EDS241: Assignment 4

Jake Eisaguirre

03/10/2022

0.0.0.0.1 Clean Data

The following code loads and cleans the data.

```
data <- read_csv(here("EU_sardines.csv")) %>%
  clean_names()
```

```
## Rows: 3988 Columns: 7
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (2): country, port
## dbl (5): year, month, price_euro_kg, volume_sold_kg, wind_m_s
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

0.0.0.0.2 (a) Estimate a bivariate regression of log(volume_sold_kg) on log(price euro_kg). What is the price elasticity of demand for sardines? Test the null hypothesis that the price elasticity is equal to -1.

The following code estimates the bivariate regression and price elasticity demand for sardines

```
mod1 <- lm_robust(log(volume_sold_kg) ~ log(price_euro_kg), data = data)
```

```
tidy(mod1) %>%
  kable()
```

term	estimate	std.error	statistic	p.value	conf.low	conf.high	df	outcome
(Intercept)	7.759061	0.0430246	180.34002	0	7.674709	7.843413	3986	log(volume_sold_
log(price_euro_kg)	-1.545335	0.0781254	-19.78018	0	-1.698505	-1.392166	3986	log(volume_sold_

```
linearHypothesis(mod1, c("log(price_euro_kg) = -1"), white.adjust = "hc2")
```

```
## Linear hypothesis test
##
## Hypothesis:
## log(price_euro_kg) = - 1
##
## Model 1: restricted model
## Model 2: log(volume_sold_kg) ~ log(price_euro_kg)
```

```
##
##   Res.Df Df  Chisq Pr(>Chisq)
## 1   3987
## 2   3986  1 48.724  2.946e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The price elasticity for demand sardines is -1.54% change in quantity for a 1% change in price. Based on the linear hypothesis test we would reject the null hypothesis that the price elasticity is equal -1. Because we have a significant p-value and an F statistic greater than 10.

0.0.0.0.3 (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. The following code answers question b

```
fsl <- lm(log(price_euro_kg) ~ wind_m_s, data = data)
```

```
tidy(fsl) %>%
  kable()
```

term	estimate	std.error	statistic	p.value
(Intercept)	-0.3048875	0.0266596	-11.43632	0
wind_m_s	0.0673459	0.0053741	12.53160	0

```
linearHypothesis(fsl, c("wind_m_s = 0"), white.adjust = "hc2")
```

```
## Linear hypothesis test
##
## Hypothesis:
## wind_m_s = 0
##
## Model 1: restricted model
## Model 2: log(price_euro_kg) ~ wind_m_s
##
## Note: Coefficient covariance matrix supplied.
##
##   Res.Df Df      F    Pr(>F)
## 1   3987
## 2   3986  1 144.65 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Wind coefficient: For every 1 unit increase in wind speed (+1 m/s) we expect to see the log(price_euro_kg) to increase by 0.067346.

Yes it does have the expected sign because we would think that as wind speeds increase, boats will not be able to fish due to bad weather thus driving the price of sardines up due to a decrease in supply.

It is not a weak instrument as the F-statistic is quite large at 144.65, which is greater than 10.

0.0.0.0.4 (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? The following code answers question c

```
tsls <- ivreg(log(volume_sold_kg) ~ log(price_euro_kg) | wind_m_s, data = data)
```

```
tidy(tsls) %>%
  kable()
```

term	estimate	std.error	statistic	p.value
(Intercept)	7.755341	0.0433068	179.078961	0.0000000
log(price_euro_kg)	-1.088015	0.3700295	-2.940348	0.0032973

The two-stage least-squares estimated price elasticity for demand of sardines is -1.088% change in quantity for a 1% change in price

0.0.0.0.5 (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. The following code answers question d

```
tsls3 <- ivreg(log(volume_sold_kg) ~ log(price_euro_kg) + as.factor(country) +
                 as.factor(year) + as.factor(month) | wind_m_s + as.factor(country) +
                 as.factor(year) + as.factor(month), data = data)
```

```
tidy(tsls3) %>%
  kable()
```

term	estimate	std.error	statistic	p.value
(Intercept)	7.3374236	0.2078052	35.3091380	0.0000000
log(price_euro_kg)	-1.2500413	0.4639288	-2.6944679	0.0070798
as.factor(country)Italy	-0.6892477	0.1296958	-5.3143410	0.0000001
as.factor(country)Portugal	1.7156252	0.3461351	4.9565189	0.0000007
as.factor(country)United Kingdom	-0.0742223	0.3142812	-0.2361651	0.8133168
as.factor(year)2014	0.1461004	0.1528131	0.9560724	0.3390939
as.factor(year)2015	0.1848675	0.1522107	1.2145495	0.2246103
as.factor(year)2016	0.2133455	0.1532014	1.3925815	0.1638245
as.factor(year)2017	0.0740035	0.1522378	0.4861044	0.6269200
as.factor(year)2018	-0.0913677	0.1550847	-0.5891473	0.5557960
as.factor(year)2019	0.0360239	0.1968818	0.1829721	0.8548292
as.factor(month)2	0.0686605	0.2097237	0.3273855	0.7433936
as.factor(month)3	0.5158251	0.2048850	2.5176322	0.0118537
as.factor(month)4	0.9143275	0.2029709	4.5047229	0.0000068
as.factor(month)5	1.1488658	0.2036995	5.6400021	0.0000000
as.factor(month)6	1.1447382	0.2016413	5.6771008	0.0000000
as.factor(month)7	1.4004650	0.2104651	6.6541437	0.0000000
as.factor(month)8	1.2638172	0.2169211	5.8261617	0.0000000
as.factor(month)9	1.3107231	0.2129754	6.1543400	0.0000000
as.factor(month)10	0.7205877	0.2295819	3.1386962	0.0017095
as.factor(month)11	0.4812754	0.2257501	2.1318947	0.0330768
as.factor(month)12	0.0668261	0.2191991	0.3048648	0.7604851

```r
mod2 <- lm_robust(log(price_euro_kg) ~ wind_m_s + as.factor(country) +
                  as.factor(year) + as.factor(month), data = data)

linearHypothesis(mod2, c("wind_m_s = 0"), white.adjust = "hc2")
```

```
## Linear hypothesis test
##
## Hypothesis:
## wind_m_s = 0
##
## Model 1: restricted model
## Model 2: log(price_euro_kg) ~ wind_m_s + as.factor(country) + as.factor(year) +
##     as.factor(month)
##
##   Res.Df Df  Chisq Pr(>Chisq)
## 1   3967
## 2   3966  1 77.658  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The price elasticity for demand sardines is -1.25% change in quantity for a 1% change in price. Based on the F statistic of 5.645 than wind_m_s is a weak instrument.