Time Serires hw3

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Chap3

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Origin:

Cochrane-orcutt estimation for first order autocorrelation

Call:

lm(formula = y ~ x)

number of interaction: 7

rho 0.43638

Durbin-Watson statistic

(original): 1.08012 , p-value: 7.689e-03

(transformed): 2.06581 , p-value: 4.444e-01

coefficients:

(Intercept) x

-1.184780 0.296519

First Difference:

Cochrane-orcutt estimation for first order autocorrelation

Call:

lm(formula = y.diff ~ x.diff)

number of interaction: 6

rho -0.292592

Durbin-Watson statistic

(original): 2.54272 , p-value: 8.737e-01

(transformed): 1.90010 , p-value: 4.044e-01

coefficients:

(Intercept) x.diff

-0.000480 0.291603

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a.

Model

Residuals:

1 2 3 4 5 6 7 8

32.35 -12.80 -4.35 -15.20 -15.20 -4.35 -12.80 32.35

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 79.15 11.03 7.175 0.00558 \*\*

x1 41.83 11.03 3.791 0.03219 \*

x2 9.85 11.03 0.893 0.43770

x3 26.38 11.03 2.391 0.09666 .

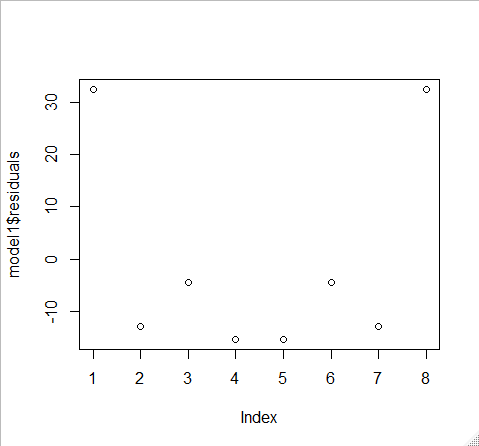
x4 5.45 11.03 0.494 0.65519

---

Residual standard error: 31.2 on 3 degrees of freedom

Multiple R-squared: 0.8757, Adjusted R-squared: 0.7099

F-statistic: 5.283 on 4 and 3 DF, p-value: 0.1014



We can see that the first and the last observation has a big residual.

b.

Call:

lm(formula = y ~ x1 + x2 + x3 + x4, data = data, weights = data$V8)

Weighted Residuals:

1 2 3 4 5 6 7 8

14.0337 -1.6235 -0.5652 -10.9463 -9.6885 -0.5640 -6.9578 26.7262

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 75.427 9.268 8.138 0.00388 \*\*

x1 38.391 8.433 4.553 0.01986 \*

x2 7.114 8.660 0.821 0.47160

x3 19.568 7.855 2.491 0.08838 .

