Chapter 4 - Basic Regression Analysis with Time Series Data

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Exercise 10.5

Upload packages

```
library(lmreg)
library(wooldridge)
library(seastests)
```

Upload database

```
data<-wooldridge::ezanders
```

Use the data in EZANDERS.RAW for this exercise. The data are on monthly unemployment claims in Anderson Township in Indiana, from January 1980 through November 1988. In 1984, an enterprise zone (EZ) was located in Anderson (as well as other cities in Indiana). [See Papke (1994) for details.]

(i) Regress `log(uclms)` on a linear time trend and 11 monthly dummy variables. What was the overall trend in unemployment claims over this period? (Interpret the coefficient on the time trend.) Is there evidence of seasonality in unemployment claims?

Creating dummy month variables to the existing dataframe

```
data[paste0("M", 1:12)] <- as.data.frame(t(sapply(data$Month, tabulate, 12)))
```

Regression on `log(uclms)`

```
data$t<-c(1:108)

lm1<-lm(luclms~t+jan+feb+mar+apr+may+jun+jul+aug+sep+oct+nov, data)

summary(lm1)
```

```
##
## Call:
## lm(formula = luclms ~ t + jan + feb + mar + apr + may + jun +
##     jul + aug + sep + oct + nov, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.72696 -0.22122  0.00468  0.22535  0.84876
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.462322   0.155368  60.903   <2e-16 ***
## t           -0.013879   0.001246 -11.140   <2e-16 ***
## jan          0.221384   0.192577   1.150   0.2532
## feb          0.222037   0.192541   1.153   0.2518
## mar          0.182977   0.192512   0.950   0.3443
## apr         -0.101908   0.192492  -0.529   0.5978
## may         -0.237879   0.192480  -1.236   0.2196
## jun         -0.263346   0.192476  -1.368   0.1745
## jul         -0.214500   0.192480  -1.114   0.2679
## aug         -0.019313   0.192492  -0.100   0.9203
## sep         -0.420445   0.192512  -2.184   0.0315 *
## oct         -0.440502   0.192541  -2.288   0.0244 *
## nov         -0.321496   0.192577  -1.669   0.0984 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3961 on 94 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.647,  Adjusted R-squared:  0.602
## F-statistic: 14.36 on 12 and 94 DF,  p-value: < 2.2e-16
```

The coefficient associated to variable `Trend` is equal to -0.01 and has statistical significance at the 1% level.

Seasonality tests

```
isSeasonal(data$uclms, test = "combined", freq = 12)
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
## [1] TRUE
```

```
fried(data$uclms, freq = 12, diff = T, residuals = F, autoarima = T)
```

```
## Test used:  Friedman rank
##
## Test statistic:  57.28
## P-value:  2.956098e-08
```

The null hypothesis of no stable seasonality is rejected at the 1% significance level.

In both tests, the variable `uclms` presents seasonality.

(ii) Add ez, a dummy variable equal to 1 in the months Anderson had an EZ, to the regression in part (i). Does having the enterprise zone seem to decrease unemployment claims? By how much? [You should use formula (7.10) from Chapter 7.]

```
lm2<-lm(luclms~t+jan+feb+mar+apr+may+jun+jul+aug+sep+oct+nov+ez, data)

summary(lm2)
```

```
##
## Call:
## lm(formula = luclms ~ t + jan + feb + mar + apr + may + jun +
##     jul + aug + sep + oct + nov + ez, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.75302 -0.16295  0.00014  0.17481  0.82032
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.332059   0.151565  61.571  < 2e-16 ***
## t           -0.006762   0.002356  -2.870 0.005077 **
## jan          0.285189   0.182986   1.559 0.122504
## feb          0.278725   0.182759   1.525 0.130628
## mar          0.232550   0.182562   1.274 0.205905
## apr         -0.059452   0.182396  -0.326 0.745196
## may         -0.202539   0.182259  -1.111 0.269318
## jun         -0.235122   0.182154  -1.291 0.199976
## jul         -0.193392   0.182078  -1.062 0.290923
## aug         -0.005322   0.182033  -0.029 0.976740
## sep         -0.413570   0.182019  -2.272 0.025383 *
## oct         -0.440744   0.182035  -2.421 0.017410 *
## nov         -0.328853   0.182081  -1.806 0.074141 .
## ez          -0.508027   0.145667  -3.488 0.000746 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3745 on 93 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.6879, Adjusted R-squared:  0.6442
## F-statistic: 15.76 on 13 and 93 DF,  p-value: < 2.2e-16
```