

## Panel Data 2: Implementation in R

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## Section 1

Panel

## Preliminary:

- ▶ I use the following package
  - ▶ lfe package.

## Panel Data Regression

- ▶ I use the dataset Fatalities in AER package.
  - ▶ See <https://www.rdocumentation.org/packages/AER/versions/1.2-6/topics/Fatalities> for details.

```
library(AER)
```

```
## Loading required package: car
```

```
## Loading required package: carData
```

```
## Loading required package: lmtest
```

```
## Loading required package: zoo
```

```
##
```

```
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
```

```
##
```

- ▶ As a preliminary analysis, let's plot the relationship between fatality rate and beer tax in 1998.

```
library("dplyr")
```

```
##
```

```
## Attaching package: 'dplyr'
```

```
## The following object is masked from 'package:car':
```

```
##
```

```
##      recode
```

```
## The following objects are masked from 'package:stats':
```

```
##
```

```
##      filter, lag
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
##      intersect, setdiff, setequal, union
```

- ▶ Run fixed effect regression using `felm` command in `lfe` package.
  - ▶ <https://www.rdocumentation.org/packages/lfe/versions/2.8-3/topics/felm>

```
library("lfe")
```

```
## Loading required package: Matrix
```

```
##
```

```
## Attaching package: 'lfe'
```

```
## The following object is masked from 'package:lmtest':
```

```
##
```

```
##      waldtest
```

```
Fatalities %>%
```

```
  mutate(fatal_rate = fatal / pop * 10000) -> data
```

```
# OLS
```

```
result_ols <- felm(fatal_rate ~ beertax | 0 | 0 | 0, data =
```

► What if we do not use the cluster-robust standard error?

```
# State FE w.o. CRS
```

```
result_wo_CRS <- felm( fatal_rate ~ beertax | state | 0 | 0,
```

```
# State FE w. CRS
```

```
result_w_CRS <- felm( fatal_rate ~ beertax | state | 0 | stat
```

```
# Report heteroskedasticity robust standard error and cluster-  
stargazer::stargazer(result_wo_CRS, result_w_CRS, type = "tex
```

```
##
```

```
## =====
```

```
##
```

Dependent variable:

```
##
```

```
##
```

fatal\_rate

```
##
```

(1)

(2)

```
## -----
```

```
## beertax
```

-0.656\*\*\*

-0.656\*\*/ 14

## Section 2

Panel + IV



## Panel Data with Instrumental Variables

- ▶ Revisit the demand for Cigaretts
- ▶ Consider the following model

$$\log(Q_{it}) = \beta_0 + \beta_1 \log(P_{it}) + \beta_2 \log(\text{income}_{it}) + u_i + e_{it}$$

where

- ▶  $Q_{it}$  is the number of packs per capita in state  $i$  in year  $t$ ,
- ▶  $P_{it}$  is the after-tax average real price per pack of cigarettes, and
- ▶  $\text{income}_{it}$  is the real income per capita. This is demand shifter.
- ▶ As an IV for the price, we use the followings:
  - ▶  $\text{SalesTax}_{it}$ : the proportion of taxes on cigarettes arising from the general sales tax.
    - ▶ Relevant as it is included in the after-tax price
    - ▶ Exogenous(independent) since the sales tax does not influence demand directly, but indirectly through the price.
  - ▶  $\text{CigTax}_{it}$ : the cigarett-specific taxes

```
# load the data set and get an overview
```

```
library(AER)
```

```
data("CigarettesSW")
```

```
CigarettesSW %>%
```

```
  mutate( rincome = (income / population) / cpi) %>%
```

```
  mutate( rprice = price / cpi ) %>%
```

```
  mutate( saletax = (taxs - tax) / cpi ) %>%
```

```
  mutate( cigtax = tax/cpi ) -> Cigdata
```

► Run IV regression with panel data.

*# OLS*

```
result_1 <- felm( log(packs) ~ log(rprice) + log(rincome) | 0
```

*# State FE*

```
result_2 <- felm( log(packs) ~ log(rprice) + log(rincome) | s
```

*# IV without FE*

```
result_3 <- felm( log(packs) ~ log(rincome) | 0 | (log(rprice
```

*# IV with FE*

```
result_4 <- felm( log(packs) ~ log(rincome) | state | (log(rp
```

```
stargazer::stargazer(result_1, result_2, result_3, result_4, t
```

##

## =====

## Dependent variable

## Section 3

felm command

## How to report heteroskedasticity robust standard error in stargazer

*# Run felm command without specifying cluster.*

```
result_1 <- felm( log(packs) ~ log(rprice) + log(rincome) | 0
```

*# `result\_1\$rse` contains heteroskedasticity robust standard error*

```
stargazer::stargazer(result_1, type = "text",  
                      se = list(result_1$rse ) )
```

```
##  
## =====  
##                               Dependent variable:  
##                               -----  
##                               log(packs)  
## -----  
## log(rprice)                  -1.334***  
##                               (0.154)  
##  
## log(rincome)                 0.318**
```

## How to conduct F test after felm

*# Run felm command without specifying cluster.*

```
result_1 <- felm( packs ~ rprice + rincome | 0 | 0 | 0, data
```

*# The following tests  $H_0: \_b[rincome] = 0 \ \& \ \_b[rprice] = 0$*

```
fctest1 = waldtest(result_1, ~ rincome | rprice )
```

```
fctest1
```

```
##                               p
## 0.0000000000000000000000004180596 98.452836639283432873526180
##                               df1
## 2.0000000000000000000000000000000 0.00000000000000002621700979
##                               F
## 49.2264183196417164367630903143 93.00000000000000000000000000
## attr("formula")
## ~rincome | rprice
## <environment: 0x000000001bf47c88>
```