Econometrics-Damodar N. Gujarati / Chapter 9

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19 08 2021

$$Dummy\ Variable\ Regression\ Models$$

$$Y_i = \beta_1\ + \beta_2 D_{2i} + \beta_3 D_{3i} + u_i \tag{9.2.1}$$

$$\boldsymbol{E}[(Y_i \mid D_{2i} = 1, D_{3i} = 0) = \beta_1 + \beta_2] \tag{9.2.2}$$

$$\cdots$$

```
options(scipen = 999)

library(gujarati)

library(ggplot2)

fix(Table9_1)

MODEL1 = lm(Table9_1$Salary ~ Table9_1$D2 + Table9_1$D3)

summary(MODEL1)
```

```
library(ggplot2)

labs =  as_labeller(c(`0` = "D2", `1` = "D3"))

ggplot(Table9_1, aes(Table9_1$Spending, Table9_1$Salary))+geom_point()+
  facet_wrap(~Table9_1$D2,labeller=labs)+xlab("Spending")+ylab("Salary")
```

$$\hat{Y}_t = \underset{(1857)}{48015} + \underset{(2363)}{1524} D_{2i} - \underset{(2467)}{1721} D_{3i} \qquad R^2 = 0.04397 \tag{9.2.5}$$

```
options(scipen = 999)


MODEL2 = lm(Table9_1$Salary ~ Table9_1$D2 + Table9_1$D3 + Table9_1$Spending)

summary(MODEL2)

library(ggplot2)

labs =  as_labeller(c(`0` = "D2", `1` = "D3"))

ggplot(Table9_1, aes(Table9_1$Spending, Table9_1$Salary))+geom_point()+
  facet_wrap(~Table9_1$D2,labeller=labs)+xlab("Spending")+ylab("Salary")

ggplot(Table9_1, aes(Table9_1$Spending, Table9_1$Salary))+
  geom_point()+facet_wrap(~Table9_1$D2,labeller=labs)+geom_smooth(method = "lm")+xlab("Spending")+ylab("Salary")
```

$$\hat{Y}_t = \underset{(3262.5213)}{28694.9180} - \underset{(1862.575)}{2954.1268} D_{2i} - \underset{(1819.8725)}{3112.1948} D_{3i} + \underset{(0.3592)}{2.3404} X_i \qquad R^2 = 0.4977 \tag{9.4.2}$$

Interaction Effects Using Dummy Variables

$$Y_i = \alpha_1 \ + \alpha_2 D_{2i} + \alpha_3 D_{3i} + \alpha_4 (D_{2i} D_{3i}) + \beta X_i + u_i \tag{9.6.2}$$

$$\boldsymbol{E}[(Y_i \mid D_{2i} = 1, D_{3i} = 1, X_i)] = (\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4) + \beta X_i) \tag{9.6.3}$$

$Y = hourly\ wage\ in\ dollars$

$X = education$

$D_2 = 1\ if\ female,\ 0\ otherwise$

$D_3 = 1\ if\ NonWhite\ and\ NonHispanic,\ 0\ otherwise$

There is no dataset for gender difference model, we can use Wooldrigde's data.

```
options(scipen = 999)
library(wooldridge)

attach(wage1)
MODEL3=lm(log(wage)~female+educ+female*educ+exper+expersq+tenure+tenursq)
summary(MODEL3)


labs =  as_labeller(c(`0` = "Male", `1` = "Female"))

ggplot(wage1, aes(educ, wage))+geom_point()+
  facet_wrap(~female,labeller=labs)+xlab("Education")+ylab("Wage")


library(sjPlot)
library(sjmisc)
library(ggplot2)
data(wage1)
theme_set(theme_sjplot())

wage1$female <- to_factor(wage1$female)

MODEL3 <- lm(log(wage)~educ+female+female*educ, data = wage1)

plot_model(MODEL3, type = "pred", terms = c("educ", "female"))
```

```
options(scipen = 999)

fix(Table9_4)


MODEL4=lm(Table9_4$FRIG ~  Table9_4$D2 + Table9_4$D3 +
            Table9_4$D4)
summary(MODEL4)


MODEL5=lm(Table9_4$FRIG ~  Table9_4$DUR +  Table9_4$D2 + Table9_4$D3 +
            Table9_4$D4)

summary(MODEL5)

library(stargazer)
stargazer(list(MODEL4,MODEL5) ,type = "text")



Fitted_Values = fitted(MODEL4)
Residuals = residuals(MODEL4)
Actual = Table9_4$FRIG
DF = data.frame(Actual,Fitted_Values,Residuals)

DF

plot(MODEL4$residuals)
```

```
options(scipen = 999)

fix(Table9_6)
plot(Table9_6$Output,Table9_6$TotalCost,type = "l")

attach(Table9_6)


#Threshold value is 5.500
X_star = 5500
D = ifelse(Output >= 5500,1,0)
subs = (Table9_6$Output - X_star)

New1 = data.frame(Table9_6,D,subs)
fix(New1)
MODEL6=lm(New1$TotalCost ~  New1$Output + New1$subs*D)
summary(MODEL6)
```

```
options(scipen = 999)

fix(Table9_7)
plot(Table9_7$WI,Table9_6$TotalCost,type = "l")

attach(Table9_6)


#Threshold value is 5.500
X_star = 5500
D = ifelse(Output >= 5500,1,0)
subs = (Table9_6$Output - X_star)

New1 = data.frame(Table9_6,D,subs)
fix(New1)
MODEL7=lm(log(Table9_7$WI) ~ Table9_7$AGE +Table9_7$DE2 + Table9_7$DE3 + Table9_7$DE4 +
            Table9_7$DPT + Table9_7$DSEX)
summary(MODEL7)
```

```
options(scipen = 999)

fix(Table9_9)
attach(Table9_9)
MODEL8=lm(V ~ I + D + W +G*I + N +P)
summary(MODEL8)
```

$$\hat{Y}_t = \underset{(1857)}{0.499592} - \underset{(0.012934)}{0.00956I_i} - \underset{(0.016329)}{0.037411D_i} + \underset{(0.040128)}{0.007716W_i} + \underset{(0.002099)}{0.002621G_i} - \tag{9.24.c}$$

$$\underset{(0.003521)}{0.005109N_i} + \underset{(0.004331)}{0.001557P_i} + \underset{(0.001797)}{0.010298IG_i} \qquad R^2 = 0.7958$$