,326	22.6%
Net income	21,204	23.6%

Apple Partial Income Statement In Millions of USD		Percent of sales
Year ended September 30,	2017	
Total revenue	229,234	100%
Total cost of revenue	141,048	61.5%
Gross profit	88,186	38.5%
Research and development	11,581	5.1%
Sales and marketing	15,261	6.7%
Net income	48,351	21.1%

We can compare accross companies or years

Balance sheet ratios

What is ratio analysis?

- Using various ratios of numbers from financial statements to better understand companies

All examples use the following data:

Microsoft
Partial Income Statement
In millions of USD

Year ended June 30,	2017	2016
Revenue		
Product	51,190	61,502
Service	32,760	23,818
Total revenue	89,950	85,320
Total cost of revenue (COGS)	34,261	32,780
Gross profit	55,689	52,540
Research and development	13,037	11,988
Sales and marketing	15,539	14,697
Operating income	22,326	20,182
Interest expense	2,222	1,243
Net income	21,204	16,798

Microsoft
Partial Balance Sheet
In millions of USD

Year ended June 30,	2017	2016
Current assets		
Cash	7,663	6,510
Short term investments	125,318	106,730
A/R	19,792	18,277
Inventory	2,181	2,251
Total current assets	159,851	139,660
Total assets	241,086	193,468
Current liabilities		
A/P	7,390	6,898
Total current liabilities	64,527	59,357
Total liabilities	168,692	121,471
Total equity	72,394	71,997

MSFT Stock Quotes
(price in USD, shares in millions, dividends paid in millions of USD)

June 30,	2017	2016
Price	68.93	51.17
Shares	7,708	7,808
Dividend paid	12,040	11,329

Caveats

1. There are a few differences between the ratios in these slides and in the book. These differences are due to simplifications I have made – you can use these ratios on the final instead of the book's ratios without penalty.
2. Some ratios have many definitions. If you look online, you may find other definitions for some of these ratios. Don't use those on the final.

Inventory turnover

$$\frac{COGS}{\frac{1}{2}(Inventory_T + Inventory_{T-1})}$$

- How many times per year a company sells its inventory on hand
- A similar measure is *Inventory resident period*
  - A.k.a. Number of days' sales in inventory
  - Calculated as $\frac{365}{Inventory\ turnover}$
  - The number of days it take to sell the company's inventory

> Microsoft's 2017 inv. turnover: $\frac{34{,}261}{\frac{1}{2}(2{,}181+2{,}251)} = 15.46$

> Microsoft's 2017 inv. period: $\frac{365}{15.46} = 23.6\ days$

Accounts receivable turnover

$$\frac{Revenue}{\frac{1}{2}(A/R_T + A/R_{T-1})}$$

- How many times per year a company collects its A/R on hand
- A similar measure is *Receivable collection period*
  - A.k.a. Number of days' sales in receivables
  - Calculated as $\frac{365}{Accounts\ receivable\ turnover}$
  - The number of days it take to collect the company's A/R

> Microsoft's 2017 A/R turnover: $\frac{89{,}950}{\frac{1}{2}(19{,}792+18{,}277)} = 4.73$

> Microsoft's 2017 A/R period: $\frac{365}{4.73} = 77.2\ days$

Payable turnover

$$\frac{COGS}{\frac{1}{2}(A/P_T + A/P_{T-1})}$$

- How many times per year a company pays its A/P it owes
- A similar measure is *Payable outstanding period*
  - Calculated as $\frac{365}{Payable\ turnover}$
  - The number of days it take to pay the company's A/P

> Microsoft's 2017 A/P turnover: $\frac{34{,}261}{\frac{1}{2}(7{,}390+6{,}898)} = 4.80$