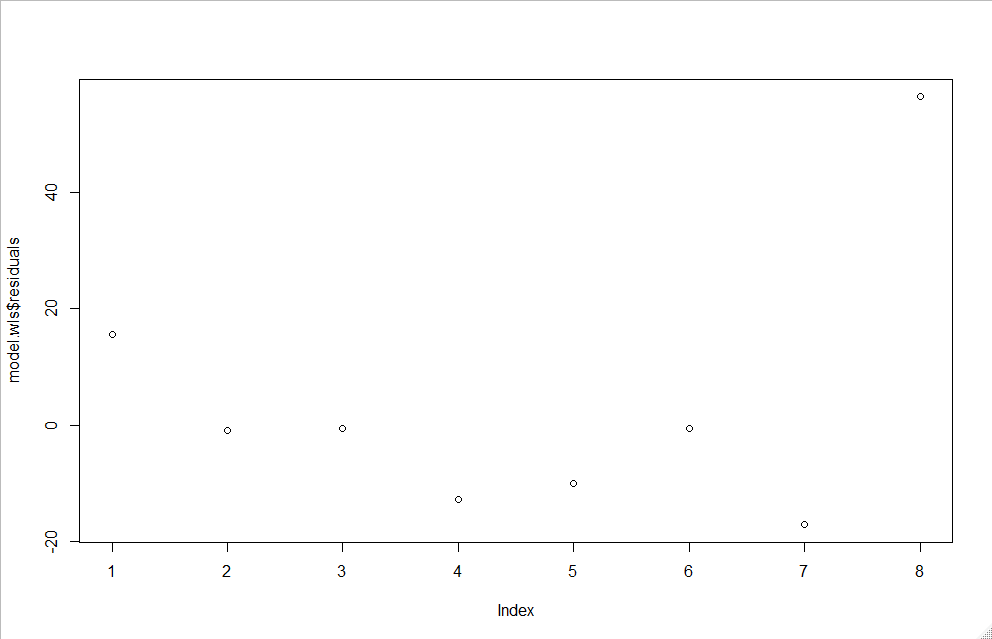
x4 -2.053 7.908 -0.260 0.81195

---

Residual standard error: 19.8 on 3 degrees of freedom

Multiple R-squared: 0.8901, Adjusted R-squared: 0.7436

F-statistic: 6.074 on 4 and 3 DF, p-value: 0.08508



By using weighteing least square with sample variance , we can see that the Adjusted R-squared is improved.

But in residuals plot , the last point is too big.

C.

Call:

lm(formula = V8 ~ x1 + x2 + x3 + x4, data = data)

Residuals:

1 2 3 4 5 6 7 8

-0.4167 0.6483 -0.1217 -0.1100 -0.1100 -0.1217 0.6483 -0.4167

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 0.9333 0.2275 4.103 0.0262 \*

x1 -0.4025 0.2275 -1.770 0.1749

x2 -0.4533 0.2275 -1.993 0.1403

x3 0.2567 0.2275 1.128 0.3412

x4 0.3058 0.2275 1.345 0.2714

---

Residual standard error: 0.6434 on 3 degrees of freedom

Multiple R-squared: 0.7725, Adjusted R-squared: 0.4691

F-statistic: 2.546 on 4 and 3 DF, p-value: 0.2343

By using Sample variance ~ x1 + x2 + x3 + x4, we only have Adjusted R-Squared = 0.4691

Call:

lm(formula = y ~ x1 + x2 + x3 + x4, data = data, weights = data$V8)

Weighted Residuals:

1 2 3 4 5 6 7 8

14.0337 -1.6235 -0.5652 -10.9463 -9.6885 -0.5640 -6.9578 26.7262

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 75.427 9.268 8.138 0.00388 \*\*

x1 38.391 8.433 4.553 0.01986 \*

x2 7.114 8.660 0.821 0.47160

x3 19.568 7.855 2.491 0.08838 .

x4 -2.053 7.908 -0.260 0.81195

---

Residual standard error: 19.8 on 3 degrees of freedom

Multiple R-squared: 0.8901, Adjusted R-squared: 0.7436

F-statistic: 6.074 on 4 and 3 DF, p-value: 0.08508

By using the same weighting like (b), we found that Adjusted R-Squared is improved.

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Call:

arima(x = y, order = c(1, 0, 0), xreg = x)

Coefficients:

ar1 intercept x

0.7217 26.1878 -0.1075

s.e. 0.2134 1.1997 0.0134

sigma^2 estimated as 0.08523: log likelihood = -3.18, aic = 14.37

Training set error measures:

ME RMSE MAE MPE MAPE

Training set -0.03350246 0.2919393 0.2278712 -0.217486 1.367033

MASE ACF1

Training set 0.2921425 0.2707497

Cochrane-Orcutt

Call:

lm(formula = y ~ x, data = data)

number of interaction: 23

rho 0.76023

Durbin-Watson statistic

(original): 0.81830 , p-value: 1.563e-03

(transformed): 0.85205 , p-value: 1.243e-02

coefficients:

(Intercept) x

26.611277 -0.115793

I don’t know how to compare.

