

# Minimal `knitr` document

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```
library(foreign)
mydata <- read.dta("auto.dta")
names(mydata) <- c("price", "mpg", "weight")

y <- matrix(mydata$price)
X <- cbind(rep(1, NROW(mydata)), mydata$mpg, mydata$weight)

head(X)

##      [,1] [,2] [,3]
## [1,]    1   22 2930
## [2,]    1   17 3350
## [3,]    1   22 2640
## [4,]    1   20 3250
## [5,]    1   15 4080
## [6,]    1   18 3670

b <- solve(t(X) %*% X) %*% t(X) %*% y
b

##      [,1]
## [1,] 1946.068668
## [2,] -49.512221
## [3,]  1.746559
```

Coding up OLS:

```
y <- matrix(mydata$price)
X <- cbind(1, mydata$mpg)

OLS <- function(y,X) {
  b <- solve(t(X) %*% X) %*% t(X) %*% y
  return(b)
}
```

```

resultsOLS <- OLS(y, X)
lm(y ~ X - 1)

##
## Call:
## lm(formula = y ~ X - 1)
##
## Coefficients:
##      X1      X2
## 11253.1  -238.9

OLS(y, X)

##           [,1]
## [1,] 11253.0607
## [2,] -238.8943

```

```

set.seed(222015)

resultsBoot <- sapply(1:10000, function(x){
  indices <- sample(1:length(y), size = length(y), replace = TRUE)
  OLS(y[indices], X[indices,])
})
head(t(resultsBoot))

##           [,1]      [,2]
## [1,] 13006.32 -299.6718
## [2,] 11292.59 -229.2489
## [3,] 10745.55 -220.9619
## [4,] 11020.65 -210.0042
## [5,] 11416.53 -262.3235
## [6,] 12480.89 -309.8984

```

```

seBoot <- function(y, X, nReps){
  # Get the bootstrap results
  resultsBoot <- sapply(1:nReps, function(x){
    indices <- sample(1:length(y), size = length(y), replace = TRUE)
    OLS(y[indices], X[indices,])
  })
  # Get the standard deviations
  myRowMeans <- rowMeans(resultsBoot)
  sapply(1:NCOL(X), function(x){
    sqrt(sum((resultsBoot[x,] - myRowMeans[x])^2)/(nReps - 1))
  })
}

```

```

})
}
# These are the canned standard errors.
resultsLm <- summary(lm(y ~ X))
resultsLm$coefficients[,2]

## (Intercept)          X2
## 1170.81276      53.07669

# These are our bootstrap standard errors.
seBootResults <- seBoot(y, X, 1000)
seBootResults

## [1] 1333.68544    55.89335

```

TABLE 1: OLS RESULTS AND BOOTSTRAP STANDARD ERRORS

Variable	Coefficient
Intercept	11253 (1334)
MPG	-239 (55.9)