EDS241: Assignment 4

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Reading in data

```
df <- read_csv(here("data", "EU_sardines.csv")) %>%
  clean_names() %>%
  mutate(log_price = log(price_euro_kg),
         log_volume = log(volume_sold_kg))
```

(a) Bivariate regression of `log(volume_sold_kg)` on `log(price_euro_kg)`.

```
mdl_a <- lm_robust(log_volume ~ log_price, df)
```

```
mdl_a %>% summary()
elast_a <- mdl_a$coefficients["log_price"]
```

```
mdl_a %>%
  tidy() %>%
  xtable()
```

	term	estimate	std.error	statistic	p.value	conf.low	conf.high	df	outcome
1	(Intercept)	7.76	0.04	180.34	0.00	7.67	7.84	3986.00	log_volume
2	log_price	-1.55	0.08	-19.78	0.00	-1.70	-1.39	3986.00	log_volume

```
linearHypothesis(mdl_a, "log_price=-1", white.adjust = "hc2", test = "F")
```

```
linearHypothesis(mdl_a, "log_price=-1", white.adjust = "hc2", test = "F") %>%
  tidy %>%
  xtable()
```

	res.df	df	statistic	p.value
1	3987.00			
2	3986.00	1.00	48.72	0.00

The estimated price elasticity of demand for sardines is -1.5453352.

Based on our linear hypothesis test, we can reject the null hypothesis that the price elasticity of demand for sardines is equal to -1 with a p-value of less than 0.001.

(b) Wind speed as an instrumental variable: first-stage regression of `log(price_euro_kg)` on `wind_m_s`

```
mdl_b <- lm_robust(log_price ~ wind_m_s, df)
```

```
mdl_b %>%
  tidy() %>%
  xtable()
```

	term	estimate	std.error	statistic	p.value	conf.low	conf.high	df	outcome
1	(Intercept)	-0.30	0.03	-11.16	0.00	-0.36	-0.25	3986.00	log_price
2	wind_m_s	0.07	0.01	12.03	0.00	0.06	0.08	3986.00	log_price

The estimated coefficient on `wind_m_s` represents the increase of `log(price_euro_kg)` given a 1 m/s increase in wind speed. The coefficient is positive—this makes sense as we would expect fish prices to increase with wind speeds due to higher wind speeds posing challenges for fishing vessels.

The first stage F-statistic, 144.6526487, is greater than 10 and thus `wind_m_s` is a relevant and non-weak instrument.

(c) Two-stage least squares estimator of the price elasticity of demand for sardines using `wind_m_s` as an instrument for `log(price_euro_kg)`

```
tsls_c <- ivreg(log_volume ~ log_price | wind_m_s, data = df)
```

```
elast_c <- tsls_c$coefficients["log_price"]
tsls_c %>% summary()
```

```
tsls_c %>%
  tidy() %>%
  xtable()
```

	term	estimate	std.error	statistic	p.value
1	(Intercept)	7.76	0.04	179.08	0.00
2	log_price	-1.09	0.37	-2.94	0.00

The estimated price elasticity of demand for sardines based on this TSLS estimator is -1.0880152.

(d) Two-stage least squares estimator of the price elasticity of demand for sardines using `wind_m_s` as an instrument for `log(price_euro_kg)` with fixed effects for `year`, `month`, and `country`.

```
tsls_d <- ivreg(log_volume ~ log_price + as.factor(country) + as.factor(year) + as.factor(month) |
                  wind_m_s + as.factor(country) + as.factor(year) + as.factor(month), data = df)
```

```
tsls_d %>%
  tidy %>%
  xtable()
```

	term	estimate	std.error	statistic	p.value
1	(Intercept)	7.34	0.21	35.31	0.00
2	log_price	-1.25	0.46	-2.69	0.01
3	as.factor(country)Italy	-0.69	0.13	-5.31	0.00
4	as.factor(country)Portugal	1.72	0.35	4.96	0.00
5	as.factor(country)United Kingdom	-0.07	0.31	-0.24	0.81
6	as.factor(year)2014	0.15	0.15	0.96	0.34
7	as.factor(year)2015	0.18	0.15	1.21	0.22
8	as.factor(year)2016	0.21	0.15	1.39	0.16
9	as.factor(year)2017	0.07	0.15	0.49	0.63
10	as.factor(year)2018	-0.09	0.16	-0.59	0.56
11	as.factor(year)2019	0.04	0.20	0.18	0.85
12	as.factor(month)2	0.07	0.21	0.33	0.74
13	as.factor(month)3	0.52	0.20	2.52	0.01
14	as.factor(month)4	0.91	0.20	4.50	0.00
15	as.factor(month)5	1.15	0.20	5.64	0.00
16	as.factor(month)6	1.14	0.20	5.68	0.00
17	as.factor(month)7	1.40	0.21	6.65	0.00
18	as.factor(month)8	1.26	0.22	5.83	0.00
19	as.factor(month)9	1.31	0.21	6.15	0.00
20	as.factor(month)10	0.72	0.23	3.14	0.00
21	as.factor(month)11	0.48	0.23	2.13	0.03
22	as.factor(month)12	0.07	0.22	0.30	0.76

```
mdl_d <- lm_robust(log_price ~ wind_m_s +
                     as.factor(country) +
                     as.factor(year) +
                     as.factor(month), df)
```

```
fstat_d <- mdl_d$fstatistic[1]
fstat_d
```

```
##    value
## 14.44736
```

The estimated price elasticity based on this TSLS estimator is -1.2500413. The F-statistic associated with wind as an instrumental variable with fixed effects for country, year, and month is 14.4473569, and thus the instruments are considered relevant and non-weak.