33

Call:

lm(formula = dyn(yt ~ xt + lag(yt, -1)))

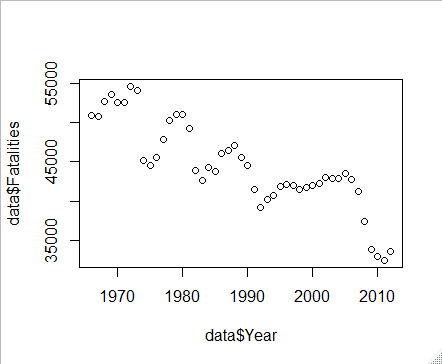
Coefficients:

(Intercept) xt lag(yt, -1)

-0.9272 0.2341 0.2100

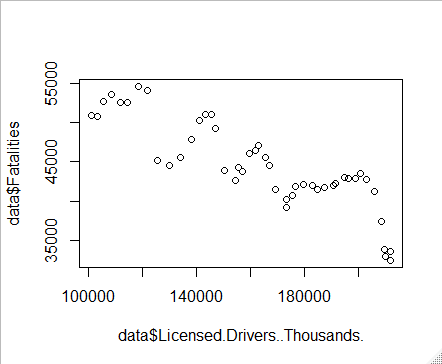
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a.



We can see Fatalities is decreasing.

b.



We can see the same trend as a.

c.

Call:

lm(formula = Fatalities ~ Licensed.Drivers..Thousands.)

Residuals:

Min 1Q Median 3Q Max

-5000.9 -2382.8 342.6 2537.3 4402.8

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 6.792e+04 2.081e+03 32.63 < 2e-16 \*\*\*

Licensed.Drivers..Thousands. -1.437e-01 1.252e-02 -11.47 5.91e-15 \*\*

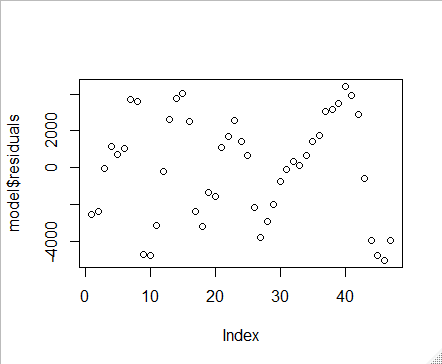
Residual standard error: 2843 on 45 degrees of freedom

Multiple R-squared: 0.7452, Adjusted R-squared: 0.7396

F-statistic: 131.6 on 1 and 45 DF, p-value: 5.909e-15

By b. , We can see Licensed.Drivers and Fatalities have a strong correlation, so the regression model does well.

d.



We found that in c. the regression is good , but the residuals plot is a mess.

e.

Durbin-Watson test

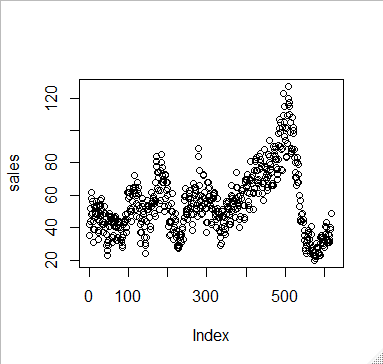
data: Fatalities ~ Licensed.Drivers..Thousands.

DW = 0.51811, p-value = 1.11e-10

alternative hypothesis: true autocorrelation is greater than 0

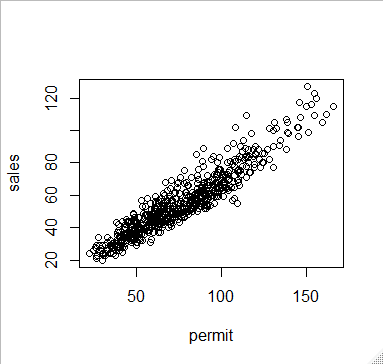
40

a.



We can see that sales is staying calm and increasing and decreaing rapidly.

b.



The two variable have a strong correlation .

c.

