ACCT 101: Financial Statement Analysis

Session 11

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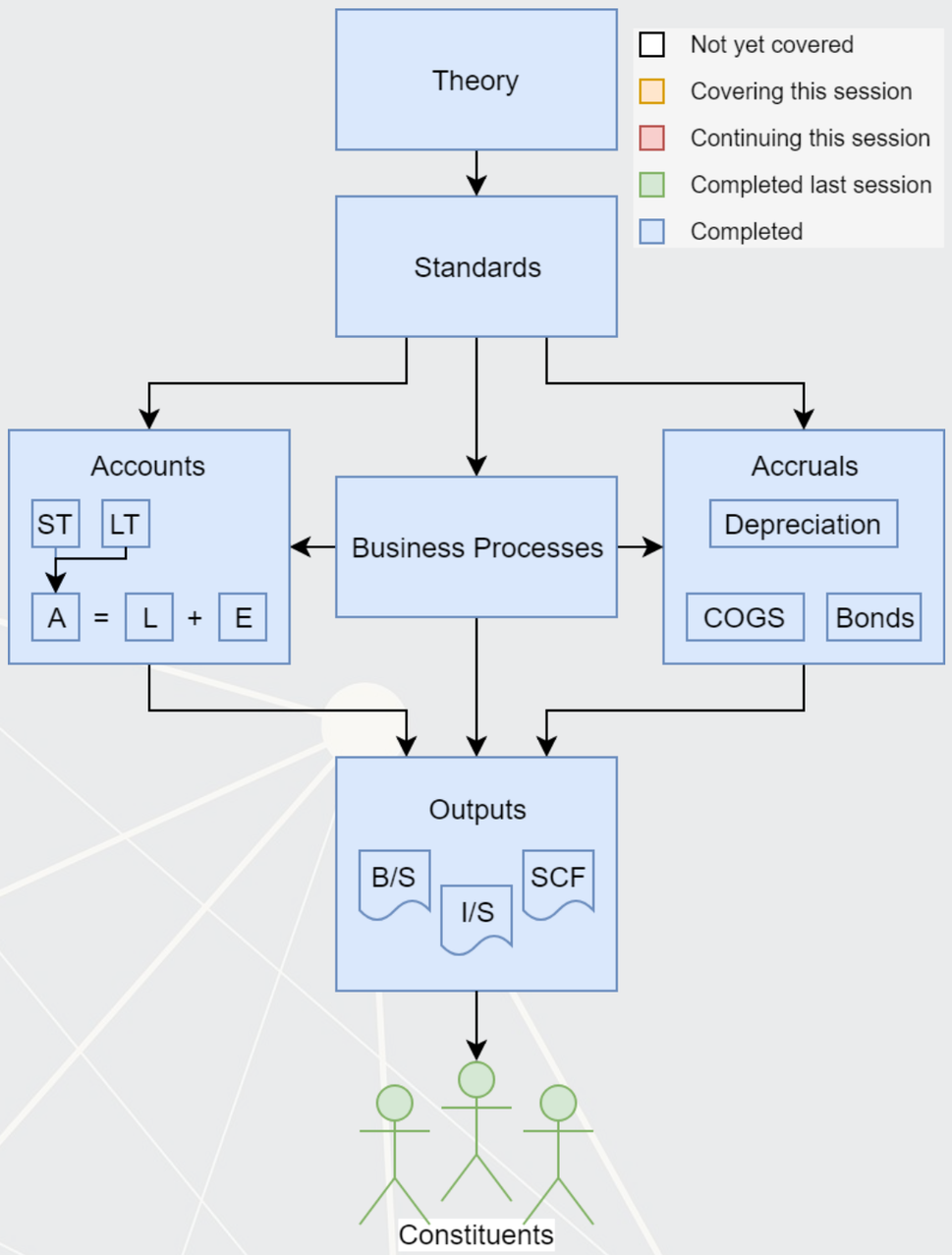
Frontmatter

Learning objectives



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

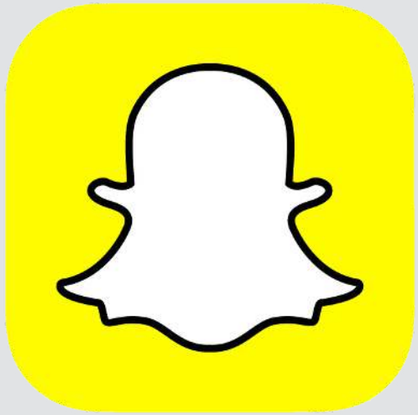
Financial statement analysis

What matters?

