

EDS241: Assignment 4

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1 Homework 4

This question will ask you to estimate the price elasticity of demand for fresh sardines across 56 ports located in 4 European countries with monthly data from 2013 to 2019. The data are contained in the file EU_sardines.csv, which is available on Gauchospace.

Each row in the data file is a combination of port location (where the fish is landed and sold) in a given year and month. You can ignore the fact that the sample is not balanced (the number of monthly observations varies across ports).

For the assignment, you will need the following variables: year, month, country, port (port where sardines are landed and sold), price_euro_kg (price per kg in €), and volume_sold_kg (quantity of sardines sold in kg). In the questions below, I use $\log()$ to denote the natural logarithm.

1.1 Read in the data

```
fish_data <- read.csv(here("data/EU_sardines.csv"))
```

- 1.2 (a) Estimate a bivariate regression of $\log(\text{volume_sold_kg})$ on $\log(\text{price_euro_kg})$. What is the price elasticity of demand for sardines? Test the null hypothesis that the price elasticity is equal to -1.

```
fish_data <- fish_data %>%  
  mutate(log_sold = log(volume_sold_kg),  
         log_price = log(price_euro_kg))
```

```
model1 <- lm_robust(formula = log_sold ~ log_price,  
                   data = fish_data)
```

```

modell1_table <- tidy(modell1)
modell1_table %>%
  select(term, estimate, std.error, p.value, conf.low, conf.high) %>%
  kable()

```

| term | estimate | std.error | p.value | conf.low | conf.high |
|-------------|-----------|-----------|---------|-----------|-----------|
| (Intercept) | 7.759061 | 0.0430246 | 0 | 7.674709 | 7.843413 |
| log_price | -1.545335 | 0.0781254 | 0 | -1.698505 | -1.392166 |

The estimated price elasticity of demand for sardines regression `log_sold` on `log_price` is -1.55. We can say with 95% confidence that the interval [-1.7, -1.39] contains the true β_1 . Because this CI does not contain -1 we can the null hypothesis that the price elasticity is equal to -1.

1.3 (b) Like in Lecture 8 (see the IV.R script), we will use `wind_m_s` as an instrument for `log(price_euro_kg)`. To begin, estimate the first-stage regression relating `log(price_euro_kg)` to `wind_m_s`. Interpret the estimated coefficient on wind speed. Does it have the expected sign? Also test for the relevance of the instrument and whether it is a “weak” instrument by reporting the proper F-statistic.

```

fs1 <- lm_robust(formula = log_price ~ wind_m_s,
  data = fish_data)

huxreg(fs1, statistics = c(N = "nobs", R2 = "r.squared"))

```

| | (1) |
|-------------|------------|
| (Intercept) | -0.305 *** |
| | (0.027) |
| wind_m_s | 0.067 *** |
| | (0.006) |
| N | 3988 |
| R2 | 0.038 |

*** p < 0.001; ** p < 0.01; * p < 0.05.

For every 1 m/s increase in wind speed there is a 0.067 increase in the log price of fish. The positive correlation of wind speed and `log_price` is positive as expected. This is because as wind speed increases it means it would be harder for boats to get fresh fish so supply goes down. Wind speed will likely not affect the demand for sardines so the price increases when there is less supply but a maintained demand.

```
fs1_fstat <- linearHypothesis(fs1, c("wind_m_s = 0"), white.adjust = "hc2")
huxtable(fs1_fstat)
```

| Res.Df | Df | Chisq | Pr(>Chisq) |
|----------|----|-------|------------|
| 3.99e+03 | | | |
| 3.99e+03 | 1 | 145 | 2.56e-33 |

The proper F-statistic is 145 which is greater than 10, therefore it is not a weak instrument.

- 1.4 (c) Estimate the TSLS estimator of the price elasticity of demand for sardines using `wind_m_s` as an instrument for `log(price_euro_kg)`. What is the estimated price elasticity of demand for sardines?**

```
tsls1 <- ivreg(formula = log_sold ~ log_price | wind_m_s,
              data = fish_data)
huxreg(tsls1, statistics = c(N = "nobs", R2 = "r.squared"))
```

| | (1) |
|-------------|----------------------|
| (Intercept) | 7.755 *** (0.043) |
| log_price | -1.088 ** (0.370) |
| N | 3988 |
| R2 | 0.095 |

*** p < 0.001; ** p < 0.01; * p < 0.05.

The TSLS estimated price elasticity for demand of sardines using `wind_m_s` as an instrument for `log_price` is -1.09.

- 1.5 (d) Repeat the exercise in (c), but include fixed effects for each year, month, and country. [Hint: you can use the command “`as.factor(country) + as.factor(year) + as.factor(month)`” to the `ivreg` function in R]. Report the estimated price elasticity of demand and the F-statistic testing for relevant and non-weak instruments.**

```

tsls2 <- ivreg(formula = log_sold ~ log_price +
               as.factor(country) +
               as.factor(year) +
               as.factor(month)|
               wind_m_s +
               as.factor(country) +
               as.factor(year) +
               as.factor(month),
               data = fish_data)

tsls2_hux <- huxreg(tsls2, statistics = c(N = "nobs", R2 = "r.squared"))

```

| | (1) | | (1) | | (1) |
|---|-----------------------|---------------------|----------------------|--------------------|----------------------|
| (Intercept) | 7.337 *** (0.208) | as.factor(year)2017 | 0.074 (0.152) | as.factor(month)7 | 1.400 *** (0.210) |
| log_price | -1.250 ** (0.464) | as.factor(year)2018 | -0.091 (0.155) | as.factor(month)8 | 1.264 *** (0.217) |
| as.factor(country)Italy | -0.689 *** (0.130) | as.factor(year)2019 | 0.036 (0.197) | as.factor(month)9 | 1.311 *** (0.213) |
| as.factor(country)Portugal | 1.716 *** (0.346) | as.factor(month)2 | 0.069 (0.210) | as.factor(month)10 | 0.721 ** (0.230) |
| as.factor(country)United Kingdom | -0.074 (0.314) | as.factor(month)3 | 0.516 * (0.205) | as.factor(month)11 | 0.481 * (0.226) |
| as.factor(year)2014 | 0.146 (0.153) | as.factor(month)4 | 0.914 *** (0.203) | as.factor(month)12 | 0.067 (0.219) |
| as.factor(year)2015 | 0.185 (0.152) | as.factor(month)5 | 1.149 *** (0.204) | N | 3988 |
| as.factor(year)2016 | 0.213 (0.153) | as.factor(month)6 | 1.145 *** (0.202) | R2 | 0.152 |
| *** p < 0.001; ** p < 0.01; * p < 0.05. | | | | | |

The TSLS estimated price elasticity for demand of sardines using wind_m_s as an instrument for log_price and including fixed effects for each year, month, and country is -1.25.

```

model2 <- lm_robust(formula = log_price ~ wind_m_s +
                    as.factor(country) +
                    as.factor(year) +
                    as.factor(month),
                    data = fish_data)

```

```
model3_fstat <- linearHypothesis(model2, c("wind_m_s = 0"), white.adjust = "hc2")
huxtable(model3_fstat)
```

| Res.Df | Df | Chisq | Pr(>Chisq) |
|----------|----|-------|------------|
| 3.97e+03 | | | |
| 3.97e+03 | 1 | 77.7 | 1.23e-18 |

The F-statistic is 78 which is greater than 10, therefore it is not a weak instrument.