Chapter 4

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The Simple Linear Regression Model

LOAD DATA

```
food = read.table(url("http://www.principlesofeconometrics
```

```
head(food)
```

```
##       V1    V2
## 1 115.22  3.69
## 2 135.98  4.39
## 3 119.34  4.75
## 4 114.96  6.03
## 5 187.05 12.47
## 6 243.92 12.98
```

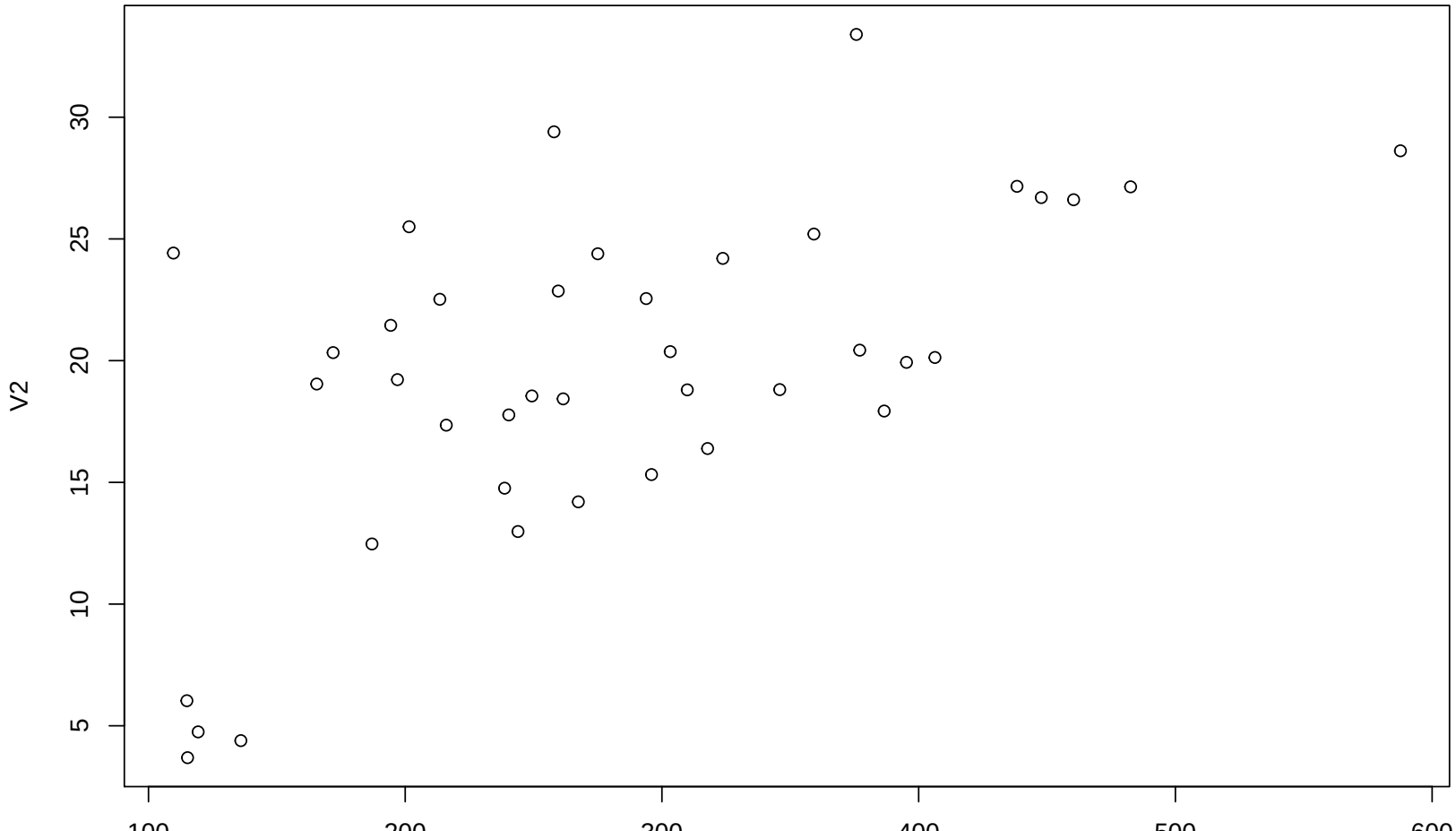
DATA Summary

```
summary(food)       # Summary statistics
```

```
##        V1              V2
##  Min.   :109.7   Min.   : 3.69
##  1st Qu.:200.4   1st Qu.:17.11
##  Median :264.5   Median :20.03
##  Mean   :283.6   Mean   :19.60
##  3rd Qu.:363.3   3rd Qu.:24.40
##  Max.   :587.7   Max.   :33.40
```