1. The business environment
   - Economy health
   - Other countries (particularly for multinational firms)
   - Industry demand
   - Resource scarcity or supplier concentration
   - Consumer concentration

What matters?

2. Historical financials
    - Financial statements and notes
    - Competitors statements



https://rmc.link/101class11-1

What matters?

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

https://rmc.link/101class11-2

https://rmc.link/101class11-3

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

- Nike Rides Out its #MeToo Moment, WSJ

> That is a reflection of a strong quarter: Nike reported earnings of 68 cents a share, beating analysts' estimates by 15 cents, and *grew revenue by 7%*.

- China's Tencent Invests in Video, AI and Mobile Payments, as Earnings Soar, WSJ

> The plans emerged as the Shenzhen-based company said its *fourth-quarter revenue grew 51% year over year* to 66.4 billion yuan ($10.2 billion), boosted by strong growth in mobile payments, digital content subscriptions and advertising on its flagship mobile social apps, WeChat and QQ.

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 margin	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 finanical statements accross 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

- Cheerios Could Get Pricier as General Mills Faces Rising Costs, WSJ

> Fourteen of the last 15 packaged food makers to [report] earnings posted lower-than-expected gross margins, said J.P. Morgan analyst Ken Goldman.

- Ford CEO Says Company Could Exceed 8% Margin Target, WSJ

> The company is forecasting an 8% global profit margin by about 2022, a number that would put it closer to better-performing peers, including GM. Ford's 5% operating margin last year was disappointing…

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

Year ended June 30,	2017		Percent of sales
Total revenue	89,950	⇨	100%
Total cost of revenue	34,261	⇨	38.1%
Gross margin	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

Year ended September 30,	2017		Percent of sales
Total revenue	229,234	⇨	100%
Total cost of revenue	141,048	⇨	61.5%
Gross margin	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 margin	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 to convert inventory to cash, less time to pay payables
  - Time from paying for inventory to getting cash on 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 ratio

$$\frac{Total\ liabilities}{Total\ assets}$$

- A.k.a. Debt to assets ratio
- Measures a company's leverage
  - Leverage = how much the company is financed by debt
- Higher = more leverage = more debt financing

Microsoft's 2017 debt ratio: $\frac{168{,}692}{241{,}086} = 70.0\%$

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 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
- Operating profit margin tells you about its operating efficiency
- 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 operating profit margin: $\frac{22{,}326}{89{,}950} = 24.8\%$

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

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

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

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

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

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

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

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

$$\text{Debt ratio} = \frac{Total\ liabilities}{Total\ assets}$$

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

Income statement ratio equations

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

$$\text{Operating profit margin} = \frac{Operating\ profit}{Revenue}$$

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

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

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

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 major 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

```
summary(fit)
```

