Example - Yara - Growth estimation

For purposes of valuation, you want to estimate a historical growth measure for the fertilizer company *Yara*. Your intern has collected selected data from the most recent annual reports of Yara:

```
Year;Revenue(USD mill);Operating Income; EBITDA ; Debt/Equity
2019;            12936;    989         ;  2095  ; 0.42
2018;            13054;    402         ;  1523  ; 0.43
2017;            11400;    457         ;  1348  ; 0.25
Year; Revenue(NOK mill);OI            ; EBITDA ; Debt/Equity
2017;            93812;     3777       ; 11120  ; 0.25
2016;            97170;     8771       ; 15563  ; 0.17
2015;           111897;    14104       ; 21361  ;
2014;            95343;    10305       ; 13399  ; 0.17
2013;            85092;     8074       ; 16407  ; 0.06
2012;            84509;    11166       ; 16977  ; 0.02
2011;            80352;    13240       ; 18163  ; 0.12
2010;            65374;     7467       ; 15315  ; 0.27
2009;            61418;     1271       ;  5549  ; 0.56
2008;            88775;    12281       ; 17917  ; 0.84
2007;            56631;                ;
2006;            46969;                ;
2005;            46171;                ;
```

Yara - Growth estimation

Consider first estimation of the revenue growth.

1. Plot the time series of annual revenue growth
2. Calculate the (arithmetric) average of this series for the period 2004–2019.
3. Why is it not possible to calculate the geometric average of annual sales growth?
4. Compare the average above with some alternative ways of estimating the growth:
   - regress
     $$Revenue_t = a + b\mathbf{t} + \varepsilon_t$$
     where $\mathbf{t} = (1, 2, \ldots,)$ counts the number of years since the start.
     Dividing the estimated b by the Revenue average is the estimate of growth. This is called a "trend regression"
   - the growth can also be estimated from the logarithmic regression
     $$\log(Revenue_t) = a + b\mathbf{t} + \epsilon t$$
     The coefficient b is the growth estimate

Yara - Growth estimation

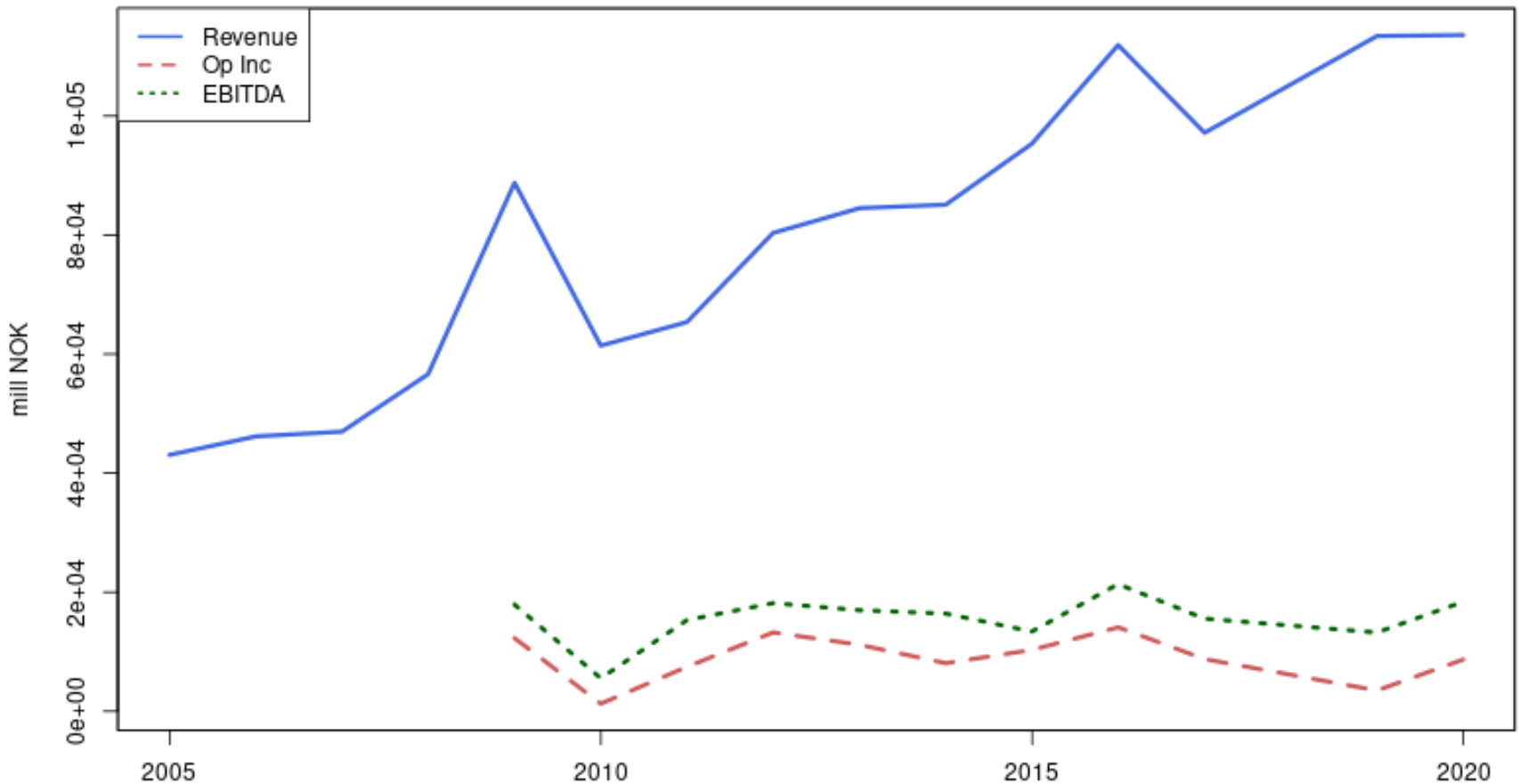
First things first.
Some of the numbers are in dollars, most in NOK. Need to transate everything into a common currency. Get the year-end exchange rate for 2019 and 2018 and translate the dollar values to NOK.

