

Chapter 2 - The Simple Regression Model

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Exercise 2.5

Upload packages

```
library(wooldridge)
library(dplyr)
library(lmreg)
```

Upload database

```
data5<-wooldridge::rdchem

attach(data5)
```

For the population of firms in the chemical industry, let rd denote annual expenditures on research and development, and let $sales$ denote annual sales (both are in millions of dollars).

(i) Write down a model (not an estimated equation) that implies a constant elasticity between rd and $sales$. Which parameter is the elasticity?

The CES model is written in following way:

$$\log(sales) = \beta_0 + \beta_1 \log(rd) + \varepsilon$$

The coefficient β_1 captures the elasticity. In this case, the percentual return on sales for each dollar spent on R & D.

(ii) Now, estimate the model using the data in RDCHEM.RAW. Write out the estimated equation in the usual form. What is the estimated elasticity of rd with respect to $sales$? Explain in words what this elasticity means.

```
lm1<-lm(lsales~lrd, data5)

summary(lm1)
```

```
##
## Call:
## lm(formula = lsales ~ lrd, data = data5)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.82886 -0.39299  0.04353  0.38238  0.66387
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.11773    0.19380   21.25  <2e-16 ***
## lrd          0.84578    0.04861   17.40  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4694 on 30 degrees of freedom
## Multiple R-squared:  0.9098, Adjusted R-squared:  0.9068
## F-statistic: 302.7 on 1 and 30 DF,  p-value: < 2.2e-16
```

The estimated equation is given by

$$\log(sales) = 4.11 + 0.84 \times \log(rd)$$

Hence, for each dollar spent in R & D, there's 0.84% of return on sales.