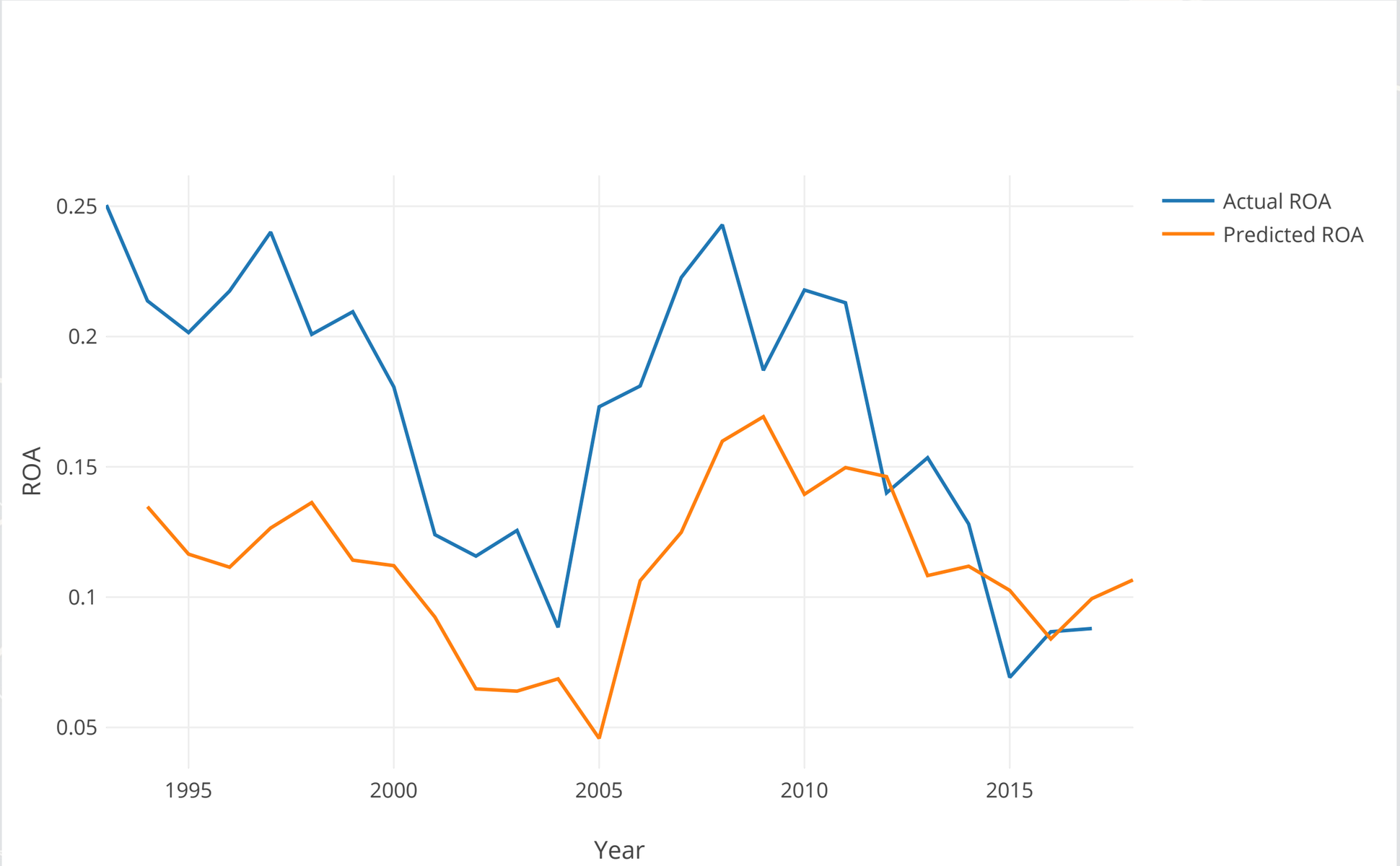
```
##
## Call:
## lm(formula = ROA ~ ROA_lag + Revenue_lag + Debt_lag + factor(gind),
##     data = df_tech)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.4421 -0.0238  0.0107  0.0467  0.4378
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           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 **
## factor(gind)451030 -0.035024   0.033293  -1.052  0.29310
## factor(gind)452010 -0.138055   0.034286  -4.027 6.16e-05 ***
## factor(gind)452020 -0.077091   0.032478  -2.374  0.01784 *
## factor(gind)452030 -0.090377   0.034553  -2.616  0.00906 **
## factor(gind)453010 -0.014934   0.032090  -0.465  0.64178
```

Code: Revenue prediction

```
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

```
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")
```

```
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') %>%
  add_trace(y=~ROA_predicted, name='Predicted ROA') %>%
  layout(autosize = F, width = 800, height = 500, 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