> Microsoft's 2017 A/P period: $\frac{365}{4.80} = 76.1\ days$

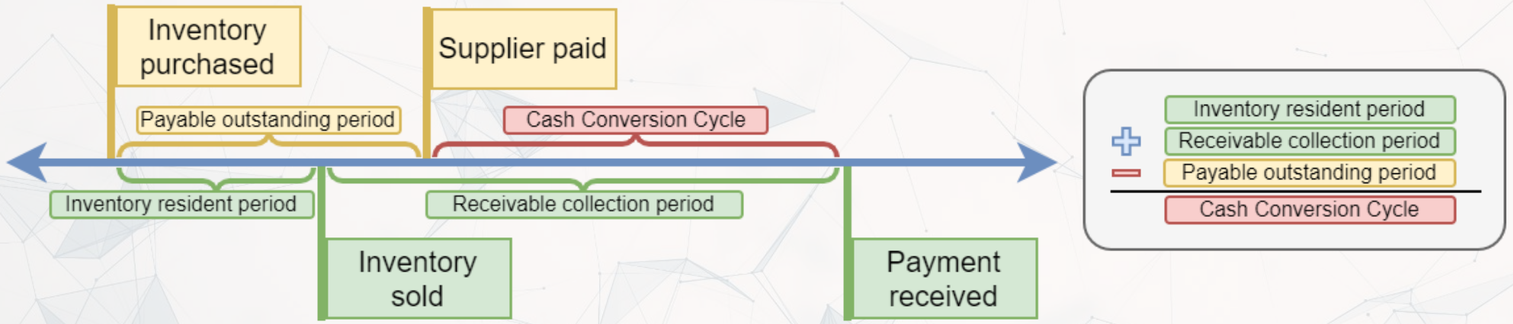
Cash conversion cycle

$$\frac{365}{Inventory\ turnover} + \frac{365}{A/R\ turnover} - \frac{365}{A/P\ turnover}$$

$$\Updownarrow$$

$$Receivable\ collection\ period + Inventory\ resident\ period - Payable\ outstanding\ period$$

- Measures how long it takes from paying payables to receiving cash for a sale
- Can calculate from turnover ratios or periods



> Microsoft's 2017 cash conversion cycle: $23.6 + 77.2 - 76.1 = 24.7\ days$

Asset turnover

$$\text{Asset turnover} = \frac{Net\ revenue}{\frac{1}{2}(Assets_T + Assets_{T-1})}$$

- Measures sales volume in relation to asset base

> Microsoft's 2017 asset turnover: $\frac{89{,}950}{\frac{1}{2}(241{,}086+193{,}468))} = 41.4\%$

Current ratio

$$\frac{Current\ assets}{Current\ liabilities}$$

- Measures a company's ability to pay current liabilities
- This should usually be > 2

> Microsoft's 2017 current ratio: $\frac{159{,}851}{64{,}527} = 2.48$

Quick ratio

$$\frac{Cash + Short\ term\ investments + A/R}{Current\ liabilities}$$

- A.k.a. acid-test ratio
- Measures a company's ability to pay current liabilities
  - Only factors in liquid current assets
- This should be > 1

> Microsoft's 2017 quick ratio: $\frac{7{,}663+125{,}318+19{,}792}{64{,}527} = 2.37$

Debt to equity ratio

$$\frac{Total\ liabilities}{Total\ equity}$$

- Measures a company's leverage
  - Leverage = how much the company is financed by debt
- Higher = more leverage = more debt financing

> Microsoft's 2017 debt to equity ratio: $\frac{168{,}692}{72394} = 2.33$

Times-interest-earned ratio

$$\frac{Income\ from\ operations}{Interest\ expense}$$

- Measures a company's ability to cover interest payments
- Higher is better, < 1 should cause some worry

> Microsoft's 2017 times-interest-earned ratio: $\frac{22{,}326}{2{,}222} = 10.05$

Practice

> Calculate the following ratios for Microsoft in 2016

- Payable outstanding period
- Quick ratio
- Debt to equity ratio
- Times-interest-earned ratio

> Extra info: Microsoft’s A/P in 2015 was $6,591M

Income statement ratios

Profit Margin

$$\frac{Profit}{Revenue}$$

- Gross profit margin tells you about the company's selling margins
- Net profit margin tells you about its overall profitability

> Microsoft's 2017 gross profit margin: $\frac{55,689}{89,950} = 61.9\%$

> Microsoft's 2017 net profit margin: $\frac{21,204}{89,950} = 23.6\%$

Return on assets (ROA)

$$\frac{Net\ income}{\frac{1}{2}(Assets_T + Assets_{T-1})}$$

- Measures overall profitability based on the company's size
- Very common measure in practice
- Higher is better

> Microsoft's 2017 ROA: $\frac{21{,}204}{\frac{1}{2}(241{,}086+193{,}468))} = 9.76\%$

Return on equity (ROE)

$$\frac{Net\ income}{\frac{1}{2}(Equity_T + Equity_{T-1})}$$

- Measures overall profitability based on the company's size
  - Stockholder focussed
- Very common measure in practice
- Higher is better