Plot Data

```
plot(food)          # Plot matrix
```



Model

$$Y_i = \alpha + \beta X_i + e_i$$

Variables

```
x = food[,2]    # Income
y = food[,1]    # Food Expenditure
```

Estimation

```
reg <- lm(y ~ x)
```

Results

```
summary(reg)
```

```
##
## Call:
## lm(formula = y ~ x)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -223.025  -50.816   -6.324   67.879  212.044
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   83.416     43.410   1.922   0.0622 .
## x             10.210      2.093   4.877 1.95e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1
```

b1, b2

```
b1 <- coef(reg)[[1]]
b2 <- coef(reg)[[2]]

b1
```

```
## [1] 83.416
```

```
b2
```

```
## [1] 10.20964
```

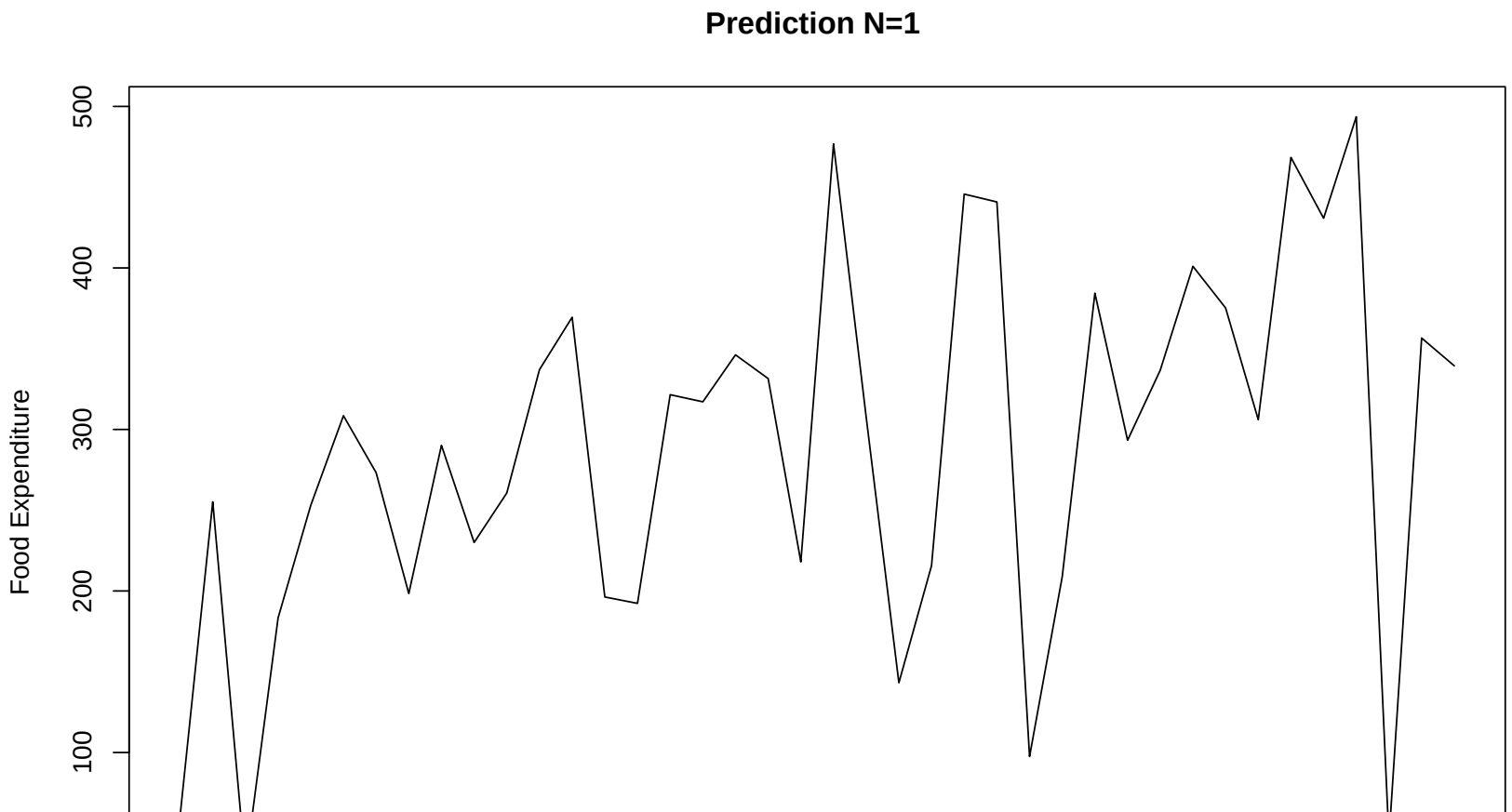
Least sqaures prediction (one time)

```
N <- 40
sde <- 89.52
y1 <- b1+b2*x+rnorm(N, mean=0, sd=sde)

y2 <- data.frame()
y2 <- cbind(y1, y)
```

