Chapter 10 - Basic Regression Analysis with Time Series Data

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Exercise 10.13

Upload packages

```
library(lmreg)
library(tseries)
library(wooldridge)
```

Upload database

```
data<-wooldridge::minwage

attach(data)
```

Use the data in MINWAGE.RAW for this exercise. In particular, use the employment and wage series for sector 232 (Men's and Boys' Furnishings). The variable `gwage232` is the monthly growth (change in logs) in the average wage in sector 232, `gemp232` is the growth in employment in sector 232, `gmwage` is the growth in the federal minimum wage, and `gcpi` is the growth in the (urban) Consumer Price Index.

(i) Run the regression `gwage232` on `gmwage` , `gcpi` . Do the sign and magnitude of $\hat{\beta}_{mwage}$ make sense to you? Explain. Is `gmwage` statistically significant?

```
summary(lm1<-lm(gwage232~gmwage+gcpi))
```

```
##
## Call:
## lm(formula = gwage232 ~ gmwage + gcpi)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.044467 -0.004093 -0.001343  0.004545  0.041190
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.0021842  0.0004213   5.185 2.95e-07 ***
## gmwage      0.1505714  0.0096574  15.591  < 2e-16 ***
## gcpi        0.2435223  0.0821280   2.965  0.00314 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.00791 on 608 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.2927, Adjusted R-squared:  0.2904
## F-statistic: 125.8 on 2 and 608 DF,  p-value: < 2.2e-16
```

The estimated equation is expressed as follows

$$\widehat{gwage232} = 0.002 + 0.15gmwage + 0.24gcpi$$

For an unit increase in `gmwage`, the growth in average wage in sector 232 is aproximatelly $0.15. In empirical terms, we would expect a negative sign for this coefficient, because a larger minimum wage, tends to decrease the level of employment, *ceteris paribus*, lowering the average wage of sector.

(ii) Add lags 1 through 12 of `gmwage` to the equation in part (i). Do you think it is necessary to include these lags to estimate the long-run effect of minimum wage growth on wage growth in sector 232? Explain.

```
summary(lm2<-lm(gwage232~gmwage_1+gmwage_2+gmwage_3+gmwage_4+gmwage_5+
          gmwage_6+gmwage_7+gmwage_8+gmwage_9+gmwage_10+
          gmwage_11+gmwage_12+gcpi+gmwage))
```

```
##
## Call:
## lm(formula = gwage232 ~ gmwage_1 + gmwage_2 + gmwage_3 + gmwage_4 +
##     gmwage_5 + gmwage_6 + gmwage_7 + gmwage_8 + gmwage_9 + gmwage_10 +
##     gmwage_11 + gmwage_12 + gcpi + gmwage)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.043581 -0.004002 -0.001165  0.004619  0.039520
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.0020967  0.0004278   4.901 1.24e-06 ***
## gmwage_1    -0.0043451  0.0094838  -0.458   0.6470
## gmwage_2     0.0007167  0.0094661   0.076   0.9397
## gmwage_3    -0.0188113  0.0094980  -1.981   0.0481 *
## gmwage_4    -0.0062754  0.0095646  -0.656   0.5120
## gmwage_5    -0.0074584  0.0096048  -0.777   0.4377
## gmwage_6     0.0015449  0.0095503   0.162   0.8715
## gmwage_7    -0.0004578  0.0095175  -0.048   0.9617
## gmwage_8     0.0190364  0.0095234   1.999   0.0461 *
## gmwage_9     0.0187524  0.0095198   1.970   0.0493 *
## gmwage_10    0.0120034  0.0095452   1.258   0.2091
## gmwage_11    0.0156649  0.0095891   1.634   0.1029
## gmwage_12    0.0179264  0.0095979   1.868   0.0623 .
## gcpi         0.2077567  0.0885913   2.345   0.0194 *
## gmwage       0.1493019  0.0094840  15.742  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.007738 on 584 degrees of freedom
##   (13 observations deleted due to missingness)
## Multiple R-squared:  0.3261, Adjusted R-squared:  0.3099
## F-statistic: 20.18 on 14 and 584 DF,  p-value: < 2.2e-16
```

For monthly data, the theory recommends an inclusion of 12 lags to the model. But, in this specific case, the model do not show a good performance, with almost all variables without statistical significance.

(iii) Run the regression `gemp232` on `gmwage` , `gcpi` . Does minimum wage growth appear to have a contemporaneous effect on `gemp232` ?

```
summary(lm2<-lm(gemp232~gmwage+gcpi))
```

```
##
## Call:
## lm(formula = gemp232 ~ gmwage + gcpi)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.072668 -0.007975  0.000155  0.008955  0.082431
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.0004429  0.0009941  -0.446    0.656
## gmwage      -0.0018752  0.0227897  -0.082    0.934
## gcpi        -0.0054697  0.1938073  -0.028    0.977
##
## Residual standard error: 0.01867 on 608 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  1.242e-05,  Adjusted R-squared:  -0.003277
## F-statistic: 0.003776 on 2 and 608 DF,  p-value: 0.9962
```

The estimated model do not show any significance.

(iv) Add lags 1 through 12 to the employment growth equation. Does growth in the minimum wage have a statistically significant effect on employment growth, either in the short run or long run? Explain

```
summary(lm3<-lm(gemp232~gmwage_1+gmwage_2+gmwage_3+gmwage_4+gmwage_5+
          gmwage_6+gmwage_7+gmwage_8+gmwage_9+gmwage_10+
          gmwage_11+gmwage_12+gcpi+gmwage))
```

```
##
## Call:
## lm(formula = gemp232 ~ gmwage_1 + gmwage_2 + gmwage_3 + gmwage_4 +
##     gmwage_5 + gmwage_6 + gmwage_7 + gmwage_8 + gmwage_9 + gmwage_10 +
##     gmwage_11 + gmwage_12 + gcpi + gmwage)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.078510 -0.007751  0.000315  0.009095  0.077974
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.0002012  0.0010270  -0.196   0.8448
## gmwage_1     0.0131872  0.0227662   0.579   0.5626
## gmwage_2    -0.0310154  0.0227237  -1.365   0.1728
## gmwage_3    -0.0056972  0.0228003  -0.250   0.8028
## gmwage_4    -0.0013479  0.0229603  -0.059   0.9532
## gmwage_5     0.0023392  0.0230567   0.101   0.9192
## gmwage_6     0.0454017  0.0229259   1.980   0.0481 *
## gmwage_7     0.0275713  0.0228472   1.207   0.2280
## gmwage_8    -0.0173222  0.0228614  -0.758   0.4489
## gmwage_9    -0.0248380  0.0228527  -1.087   0.2775
## gmwage_10   -0.0230005  0.0229137  -1.004   0.3159
## gmwage_11    0.0102054  0.0230191   0.443   0.6577
## gmwage_12    0.0345125  0.0230401   1.498   0.1347
## gcpi        -0.1143189  0.2126672  -0.538   0.5911
## gmwage      -0.0042524  0.0227668  -0.187   0.8519
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.01858 on 584 degrees of freedom
##   (13 observations deleted due to missingness)
## Multiple R-squared:  0.02215,    Adjusted R-squared:  -0.001294
## F-statistic: 0.9448 on 14 and 584 DF,  p-value: 0.5098
```

Again, the estimated equation do not show any significance.