QFin Corporate Finance - Case Study I
The Boeing Co.

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1 Exercise 1

Computing the book leverage:

$$Bookleverage = \frac{longtermdebt + currentliabilites}{bookequity}$$

```
fin_output <- Data_ex1_corporatefinanceproject[,1]
tot_debt <- c(0)
book_eq <- c(0)
mv_eq <- c(0)
for (i in 1:nrow(Data_ex1_corporatefinanceproject)) {
  tot_debt[i] <- as.numeric(Data_ex1_corporatefinanceproject[i,5])
  book_eq[i] <- as.numeric(Data_ex1_corporatefinanceproject[i,6])
  mv_eq[i] <- as.numeric(Data_ex1_corporatefinanceproject[i,7])
}


fin_output$Book_leverage <- tot_debt/book_eq
```

Computing the market leverage:

$$Marketleverage = \frac{totaldebt}{MVofequity}$$

Table 1: Multiples

	Date	Book_leverage	Market_leverage
1	1Q 2012	14.67	1.59
2	2Q 2012	12.85	1.67
3	3Q 2012	9.89	1.59
4	4Q 2012	13.90	1.69
5	1Q 2013	10.96	1.43
6	2Q 2013	11.07	1.23
7	3Q 2013	9.44	1.14
8	4Q 2013	5.00	0.82
9	1Q 2014	5.26	0.92
10	2Q 2014	5.54	0.86
11	3Q 2014	5.33	0.95
12	4Q 2014	9.57	1.00
13	1Q 2015	11.18	0.90
14	2Q 2015	14.55	1.02
15	3Q 2015	13.59	1.08
16	4Q 2015	13.76	1.10
17	1Q 2016	21.30	1.05
18	2Q 2016	137.50	1.17
19	3Q 2016	101.62	1.17
20	4Q 2016	101.62	0.93
21	1Q 2017	577.54	0.84
22	2Q 2017	-46.52	0.82
23	3Q 2017	78.48	0.63
24	4Q 2017	21.41	0.50
25	1Q 2018	86.48	0.54
26	2Q 2018	-83.38	0.53
27	3Q 2018	-95.84	0.57

2 Exercise 2

Calculating the Price-Earnings Ratio (P/E), the Market-to-Book Ratio (P/B), the Return on Equity (ROE), the Return on Assets (ROA), the Cash from operating activities (COA), the Cash from investing activities (CIA) and the Cash from financing activities (CFA) on a yearly and quarterly basis for the last 6 years.

Table 2: Calculations on yearly basis

X__1	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
P/E	14.601	22.249	16.868	18.622	19.628	21.264
P/B	9.543	6.802	10.451	15.068	109.553	423.066
ROE, %	66.473	30.824	62.851	81.705	599.143	2,309.014
ROA, %	4.387	4.948	5.861	5.483	5.439	8.878
COA, in $ millions	7,508	8,179	8,858	9,363	10,499	13,344
CIA, in $ millions	-3,757	-5,154	2,467	-1,846	-3,380	-2,062
CFI, In $ millions	-3,477	-4,249	-8,593	-7,920	-9,587	-11,350

Calculating the Price-Earnings Ratio (P/E), the Market-to-Book Ratio (P/B), the Return on Equity (ROE), the Return on Assets (ROA), the Cash from operating activities (COA), the Cash from investing activities (CIA) and the Cash from financing activities (CFA) on a yearly and quarterly basis for the last 6

years. In order to obtain these ratios, we first need to recall the formulas.

