EDS241: Assignment 4

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0.1 Import & Clean Data

```
df = read_csv("EU_sardines.csv")
```

```
df = df %>%
  mutate(log_price = log(price_euro_kg),
         log_volume = log(volume_sold_kg))
```

1 Questions

1.0.1 (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.

```
m1 = estimatr::lm_robust(data = df, log_price ~ log_volume)
summary(m1)
car::linearHypothesis(m1, "log_volume=-1", white.adjust = "hc2")
```

The model above gives a price elasticity of -0.06, which a linear hypothesis test shows rejects the null hypothesis of a price elasticity of -1 at $p < 0.0001$.

1.0.2 (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.

```
mw = estimatr::lm_robust(data = df, log_price ~ wind_m_s)
summary(mw)

# F-statistic calculated with linearHypothesis() is the same as with lm_robust() above
# summary(car::linearHypothesis(mw, "wind_m_s=0", white.adjust = "hc2"))
```

The `wind_m_s` coefficient of 0.67 means that a 1 m/s increase in wind speed should correspond to a 0.067 euro/kg increase in price (both values logged). It makes sense that this relationship is positive because higher winds means it is harder/more dangerous to catch fish (and supply may therefore go down), so cost should increase if demand is unaffected. With an F-statistic of 144.7, wind speed is a non-weak relevant instrument.

1.0.3 (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?

```
tsls = AER::ivreg(data = df, log_price ~ log_volume | wind_m_s)

summary(tsls)
```

The estimated price elasticity of demand for sardines with wind speed as an instrument for price is -0.92.

1.0.4 (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.

```
tslsf = AER::ivreg(data = df, log_price ~ log_volume | wind_m_s + as.factor(country) + as.factor(year) +

summary(tslsf)

# F statistic
fixedef <- lm(data = df, log_price ~ wind_m_s + as.factor(country) + as.factor(year) + as.factor(month)

car::linearHypothesis(fixedef, "wind_m_s=0", white.adjust = "hc2")
```

Controlling for fixed effects of country, year, and month, the new price elasticity of demand is 0.0226, substantially lower than without the fixed effects. The F-statistic of 77.7 shows it is a relevant non-weak instrument.