11) Fixed Effects

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Reference

Tables, Graphics, and Figures from

Mastering 'Metrics: The Path from Cause to Effect

Angrist & Pischke (2014): Chapter 5.2

Fixed Effects (Time-Demeaned)

$$y_{it} = \beta_1 x_{it} + \alpha_i + u_{it} \quad \textbf{(1)}$$

$$\bar{y}_i = \beta_1 \bar{x}_i + \alpha_i + \bar{u}_i \quad \textbf{(2)}$$

$$y_{it} - \bar{y}_i = \beta_1 (x_{it} - \bar{x}_i) + u_{it} - \bar{u}_i$$

$$\ddot{y}_{it} = \beta_1 \ddot{x}_{it} + \ddot{u}_{it}$$

Du Mouchel, Williams, and Zador (1987)

Raising the Alcohol Purchase Age: Its Effects on Fatal Motor Vehicle Crashes in Twenty-Six States. The Journal of Legal Studies, Vol. 16(1), pp. 249-266

$$Y_{st} = \alpha + \delta Legal_{st} + \sum_{k=Alaska}^{Wyoming} \beta_k State_{ks} + \sum_{j=1971}^{1983} \gamma_j Year_{jt} + e_{st}$$

Y_{st}: death rates in state s and year t

$Legal_{st}$: proportion of 18-20-year olds allowed to drink

State Trends : $\sum_{k=Alaska}^{Wyoming} \theta_k (State_{ks} \times t)$

Estimates of MLDA Effects on Death Rates

Dependent variable	(1)	(2)	(3)	(4)
All deaths	10.80	8.47	12.41	9.65
	(4.59)	(5.10)	(4.60)	(4.64)
Motor vehicle accidents	7.59	6.64	7.50	6.46
	(2.50)	(2.66)	(2.27)	(2.24)
Suicide	.59	.47	1.49	1.26
	(.59)	(.79)	(.88)	(.89)
All internal causes	1.33	.08	1.89	1.28
	(1.59)	(1.93)	(1.78)	(1.45)
State trends	No	Yes	No	Yes
Weights	No	No	Yes	Yes

All models control for state and year effects

Estimates of MLDA Effects Controlling for Beer Taxes

	Without trends		With trends	
Dependent variable	Fraction legal (1)	Beer tax (2)	Fraction legal (3)	Beer tax (4)
All deaths	10.98	1.51	10.03	−5.52
	(4.69)	(9.07)	(4.92)	(32.24)
Motor vehicle accidents	7.59	3.82	6.89	26.88
	(2.56)	(5.40)	(2.66)	(20.12)
Suicide	.45	−3.05	.38	−12.13
	(.60)	(1.63)	(.77)	(8.82)
Internal causes	1.46	−1.36	.88	−10.31
	(1.61)	(3.07)	(1.81)	(11.64)

All models control for state and year effects

from linearmodels import PanelOLS

```
df = pd.read_stata('C:\\Users\\Vitor\\Desktop\\ECO 6100
Introduction to Econometrics (Fall 2018)\\Lectures\\10)
Difference-in-Difference (DiD)\\deaths.dta')

df = df[df['year'] <= 1983]

df = df[df['agegr'] == '18-20 yrs']

df = df[df['dtype'] == 'all'] # All deaths

df['Weight'] = (df['pop'])

df['Trend'] = df['year']

Dstate = pd.Categorical(df.state)

Dyear = pd.Categorical(df.year)

df = df.set_index(['state', 'year'])
```

mod1 = PanelOLS(df.mrate, df.legal, entity_effects=True, time_effects=True)

print(mod1.fit(cov_type='clustered', cluster_entity=True))

	Parameter	Std. Err.	T-stat	P-value
legal	10.804	4.5501	2.3745	0.0179

mod2=PanelOLS.from_formula('mrate~legal + Dyear + Dstate', df)

print(mod2.fit(cov_type='clustered', cluster_entity=True))

Dstate[T.54]	-3.7739	2.6938	-1.4010	0.1617
Dstate[T.55]	-21.535	2.7074	-7.9541	0.0000
Dstate[T.56]	92.053	0.5169	178.09	0.0000
legal	10.804	4.5501	2.3745	0.0179

mod3 = PanelOLS.from_formula('mrate ~ legal + Trend*Dstate', df)

print(mod3.fit(cov_type='clustered', cluster_entity=True))

```
Dstate[55]            4440.3     3.7650     1179.4     0.0000
Dstate[56]         1.283e+04     397.44     32.285     0.0000
legal                 9.8573     3.7650     2.6181     0.0091
Trend                -3.9542     0.2611    -15.145     0.0000
Trend:Dstate[T.2]     1.8937     0.2204     8.5921     0.0000
```

Result is different from the Book, bc I didn't include Time Fixed Effets, given multicollinearity problem

mod4 = PanelOLS(df.mrate, df.legal, weights=df.Weight, entity_effects=True, time_effects=True)

print(mod4.fit(cov_type='clustered', cluster_entity=True))

```
==============================================================================
                Parameter  Std. Err.     T-stat    P-value
------------------------------------------------------------------------------
legal              12.413     4.5572     2.7237     0.0066
==============================================================================

F-test for Poolability: 46.173
P-value: 0.0000
Distribution: F(63,649)

Included effects: Entity, Time
```