EDS241: Assignment 4

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1 Assignment 4

In this assignment we are estimating the price elasticity of demand for fresh sardines across 56 ports located in 4 European countries with monthly data from 2013 to 2019.

1.1 Load and clean data

The following code loads and cleans the data and adds a column of `log()` values of the price and volume sold of sardines.

```
data_sardines <- read.csv("data/EU_sardines.csv") %>%
  clean_names() %>%
  mutate(log_price_euro_kg = log(price_euro_kg),
         log_volume_sold_kg = log(volume_sold_kg))
```

1.2 Question 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 code chunk below runs a bivariate regression of `log(volume_sold_kg)` on `log(price euro_kg)`:

```
model_1 <- lm_robust(data = data_sardines,
                     log_volume_sold_kg ~ log_price_euro_kg)


model_1_table <- tidy(model_1) %>%
  select(term, estimate, std.error, p.value, conf.low, conf.high) %>%
  kable()

model_1_table
```

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

a. The estimated price elasticity of demand for sardines regressing log volume on log price is -1.55. We can say with 95% confidence that the intervals of -1.7 to -1.39 contains the true β_1 (aka price elasticity). Because this range does not include -1, we can reject the null hypothesis that the price elasticity is equal to -1.

1.3 Question 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 code chunk below estimates the first-stage regression relating `log_price_euro_kg` to `wind_m_s`:

```
# first stage regression
model_2 <- lm_robust(data = data_sardines,
                     log_price_euro_kg ~ wind_m_s)

huxreg("log_price_euro_kg" = model_2)
```

	log_price_euro_kg
(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.

The code chunk below calculates the proper F-statistic:

```
model_2_fstat <- linearHypothesis(model_2, c("wind_m_s = 0"),
                                  white.adjust = "hc2")

huxtable(model_2_fstat)
```

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

b. The estimated coefficient on wind speed is 0.0673, meaning that for 1 meter per second increase in wind speed there is an increase of 0.0673 in the log price of sardines. The sign is positive, which we would expect because higher wind speeds may lead to a lower total supply of sardines for a given day. Because wind speed doesn't effect the demand for sardines, the log price goes up when supply decreases but the demand stays the same. The F-statistic is equal to 144.65, which is greater than 10. This means that our instrument (wind speed) is not weak.

1.4 Question 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 code chunk below estimates the TSLS estimator of the price elasticity of demand for sardines using `wind_m_s` as an instrument for `log_price_euro_kg`:

```
TSLS_1 <- ivreg(data = data_sardines,
                log_volume_sold_kg ~ log_price_euro_kg | wind_m_s)

huxreg("log_volume_sold_kg" = TSLS_1)
```

	log_volume_sold_kg
(Intercept)	7.755 ***
	(0.043)
log_price_euro_kg	-1.088 **
	(0.370)
N	3988
R2	0.095

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

c. The estimated price elasticity of demand for sardines using wind as an instrument of log price is -1.09.

1.5 Question D

Repeat the exercise in (c), but include fixed effects for each year, month, and country. Report the estimated price elasticity of demand and the F-statistic testing for relevant and non-weak instruments.

The code chunk below The code chunk below estimates the TSLS estimator of the price elasticity of demand for sardines using `wind_m_s` as an instrument for `log_price_euro_kg` including a fixed effects for each year, month, and country:

```
TSLS_2 <- ivreg(data = data_sardines,
                log_volume_sold_kg ~ log_price_euro_kg + as.factor(country) +
                  as.factor(year) + as.factor(month) |
                  as.factor(country) + as.factor(year) +
                  as.factor(month) + wind_m_s)

TSLS_2_huxreg <- huxreg(TSLS_2)
```

```
restack_across(TSLS_2_huxreg, 21)
```

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

The code chunk below calculates the proper F-statistic:

```
# calculate F-statistic
model_3 <- lm_robust(data = data_sardines,
                     log_price_euro_kg ~ wind_m_s + as.factor(country) +
                       as.factor(year) + as.factor(month))

model_3_fstat <- linearHypothesis(model_3, c("wind_m_s = 0"),
                                  white.adjust = "hc2")
huxtable(model_3_fstat)
```

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

d. The estimated price elasticity of demand for sardines using wind as an instrument of log_price and including fixed effects for each year, month, and country is -1.25 and the F-statistic for the instrument of windspeed is 77.66.