	NOK (mill)				USD (m	
Year	Revenue (NOK mill)	Operating Income	EBITDA	NOK/USD	Revenue (USD mill)	Oper Inc
2019	113582	8684	18395	8.7803	12936	
2018	113420	3493	13233	8.6885	13054	
2016	97170	8771	15563			
2015	111897	14104	21361			
2014	95343	10305	13399			
2013	85092	8074	16407			
...						

Yara - Growth estimation

Now have three time series in NOK: Revenue, Operating Income, and EBITDA.

Plot for a comparison of the three accounting measures.



Yara - Growth estimation

First use revenue to estimate growth.

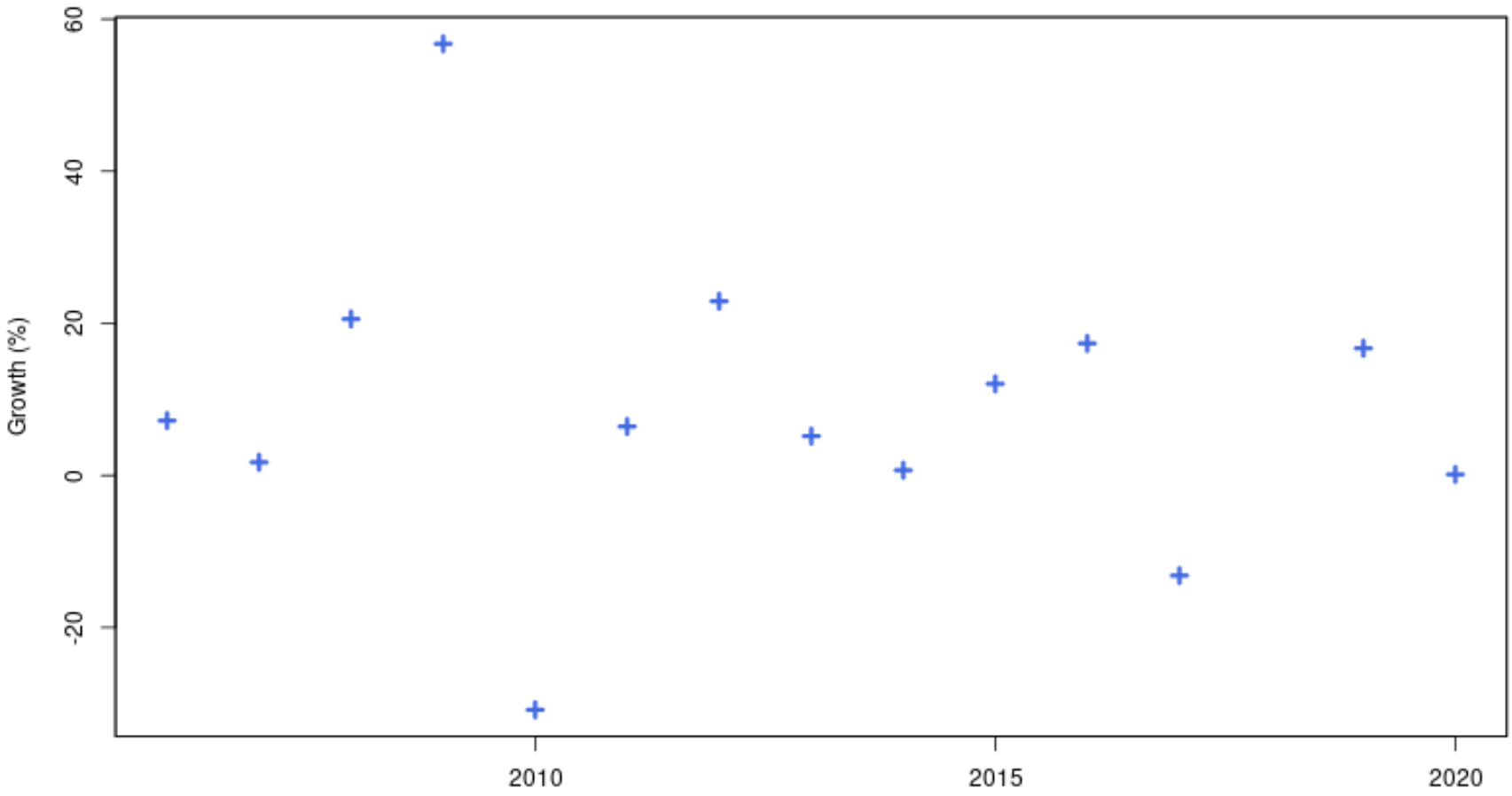
An R snippet that does this:

```
dRevenue <- diff(revenue)/as.matrix(revenue[1:(n-1)]) # div
```

Produces estimates of the percentage change in revenue (on the right)

	Revenue	DeltaRevenue
2004-12-31	43066.0	NA
2005-12-31	46171.0	7.2098639
2006-12-31	46969.0	1.7283576
2007-12-31	56631.0	20.5710149
2008-12-31	88775.0	56.7604316
2009-12-31	61418.0	-30.8161081
2010-12-31	65374.0	6.4411085
2011-12-31	80352.0	22.9112491
2012-12-31	84509.0	5.1734867
2013-12-31	85092.0	0.6898674
2014-12-31	95343.0	12.0469609
2015-12-31	111897.0	17.3625751
