

Chapter 11 - Further Issues in Using OLS with Time Series Data

Thalles Quinaglia Liduares

01/04/2022

Exercise 11.6

Upload packages

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

Upload database

```
data<-wooldridge::inven

attach(data)
```

Let *inven* be the real value inventories in the United States during year *t*, let GDP_t denote real gross domestic product, and let $r3_t$ denote the (ex post) real interest rate on threemonth T-bills. The ex post real interest rate is (approximately) $r3_t = i3_t - inf_t$, where $i3_t$ is the rate on three-month T-bills and inf_t is the annual inflation rate [see Mankiw (1994, Section 6.4)]. The change in inventories, *cinven*, is the inventory investment for the year. The accelerator model of inventory investment relates *cinven* to the *cGDP*, the change in GDP:

$$cinven_t = \beta_0 + \beta_1 cGDP_t + u_t$$

where $\beta_1 > 0$. [See, for example, Mankiw (1994), Chapter 17.]

(i) Use the data in *INVEN.RAW* to estimate the accelerator model. Report the results in the usual form and interpret the equation. Is $\hat{\beta}_1$ statistically greater than zero?

```
summary(lm1<-lm(cinven~cgdp))
```

```
##
## Call:
## lm(formula = cinven ~ cgdp)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -36.906  -5.524   0.541   5.653  23.461
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.58880    3.64080   0.711   0.482
## cgdp         0.15245    0.02348   6.493 1.99e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12.76 on 34 degrees of freedom
## (1 observation deleted due to missingness)
## Multiple R-squared:  0.5536, Adjusted R-squared:  0.5404
## F-statistic: 42.16 on 1 and 34 DF, p-value: 1.987e-07
```

The estimated equation is expressed as follows

$$\widehat{cinven}_t = 2.58 + 0.15cGDP_t$$

The coefficient associated to `cgdp` is statistically significant at the 1% level. For an unit increase in `cgdp` the `cinven` variable increases 0.15 units.

(ii) If the real interest rate rises, then the opportunity cost of holding inventories rises, and so an increase in the real interest rate should decrease inventories. Add the real interest rate to the accelerator model and discuss the results.

```
summary(lm2<-lm(cinven~cgdp+r3))
```

```
##
## Call:
## lm(formula = cinven ~ cgdp + r3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -33.685  -6.744   1.079   4.652  24.330
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.00415    3.69449   0.813   0.422
## cgdp         0.15903    0.02494   6.376 3.21e-07 ***
## r3          -0.89534    1.10062  -0.813   0.422
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12.83 on 33 degrees of freedom
## (1 observation deleted due to missingness)
## Multiple R-squared:  0.5623, Adjusted R-squared:  0.5358
## F-statistic: 21.2 on 2 and 33 DF, p-value: 1.199e-06
```

For an unit increase in r_3 the $cinven$ variable decreases by 0.89 units.

(iii) Does the level of the real interest rate work better than the first difference, $cr3_t$?

```
summary(lm3<-lm(cinven~cgdp+cr3))
```

```
##
## Call:
## lm(formula = cinven ~ cgdp + cr3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -36.586  -5.491   0.081   5.451  23.012
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.33622    3.78207   0.618   0.541
## cgdp         0.15446    0.02469   6.255 4.56e-07 ***
## cr3         -0.46975    1.53965  -0.305   0.762
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12.93 on 33 degrees of freedom
## (1 observation deleted due to missingness)
## Multiple R-squared:  0.5548, Adjusted R-squared:  0.5278
## F-statistic: 20.56 on 2 and 33 DF, p-value: 1.588e-06
```

No. The variable r_3 performs better than $cr3$.