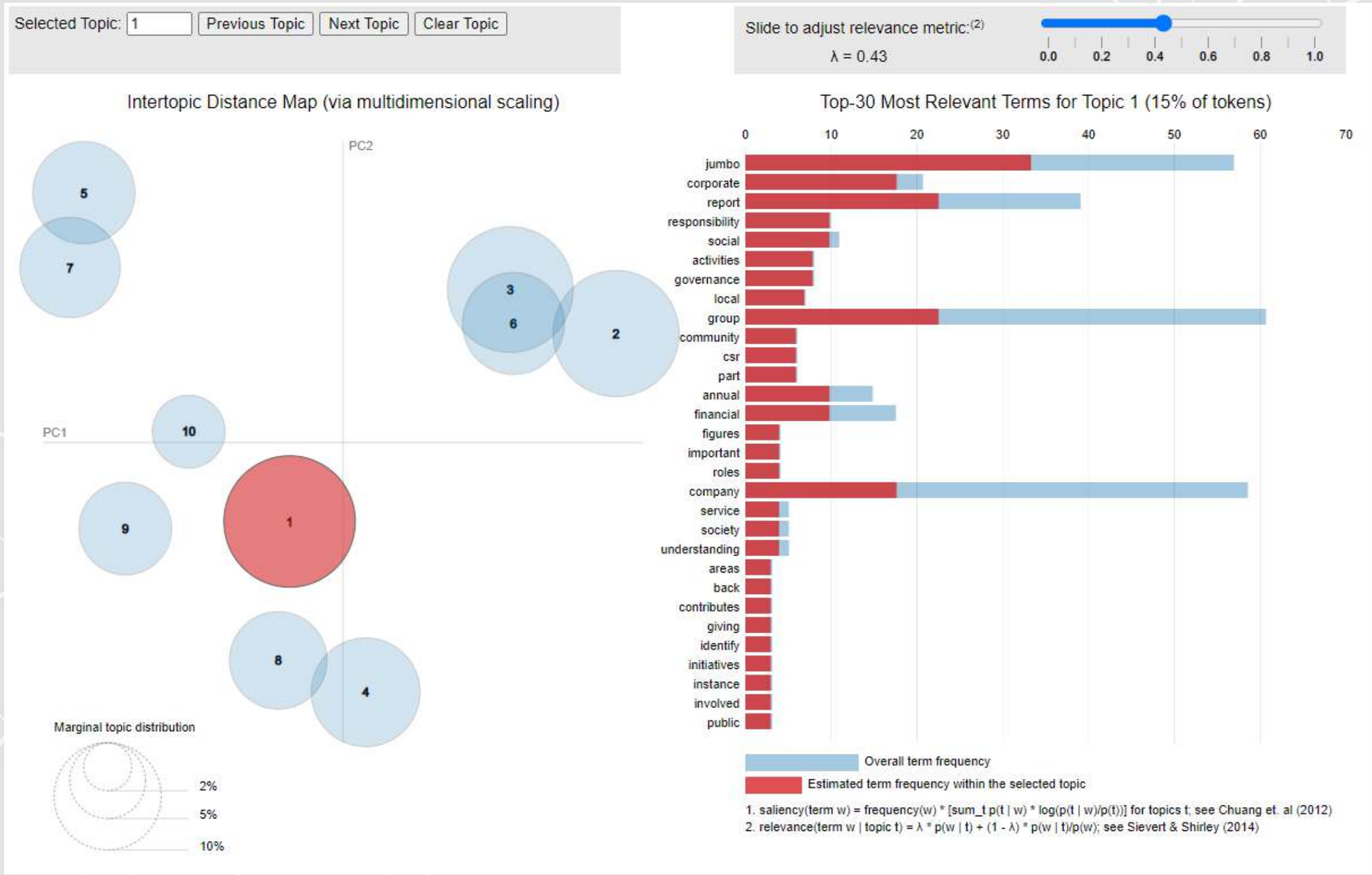
Classification Performance of *topic* for AAERs and Irregularity Restatements

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 2019

Text classification of what you found interesting on HW2



End matter

For next week

- Homework 5
  - Cash flows and financial ratios
  - Turn in before next week
- Next week:
  - Groups will present in order
    - Group numbers were randomly assigned
  - Group project presentations
  - Email me slides by 10am of that class day
- Extra practice available
  - Financial ratios eLearn quiz