> Microsoft's 2017 ROE: $\frac{21{,}204}{\frac{1}{2}(72{,}394+71{,}997))} = 29.4\%$

Practice

> Calculate the following ratios for Microsoft in 2016

- Net profit margin
- Return on assets (ROA)
- Return on equity (ROE)

> Extra info: Microsoft’s 2015 total assets was $176,223M and Microsoft’s 2015 total equity was $80,083M

Equity ratios

Earnings per share (EPS)

$$\frac{Net\ income - Dividends\ on\ pref.\ shares}{\frac{1}{2}(\#Shares_T + \#Shares_{T-1})}$$

- Measures the amount of profit tied to each share of stock
- Very common measure in practice
- Assume shares in year T and $T-1$ are the same if not stated
- Very easily manipulated

> Microsoft's 2017 EPS: $\frac{21{,}204-0}{\frac{1}{2}(7{,}708+7{,}808))} = \$2.73/share$

Price/earnings ratio (P/E ratio)

$$\frac{Stock\ price}{EPS}$$

- A measure of if a stock is overpriced
- 6 to 8 is common, 20+ is common for tech firms
  - Higher = overpriced
  - Lower = underpriced
- Very common measure in practice
- Very easily manipulated, since EPS is easily manipulated

> Microsoft's 2017 P/E ratio: $\frac{68.93}{2.73} = 25.2$

Practice

> Calculate the following ratios for Microsoft in 2016

- EPS
- P/E Ratio

> Extra info: Microsoft’s 2015 outstanding shares was 8,027M

Equations

Balance sheet ratio equations

$$\text{Inventory turnover} = \frac{COGS}{\frac{1}{2}(Inventory_T + Inventory_{T-1})}$$

$$\text{A/R turnover} = \frac{Revenue}{\frac{1}{2}(A/R_T + A/R_{T-1})}$$

$$\text{A/P turnover} = \frac{COGS}{\frac{1}{2}(A/P_T + A/P_{T-1})}$$

$$\text{Cash conversion cyle} = \frac{365}{Inv.\ turnover} + \frac{365}{A/R\ turnover} - \frac{365}{A/P\ turnover}$$

$$\text{Asset turnover} = \frac{Net\ revenue}{\frac{1}{2}(Assets_T + Assets_{T-1})}$$

$$\text{Current ratio} = Current\ assets / Current\ liabilities$$

$$\text{Quick ratio} = \frac{Cash + Short\ term\ investments + A/R}{Current\ liabilities}$$

$$\text{Debt to equity ratio} = Total\ liabilities / Total\ equity$$

$$\text{Times-interest-earned} = \frac{Income\ from\ operations}{Interest\ expense}$$

Income statement ratio equations

$$\text{Gross (profit) margin} = \frac{Gross\ profit}{Revenue}$$

$$\text{Net profit margin} = \frac{Net\ income}{Revenue}$$

$$\text{Return on assets (ROA)} = \frac{Net\ income}{\frac{1}{2}(Assets_T + Assets_{T-1})}$$

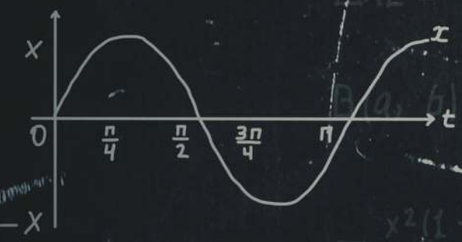
$$\text{Return on equity (ROE)} = \frac{Net\ income}{\frac{1}{2}(Equity_T + Equity_{T-1})}$$

Equity ratio equations

$$\text{Earnings per share (EPS)} = \frac{Net\ income - Dividends\ on\ pref.\ shares}{\frac{1}{2}(\#Shares_T + \#Shares_{T-1})}$$

$$\text{Price/earnings ratio (P/E)} = \frac{Stock\ price}{EPS}$$

Analytics



Background

> This is a quick preview of a module called “Forecasting and Forensic Analytics,” part of the Analytics and Forensics majors in SOA

- You don’t need to know this for this class, but the techniques covered here are becoming more and more important

Revenue prediction

> Predicting ROA for tech companies using prior year data

```
1  summary(fit)
```