The Price-Earnings Ratio (P/E) is calculated in the following way:

$$\text{P/E} = \frac{\text{Share price}}{EPS},$$

where EPS is **earnings per share** and calculated as

$$\text{EPS} = \frac{\text{Net Income}}{\text{Shares outstanding}}$$

The Market-to-Book Ratio(also called price-to-book ratio, P/B) is

$$\text{P/B} = \frac{\text{Market Value of Equity}}{\text{Book Value of Equity}},$$

where

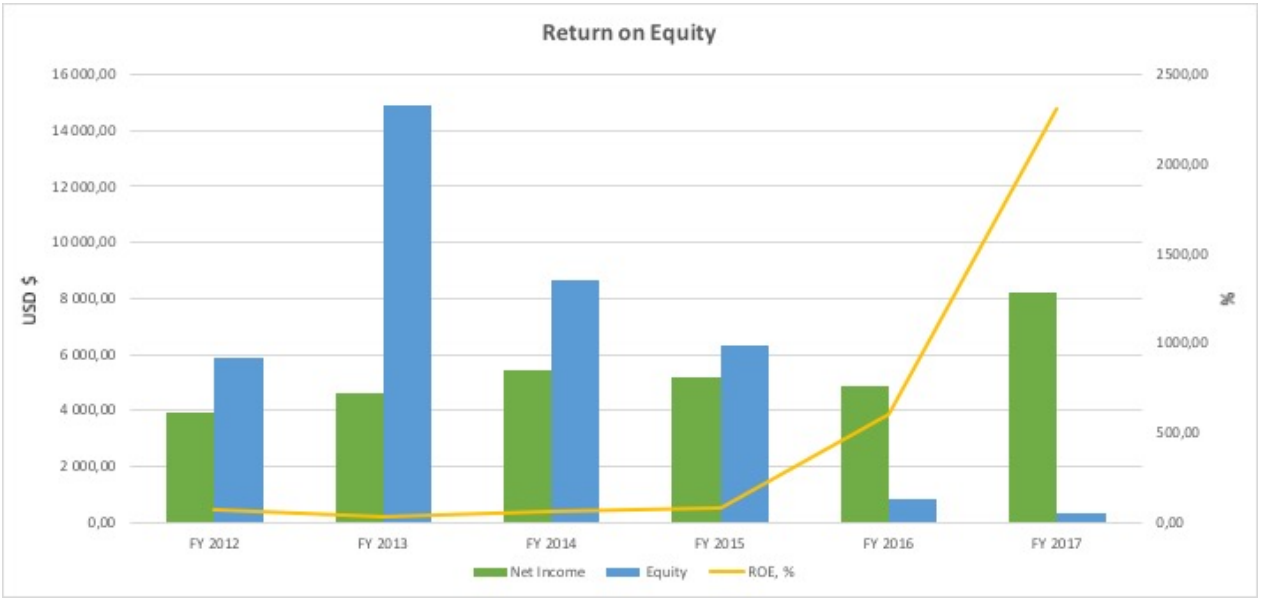
$$\text{Market Value of Equity} = \text{Shares outstanding} \times \text{Share price}$$

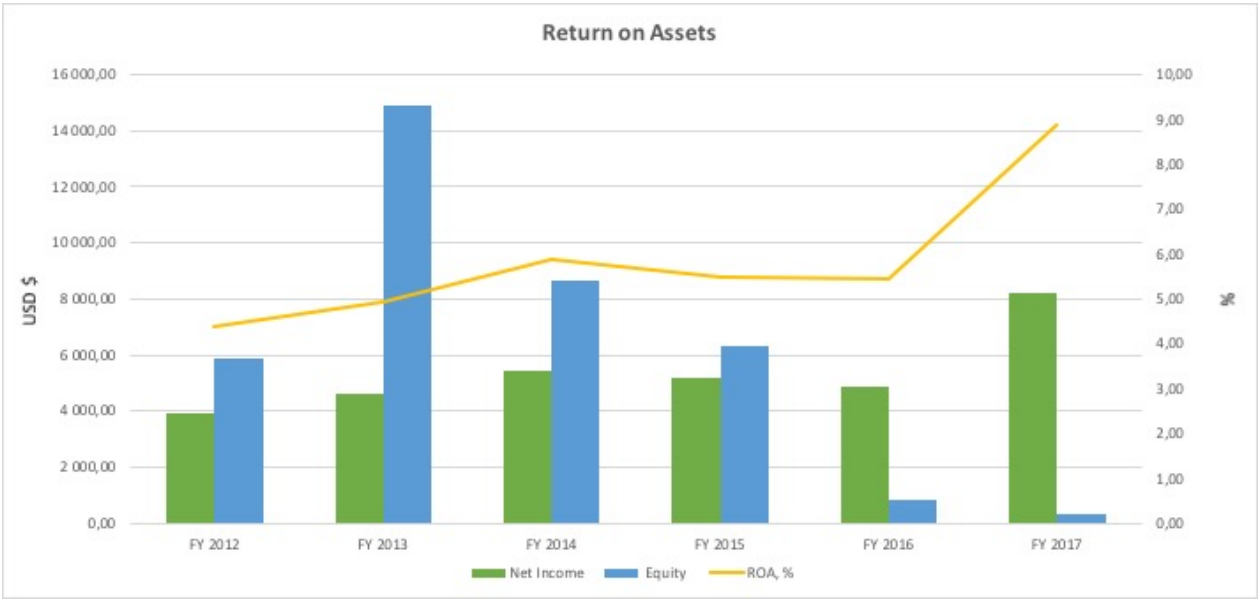
The return on equity (ROE) and the return on assets (ROA) have the following formulas:

