23.8

```
library(haven)
data <- read_dta("PSS2017.dta")
```

```
Y <- log(data$EG_total)
X1 <- data$EC_c_alt
X2 <- data$EC_d_alt

ces_model <- nls(
Y~ beta + (nu / rho) * log(alpha * X1^rho + (1- alpha) * X2^rho),
start = list(rho = 0.36, nu = 1.05, alpha = 0.39, beta = 1.66),
data = data
)
```

```
## Warning in min(x): no non-missing arguments to min; returning Inf
```

```
## Warning in max(x): no non-missing arguments to max; returning -Inf
```

```
summary(ces_model)
```

```
##
## Formula: Y ~ beta + (nu/rho) * log(alpha * X1^rho + (1 - alpha) * X2^rho)
##
## Parameters:
##         Estimate Std. Error t value Pr(>|t|)
## rho     0.411489   0.058496   7.035 1.14e-11 ***
## nu      1.042580   0.007826 133.220  < 2e-16 ***
## alpha   0.319427   0.011581  27.581  < 2e-16 ***
## beta  -12.582163   0.184574 -68.169  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1951 on 334 degrees of freedom
##
## Number of iterations to convergence: 5
## Achieved convergence tolerance: 8.564e-06
##   (52 observations deleted due to missingness)
```

Interpretation

Comparing the estimates with Table 23.1, we find that rho, alpha, and nu show similar values. Therefore, apart from beta, the estimates can be considered comparable.