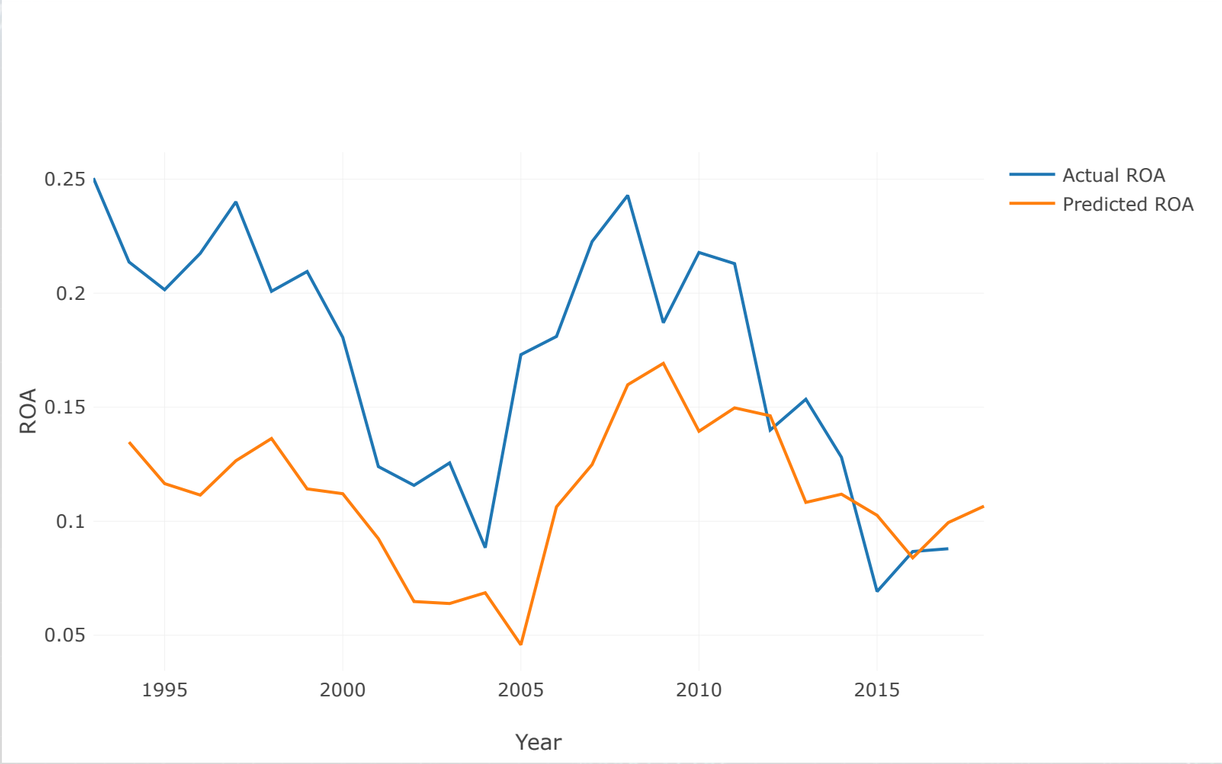
```
Call:
lm(formula = ROA ~ ROA_lag + Revenue_lag + Debt_lag + factor(gind),
    data = df_tech)

Residuals:
    Min      1Q  Median      3Q     Max
-4.4421 -0.0238  0.0107  0.0467  0.4378

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)        0.004095   0.031227   0.131  0.89569
ROA_lag            0.469025   0.061576   7.617 6.91e-14 ***
Revenue_lag        0.030639   0.015260   2.008  0.04498 *
Debt_lag           0.121253   0.040732   2.977  0.00299 **
factor(gind)451020 0.092444   0.035630   2.595  0.00964 **
```

Code: Revenue prediction

```r
library(readr)
library(dplyr)
df <-read.csv("/media/Data/Data/Compustat/Compustat_199301-201703.csv")
df <- data.frame(df)
df_tech <- subset(df,gsector == 45 & at > 10000,
                  select=c("gvkey","datadate","at","ni","lt","revt","gind"))
df_tech <- arrange(df_tech, gvkey, datadate)
df_tech$ROA <- df_tech$ni / df_tech$at
df_tech$Revenue <- df_tech$revt / df_tech$at
df_tech$Debt <- df_tech$lt / df_tech$at
x <- c("ROA", "Revenue","Debt") # Columns to lag
df_tech <- df_tech %>%
  group_by(gvkey) %>%
  mutate_at(.cols=x, .funs=funs(lag = dplyr::lag(., n=1, default=NA)))
is.na(df_tech) <- sapply(df_tech, is.infinite)
fit <- lm(ROA ~ ROA_lag + Revenue_lag + Debt_lag + factor(gind), data=df_tech)
save(fit, file = "../Data/fit.rda")
summary(fit)
```