$$\text{ROE} = \frac{\text{Net Income}}{\text{Book Value of Equity}}$$

$$\text{ROA} = \frac{\text{Net Income}}{\text{Total Assets}}$$


Price-to-Book
250
200
150
100
50
0
USD $
450,0
400,0
350,0
300,0
250,0
200,0
150,0
100,0
50,0
0,0
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
Market price per share
Book value per share
P/B


Return on Equity
16 000,00
14 000,00
12 000,00
10 000,00
8 000,00
6 000,00
4 000,00
2 000,00
0,00
USD $
2500,00
2000,00
1500,00
1000,00
500,00
0,00
%
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
Net Income
Equity
ROE, %



Now, we consider the results on a quarterly basis:

Table 3: Calculations on quaterly basis

Quarter Year	P/E	P/B	ROE,%	ROA,%	COA*	CIA*	CFA*
Q1 2012		10.876	18.361	1.151	837	-3,003	-1,187
Q2 2012		9.475	16.661	1.185	908	-585	-710
Q3 2012		6.829	13.600	1.234	1,596	-1,005	-337
Q4 2012	14.601	9.543	16.670	1.100	4,167	836	-1,243
Q1 2013	15.945	8.611	14.822	1.223	524	-814	-1,705
Q2 2013	18.378	10.121	14.443	1.180	3,467	-2,557	-525
Q3 2013	20.418	9.744	12.915	1.222	2,808	-711	-763
Q4 2013	22.263	6.802	8.289	1.331	1,380	-1,072	-1,256
Q1 2014	20.649	6.267	6.646	1.054	1,112	406	-3,668
Q2 2014	18.334	6.471	11.749	1.781	1,809	875	-2,096
Q3 2014	17.446	6.212	9.386	1.470	939	-247	-1,530
Q4 2014	16.871	10.451	16.919	1.578	4,998	1,433	-1,299
Q1 2015	17.915	12.971	16.873	1.364	88	-214	-2,935
Q2 2015	17.921	14.980	17.720	1.131	3,297	-198	-2,605
Q3 2015	15.659	12.948	25.237	1.718	2,859	-553	-2,069
Q4 2015	18.640	15.068	16.196	1.087	3,119	-881	-311
Q1 2016	16.064	19.780	30.151	1.332	1,275	-438	-4,265
Q2 2016	21.897	125.626	-40	-0.261	3,190	-912	-1,544
Q3 2016	19.021	37.926	108.952	2.559	3,202	-614	-2,204
Q4 2016	19.640	109.553	199.633	1.812	2,876	-1,416	-1,618
Q1 2017	20.400	691.229	1,662.105	1.761	2,098	-260	-2,463
Q2 2017	16.214	-59.305	-85.862	1.943	4,949	-1,123	-3,311
Q3 2017	22.434	132.622	166.667	1.989	3,396	-218	-3,335
Q4 2017	21.077	423.066	882.254	3.392	2,904	-426	-2,241
Q1 2018	20.894	147.577	202.700	2.181	3,136	119	-2,845
Q2 2018	21.293	-149.005	-152.394	1.940	4,680	-1,414	-4,332
Q3 2018	20.811	-175.030	-183.320	2.061	4,559	-902	-3,689

*Cashflows are in millions of US dollars.