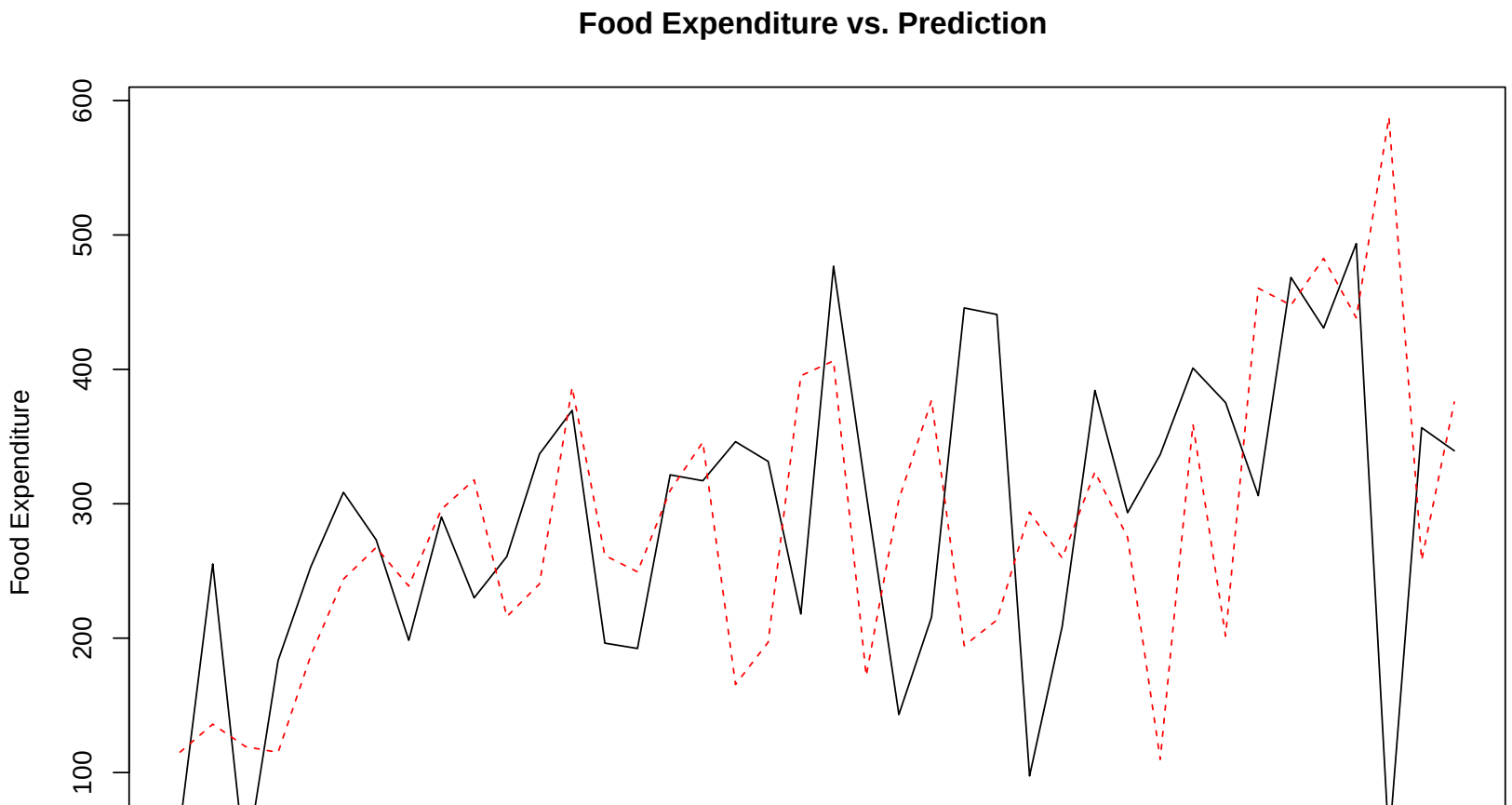
Least sqaures prediction (one time)

```
matplot(y1, type='l', col=1:40,
        xlab='Income', ylab='Food Expenditure',
        main ='Prediction N=1 ')
```