2016-12-31	97170.0	-13.1612108

Yara - Growth estimation



Yara - Growth estimation

Doing the various estimates (for the technically minded)

```
> mean(dRevenue)
[1] 0.08841687
```

Yara - Growth estimation

Trend regression

```
> time <- 1:n
> regr <- lm(as.matrix(Revenue)~time)
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  37736.2     4880.9   7.731 3.24e-06 ***
time          5197.7      536.8   9.682 2.61e-07 ***
Multiple R-squared:  0.8782,Adjusted R-squared:  0.8688
F-statistic: 93.74 on 1 and 13 DF,  p-value: 2.614e-07

> b <- regr$coefficients[2]
5197.714
> m <- mean(Revenue)
 79317.91
> growth <- b/m
0.06553014
```

Yara - Growth estimation

log regression

```
> regr <- lm(log(Revenue)~time)
> summary(regr)
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 10.669106   0.069055 154.501  < 2e-16 ***
time         0.070225   0.007595   9.246 4.43e-07 ***
Residual standard error: 0.1271 on 13 degrees of freedom
Multiple R-squared:  0.868,Adjusted R-squared:  0.8579
F-statistic: 85.49 on 1 and 13 DF,  p-value: 4.433e-07

> print(regr$coefficients[2])
0.07022456
```