3 Exercise 3

In this section we first consider the information on the announcement/ declaration date of dividends, dividend, ex-dividend date within the last 6 years.

Table 4: Dividend dates

Ex/Eff Date	Amount, $	Type	Decl.Date
2018-11-08	1.710	Quarter	2018-10-22
2018-08-09	1.710	Quarter	2018-06-25
2018-05-10	1.710	Quarter	2018-04-30
2018-02-08	1.710	Quarter	2017-12-11
2017-11-09	1.420	Quarter	2017-10-30
2017-08-09	1.420	Quarter	2017-06-26
2017-05-10	1.420	Quarter	2017-05-01
2017-02-08	1.420	Quarter	2016-12-12
2016-11-08	1.090	Quarter	2016-10-31
2016-08-10	1.090	Quarter	2016-06-27
2016-05-11	1.090	Quarter	2016-05-02
2016-02-10	1.090	Quarter	2015-12-14
2015-11-04	0.910	Quarter	2015-10-26
2015-08-05	0.910	Quarter	2015-06-22
2015-05-06	0.910	Quarter	2015-04-27
2015-02-11	0.910	Quarter	2014-12-15
2014-11-05	0.730	Quarter	2014-10-27
2014-08-06	0.730	Quarter	2014-06-23
2014-05-07	0.730	Quarter	2014-04-28
2014-02-12	0.730	Quarter	2013-12-16
2013-11-06	0.485	Quarter	2013-10-28
2013-08-07	0.485	Quarter	2013-06-24
2013-05-08	0.485	Quarter	2013-04-29
2013-02-13	0.485	Quarter	2012-12-17
2012-11-07	0.440	Quarter	2012-10-29
2012-08-15	0.440	Quarter	2012-06-25
2012-05-09	0.440	Quarter	2012-04-30
2012-02-08	0.440	Quarter	2011-12-12

The dates of announcement of a new repurchase plan for the next year are:

Table 5:

Dates
2017-12-11
2016-12-12
2015-12-14
2014-12-15
2013-12-16
2012-12-11

4 Exercise 4

As a proxy for the market portfolio, we choose the S&P 500 Total Return Index. This index is big enough for us to be able to consider it to be sufficiently diversified, i.e. so as not to contain any unsystematic risk and it is a performance index, meaning that dividend payments are included in its performance.

5 Exercise 5

We compute the arithmetic average annual return and the compound annual return with daily, weekly and monthly returns for the estimating window 1/1/2014 to 12/31/2018 for Boeing and the S&P 500 TR index.

```
#########LOG RETURNS###############
#Annual mean returns
yearlymean_BA<-mean(yearlyReturn(market_xts$BA,type="log"))
yearlymean_market<-mean(yearlyReturn(market_xts$SPXT,type="log"))

#Daily mean returns
dailymean_BA<-mean(dailyReturn(market_xts$BA,type="log"))
dailymean_market<-mean(dailyReturn(market_xts$SPXT,type="log"))

#Weekly mean returns
weeklymean_BA<-mean(weeklyReturn(market_xts$BA,type="log"))
weeklymean_market<-mean(weeklyReturn(market_xts$SPXT,type="log"))

#Monthly mean returns
monthlymean_BA<-mean(monthlyReturn(market_xts$BA,type="log"))
monthlymean_market<-mean(monthlyReturn(market_xts$SPXT,type="log"))

#Compounding to annual returns
results_log<-matrix(0,4,2)
colnames(results_log)<-c("BA","SPXT")
rownames(results_log)<-c("Daily","Weekly","Monthly","Yearly")

results_log[1,1]<-exp(252*dailymean_BA)-1
results_log[1,2]<-exp(252*dailymean_market)-1

results_log[2,1]<-exp(52*weeklymean_BA)-1
results_log[2,2]<-exp(52*weeklymean_market)-1

results_log[3,1]<-exp(12*monthlymean_BA)-1
results_log[3,2]<-exp(12*monthlymean_market)-1

results_log[4,1]<-yearlymean_BA
results_log[4,2]<-yearlymean_market
stargazer(results_log, title="Annualised log returns")
```

```
#########DISCRETE RETURNS###############
#Annual mean returns
yearlymean_BA<-mean(yearlyReturn(market_xts$BA,type="arithmetic"))
yearlymean_market<-mean(yearlyReturn(market_xts$SPXT,type="arithmetic"))

#Daily mean returns
dailymean_BA<-mean(dailyReturn(market_xts$BA,type="arithmetic"))
```