Revenue prediction for Microsoft

Predict out Microsoft’s 2018 ROA



Code: Revenue prediction for Microsoft

```r
df_ms <- subset(df,gvkey==12141, select=c("gvkey","datadate","at", "ni","lt",
                                          "revt","gind"))
df_ms2 <- data.frame(gvkey=12141, datadate=20170630, at=241086,ni=21204,
                     lt=168692,revt=89950,gind=451030)
df_ms3 <- data.frame(gvkey=12141, datadate=20180630, at=NA,ni=NA,
                     lt=NA,revt=NA,gind=451030)
df_ms <- rbind(df_ms, df_ms2, df_ms3)
df_ms$ROA <- df_ms$ni / df_ms$at
df_ms$Revenue <- df_ms$revt / df_ms$at
df_ms$Debt <- df_ms$lt / df_ms$at
x <- c("ROA", "Revenue","Debt") # Columns to lag
df_ms <- df_ms %>%
  group_by(gvkey) %>%
  mutate_at(.cols=x, .funs=funs(lag = dplyr::lag(., n=1, default=NA)))
df_ms$ROA_predicted <- predict(fit, df_ms)
df_ms$year = floor(df_ms$datadate/10000)
save(df_ms, file="Data/df_ms.rda")
```

```r
suppressPackageStartupMessages(library(plotly))
m <- list(l = 60,  r = 50,  b = 60,  t = 100,  pad = 4)
plot_ly(df_ms,x=~year,y=~ROA, name='Actual ROA', type='scatter',
        mode='lines', width = 800, height = 500) %>%
  add_trace(y=~ROA_predicted, name='Predicted ROA') %>%
  layout(autosize = F, margin = m,
         xaxis=list(title="Year"), yaxis=list(title="ROA"))
```

Fraud detection

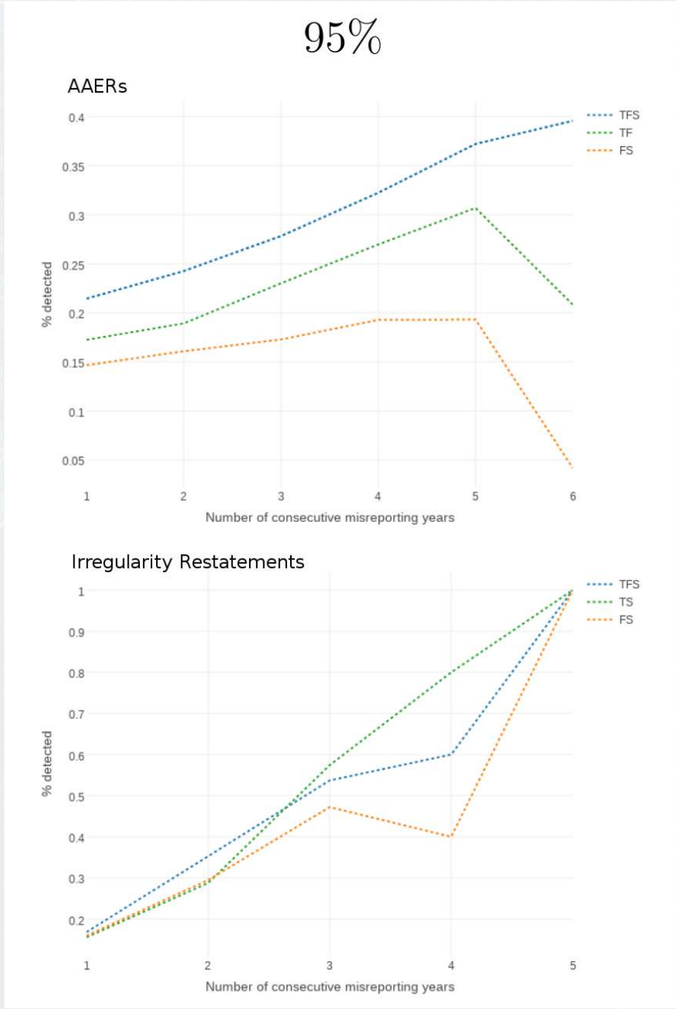
- Using 3 components:
  1. **T**opic – what companies say in annual reports
  2. **S**tyle – writing style used in annual reports
  3. **F**inancials – financial ratios