Call:

lm(formula = sales ~ permit)

Residuals:

Min 1Q Median 3Q Max

-21.5559 -4.5737 -0.6896 3.8468 28.8468

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 6.407406 0.785465 8.157 1.93e-15 \*\*\*

permit 0.642385 0.009741 65.944 < 2e-16 \*\*\*

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Residual standard error: 6.89 on 615 degrees of freedom

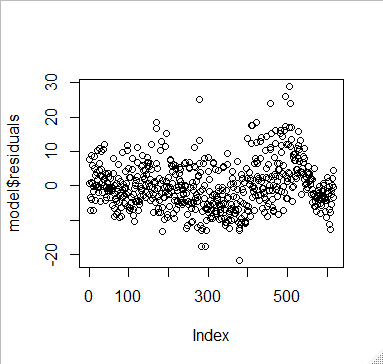
(7 observations deleted due to missingness)

Multiple R-squared: 0.8761, Adjusted R-squared: 0.8759

F-statistic: 4349 on 1 and 615 DF, p-value: < 2.2e-16

As b. we can see that Adjusted R-squared is 0.8759, just like we see in b.

d.



The plot is a mess , but we can still see that the residuals plot is a little high.

e.

Durbin-Watson test

data: sales ~ permit

DW = 0.85191, p-value < 2.2e-16

alternative hypothesis: true autocorrelation is greater than 0

R code

#13

library(orcutt)

data = read.csv("13.csv")

attach(data)

model = lm(y~x)

model.fit = cochrane.orcutt(model)

model.fit

x.diff = diff(data$x)

y.diff = diff(data$y)

data.diff = cbind(x.diff, y.diff)

data.diff = data.frame(data.diff)

attach(data.diff)

model.diff = lm(y.diff ~ x.diff)

model.diff.fit = cochrane.orcutt(model.diff)

model.diff.fit

#q18

#a

data = read.csv("ex2.csv")

model1 = lm(y ~ x1 + x2 + x3 +x4, data = data)

model2 = lm(y.1 ~ x1 + x2 + x3 +x4, data = data)

model3 = lm(y.2 ~ x1 + x2 + x3 +x4, data = data)

summary(model1)

summary(model2)

summary(model3)

par(mfrow = c(1,1))

plot(model1$residuals)

#b

for(i in 1:8){

sample = c(data[i,5], data[i,6], data[i,7])

data[i,8] = var(sample)

}

model.wls = lm(y ~ x1 + x2 + x3 + x4, data = data, weights = data$V8)

summary(model.wls)

plot(model.wls$residuals)

#c

model.variance = lm(V8 ~ x1 + x2 + x3 + x4, data = data)

summary(model.variance)

plot(model.variance$residuals)

model.variance.wls = lm(V8 ~ x1 + x2 + x3 + x4, data = data, weights = data$V8)

#32

library(forecast)

library(tseries)

data = read.csv("3.5.csv")

attach(data)

model = arima(y, xreg = x, order = c(1,0,0))

summary(model)

model = lm(y ~ x, data = data)

model.fit = cochrane.orcutt(model)

model.fit

#33

library(dyn)

data = read.csv("13.csv")

yt = ts(data$y)

xt = ts(data$x)

dyn$lm(yt ~ xt + lag(yt, -1))

#36

#a

data = read.csv("b.25.csv")

summary(data)

plot(data$Fatalities ~ data$Year)

#b

plot(data$Fatalities ~ data$Licensed.Drivers..Thousands.)

attach(data)

#c

model = lm(Fatalities ~ Licensed.Drivers..Thousands.)

summary(model)

#d

plot(model$residuals)

#e

library(lmtest)

model.dwt = dwtest(Fatalities ~ Licensed.Drivers..Thousands.)

model.dwt

#40

#a

data = read.csv("b.26.csv")

Sales = data.frame(sales = double())

for(i in 1:52){

block = data.frame(sales = double())

for(j in 1:12){

block = data[i , 2 \* j - 1]

Sales = rbind(Sales, block)

}

}

Permit = data.frame(permit = double())

for(i in 1:52){

block = data.frame(permit = double())

for(j in 1:12){

block = data[i, 2 \* j]

Permit = rbind(Permit, block)

}

}

Data = cbind(Sales, Permit)

colnames(Data) = c("sales", "permit")

attach(Data)

plot(sales)

#b

plot(sales ~ permit)

#c

model = lm(sales ~ permit)

summary(model)

#d

plot(model$residuals)

#e

model.dwt = dwtest(sales ~ permit)

model.dwt