Table 6: Annualised log returns

	BA	SPXT
Daily	0.208	0.110
Weekly	0.207	0.109
Monthly	0.208	0.110
Yearly	0.186	0.102

```
dailymean_market<-mean(dailyReturn(market_xts$SPXT,type="arithmetic"))

#Weekly mean returns
weeklymean_BA<-mean(weeklyReturn(market_xts$BA,type="arithmetic"))
weeklymean_market<-mean(weeklyReturn(market_xts$SPXT,type="arithmetic"))

#Monthly mean returns
monthlymean_BA<-mean(monthlyReturn(market_xts$BA,type="arithmetic"))
monthlymean_market<-mean(monthlyReturn(market_xts$SPXT,type="arithmetic"))

#Compounding to annual returns
results_arithmetic<-matrix(0,4,2)
colnames(results_arithmetic)<-c("BA","SPXT")
rownames(results_arithmetic)<-c("Daily","Weekly","Monthly","Yearly")

results_arithmetic[1,1]<-(1+dailymean_BA)^252-1
results_arithmetic[1,2]<-(1+dailymean_market)^252-1

results_arithmetic[2,1]<-(1+weeklymean_BA)^52-1
results_arithmetic[2,2]<-(1+weeklymean_market)^52-1

results_arithmetic[3,1]<-(1+monthlymean_BA)^12-1
results_arithmetic[3,2]<-(1+monthlymean_market)^12-1

results_arithmetic[4,1]<-yearlymean_BA
results_arithmetic[4,2]<-yearlymean_market
stargazer(results_arithmetic, title="Annualised discrete returns")
```

Table 7: Annualised discrete returns

	BA	SPXT
Daily	0.241	0.119
Weekly	0.240	0.117
Monthly	0.240	0.115
Yearly	0.242	0.110

6 Exercise 6

```
vola_daily_BA<-sd(dailyReturn(market_xts$BA,type="log"))*sqrt(252)
vola_dailymarket<-sd(dailyReturn(market_xts$SPXT,type="log"))*sqrt(252)
vola_weekly_BA<-sd(weeklyReturn(market_xts$BA,type="log"))*sqrt(52)
vola_weeklymarket<-sd(weeklyReturn(market_xts$SPXT,type="log"))*sqrt(52)
vola_monthly_BA<-sd(monthlyReturn(market_xts$BA,type="log"))*sqrt(12)
vola_monthlymarket<-sd(monthlyReturn(market_xts$SPXT,type="log"))*sqrt(12)

results_vola<-matrix(0,3,2)
colnames(results_vola)<-c("BA","SPXT")
rownames(results_vola)<-c("Daily","Weekly","Monthly")

results_vola[1,1]<-vola_daily_BA
results_vola[1,2]<-vola_dailymarket
results_vola[2,1]<-vola_weekly_BA
results_vola[2,2]<-vola_weeklymarket
results_vola[3,1]<-vola_monthly_BA
results_vola[3,2]<-vola_monthlymarket
stargazer(results_vola, title="Annualised volatilities")
```