Classification Performance of *topic* for AAERs and Irregularity Restatements

Panel A: Classification of AAERs

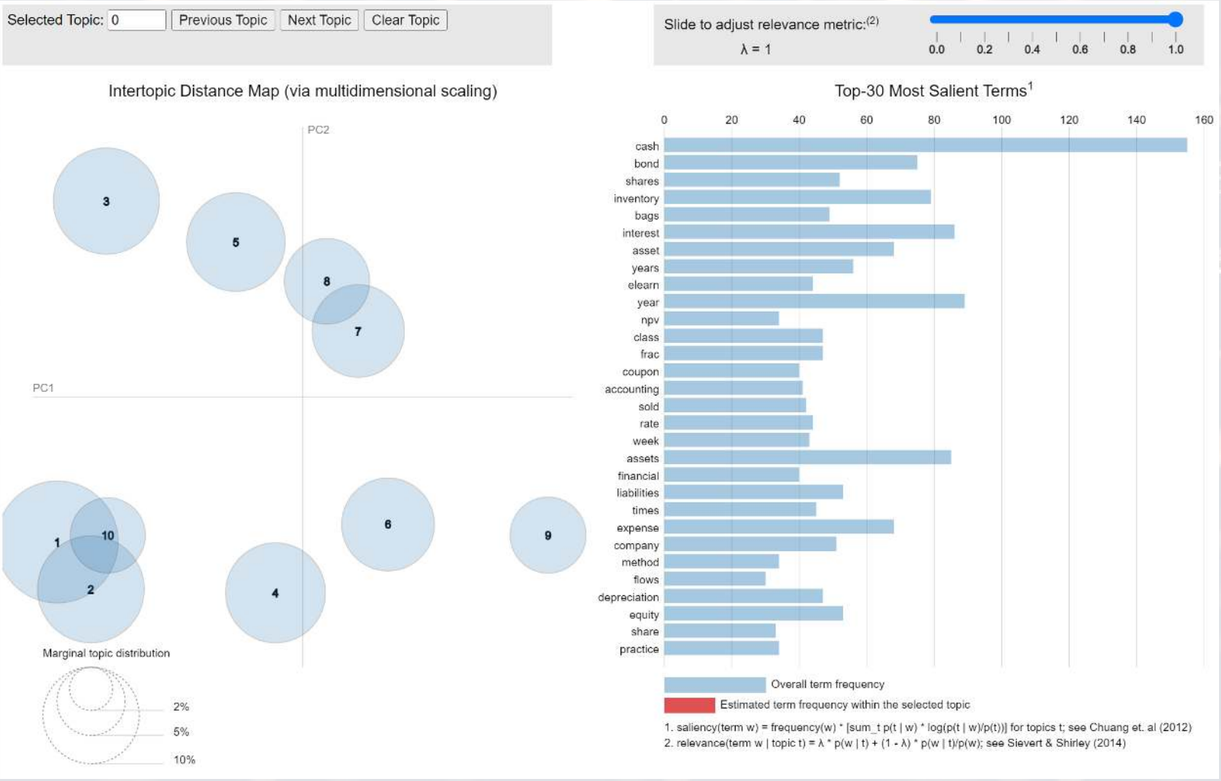
	Classification %			NDCG@k
	50th	90th	95th	99th
topic	72.54	18.60	11.25	0.097
F-score	71.16	23.86	14.04	0.141
Style	60.21	11.95	6.50	0.085
topic and *F-score*	74.07	32.07	17.24	0.192
topic and *Style*	74.47	19.40	11.27	0.123
F-score and *Style*	73.98	23.73	14.66	0.168
topic, *F-score*, and *Style*	75.09	31.50	21.44	0.176

- Brown, Crowley, & Elliott (2020, Journal of Accounting Research)



Text classification of what we cover in ACCT 101

- This shows the output of a simple machine learning model trained on individual slides from our course
- Its goal is to summarize the content by grouping related words together



End matter

Wrap up

- For next week
  1. Do Quiz 2 on eLearn!
  2. Recap the reading for this week
  3. Read the pages for next week
     - Cash flows (Chapter 11)
  4. Practice on eLearn
     - Practice on Financial ratios
     - Automatic feedback provided
- Survey on the class session at rmc.link/101survey2

Packages used for these slides

- kableExtra
- knitr
- revealjs