Yara - Growth estimation

The three estimates are summarized as

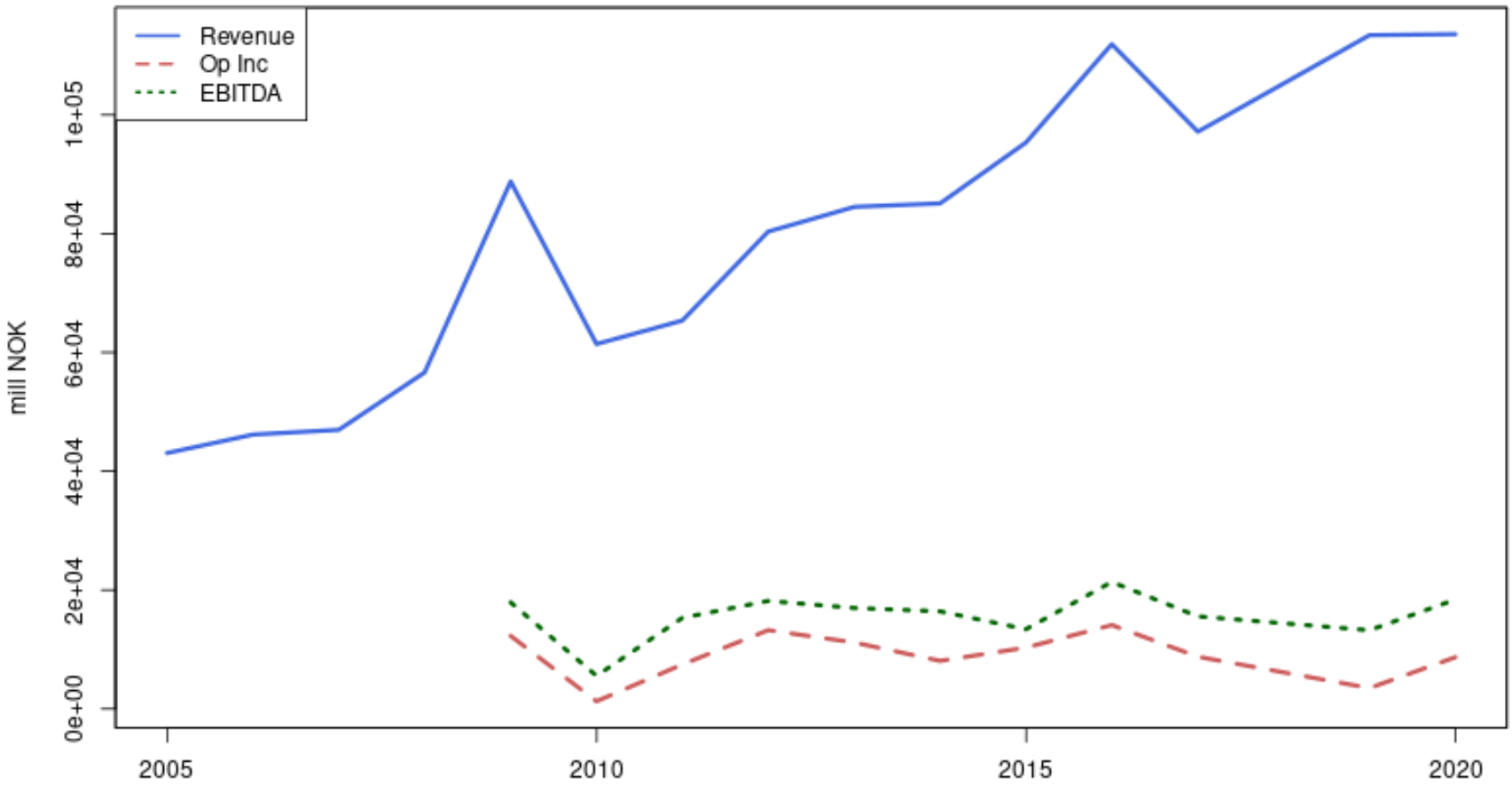
	growth(%)
arith mean	8.84
trend regr	6.55
log regr	7.02

Yara - Growth estimation

Consider next using as alternative bases for estimating growth: Operating Income, and EBIT.

1. Estimate the (arithmetric) average growth for these two alternative measures.
2. How does growth estimates using these alternatives compare to using revenue?