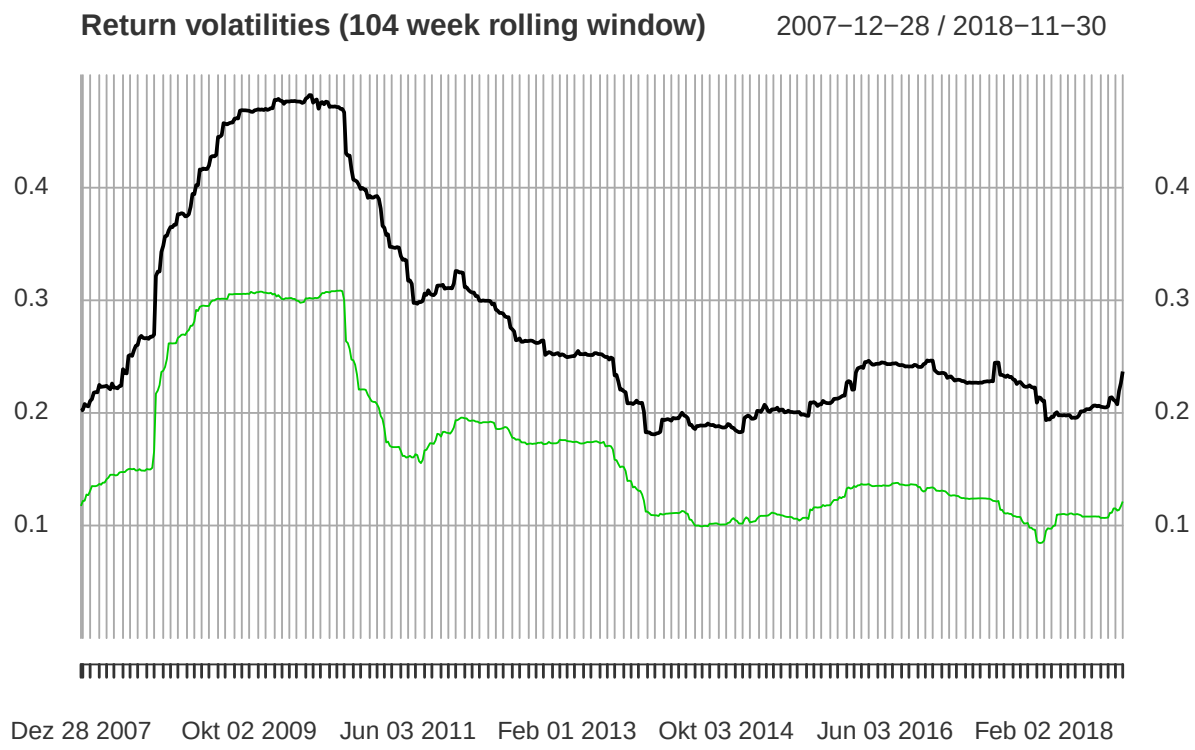
Table 8: Annualised volatilities

	BA	SPXT
Daily	0.229	0.128
Weekly	0.232	0.123
Monthly	0.229	0.100

7 Exercise 7

```
market_xts<-xts(market_data[,2:3],order.by = market_data[,1])
weekly_BA<-weeklyReturn(market_xts$BA,type="log")
weeklymarket<-weeklyReturn(market_xts$SPXT,type="log")
N<-length(weeklymarket)
rolling_volas<-matrix(0,2,N-103)
for(i in 1:(N-103)){
  rolling_volas[1,i]<-sd(weekly_BA[i:(104+i-1)])
  rolling_volas[2,i]<-sd(weeklymarket[i:(104+i-1)])
}
volas_BA<-xts(rolling_volas[1,],order.by = index(weekly_BA)[104:N])*sqrt(52)
volas_market<-xts(rolling_volas[2,],order.by = index(weeklymarket)[104:N])*sqrt(52)

invisible(plot(volas_BA,type="l",main="Return volatilities (104 week rolling window)",
               ylim=c(0,0.5),ylab="Annualised Volatility"))
lines(volas_market,col=3)
```




```
invisible(plot(weekly_BA^2))
lines(weeklymarket^2,col=3)
```