Least sqaures prediction (one time)

```
matplot(y2, type='l', col=1:40,
        xlab='Income', ylab='Food Expenditure',
        main ='Food Expenditure vs. Prediction ')
```



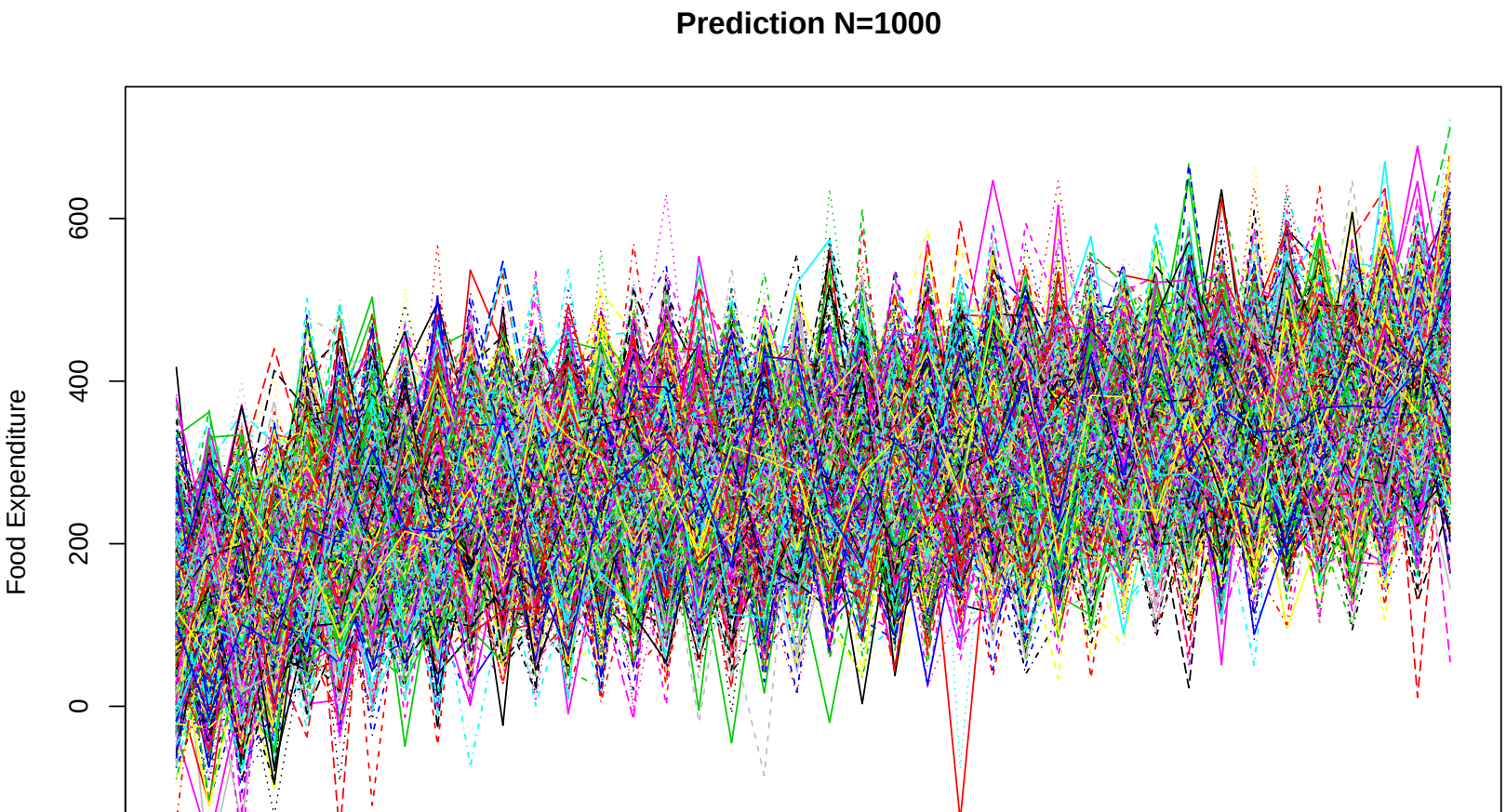
Least sqaures prediction (1,000 times)

```
b1 <- coef(reg)[[1]]
b2 <- coef(reg)[[2]]
yy <- data.frame()

trial <- 1
trials <- 1000
while(trial <= trials) {
  y3 <- b1+b2*x+rnorm(N, mean=0, sd=sde)
  yy <- rbind(yy, t(y3))
  trial <- trial + 1
}
```

Least sqaures prediction (1,000 times)

```
matplot(t(yy), type='l', col=1:40,
        xlab='Income', ylab='Food Expenditure',
        main ='Prediction N=1000 ')
```



Save DATA

sink('ch4.out')

```
# Least sqaures prediction (one time)

y1
```

```
##   [1]  60.64647 255.19286  28.98841 183.34108 253.04704 3
##   [8] 198.42109 290.15302 229.99380 260.67117 337.03811 3
##  [15] 192.31292 321.51367 317.10965 346.18362 331.48845 2
##  [22] 307.55065 143.13891 215.69091 445.70029 440.85086
##  [29] 384.37277 293.31426 336.68622 400.99697 375.23219 3
##  [36] 430.75101 493.59399  46.30770 356.58698 339.38587
```

```
# Least sqaures prediction (1,000 times)

t(yy)
```

References

- Principles of Econometrics with R
  https://bookdown.org/ccolonescu/RPoE4/
- Principles of Econometrics
  http://www.principlesofeconometrics.com/poe4/poe4.htm
- Beowulfkorea
  https://sites.google.com/site/beowulfkorea/yoon/r