Yara - Growth estimation

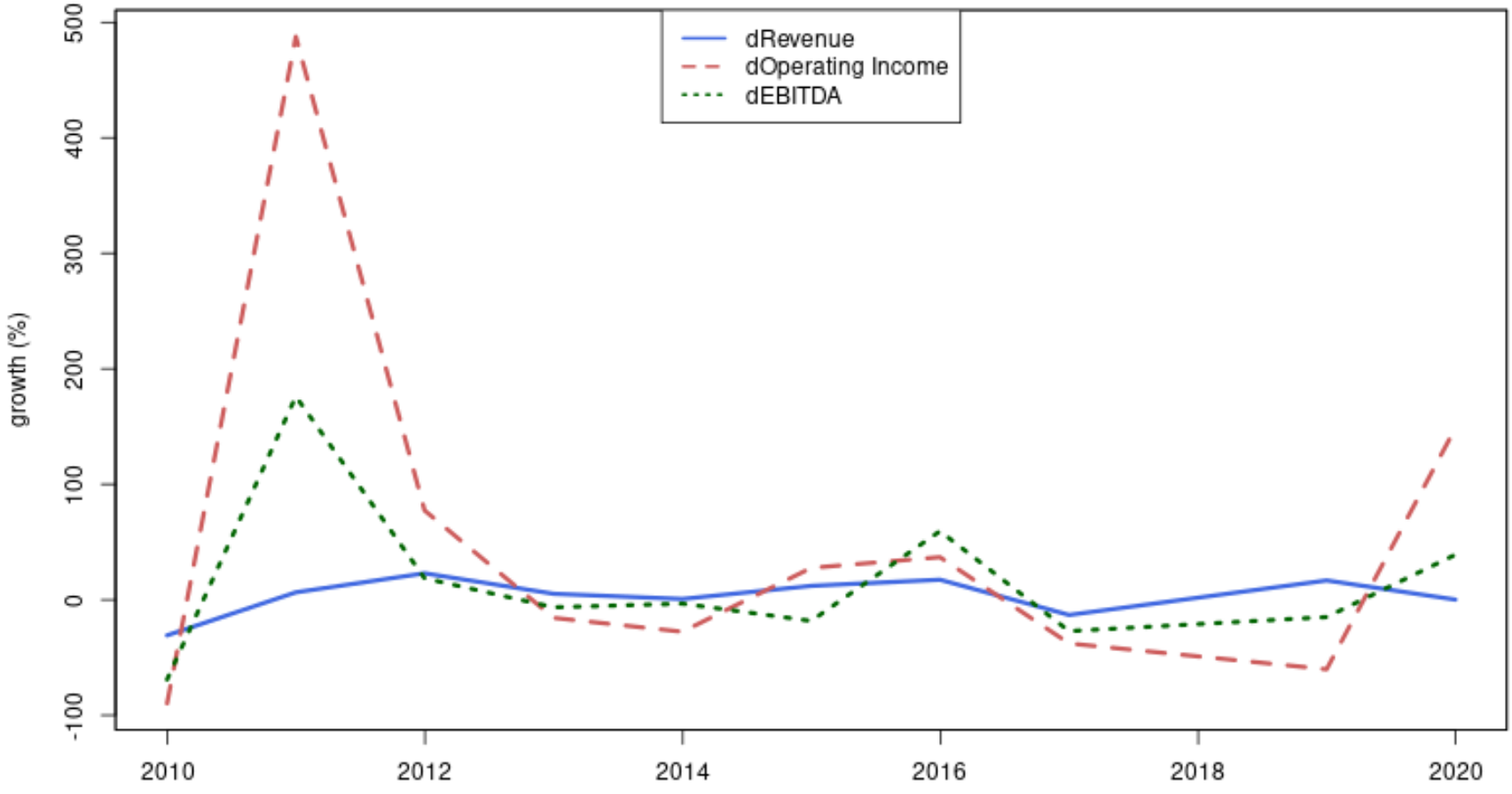


Recall the three measures evolution.

Need to calculate all three using the same periods.

Yara - Growth estimation

Next, make comparison of the three sources of growth estimates
Calculate the annual growth estimates using the three methods



Yara - Growth estimation

Calculating the averages of these three

	Growth(%)
Revenue	3.75
Operating Income	54.69
EBITDA	15.37

What is the reason for the very high estimates using Operating Income and EBITDA?