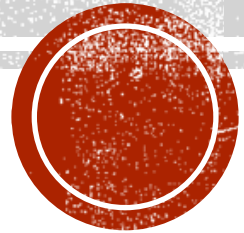
DATA MINING

Regression with panel data



1 TOOLS

1.1 BACKGROUND

- Linear Regression:
  - For every linear model: $Y_i = \alpha + \beta * X_i + U_I$
  - Goal: estimate a model that best fits the true model $\hat{\alpha}, \hat{\beta}$

- Methodology: OLS(Ordinary Least Squares)
  - To minimize the sum of the squares residuals:
    - $min \sum_{i=1}^{n} (Y_i - \widehat{Y_i})^2$
    - Where $\widehat{Y_i} = \hat{\alpha} + \hat{\beta} * X_i$

2 METHODOLOGY

- 2.1 Linear Regression
- 2.1 Non-linear Regression

2.1 LINEAR REGRESSION

- The Fixed Effects Model
  - $GDP_{i,t} = \alpha + \beta_i * X_{i,t} + \Theta_t + U_{i,t}$
- The Radom Effects Model
  - $GDP_{i,t} = \alpha + \beta_i * X_{i,t} + \gamma_t * E_t + U_{i,t}$

➢Where X is repressor, i is county, t is year, Θ is the fixed effects over years, E is dummy variable of the year.

FIXED VS RANDOM

	Pro	Con
Fixed	Can only see the time effect within-year	No assumption needs
Random	Efficient Clearly see the time effect between-year and within-year	We need to assume there is no correlation between time effect and regressor

FIXED OR RANDOM?

- Hausman test
  - H_0:no correlation between regressor and time effect

    or $\text{cov}(X_i , X_{i,t}) = 0$

  - Under H_0: Random effects model is consistent and efficient, while fixed effects model is consistent but not efficient

  - Reject H_0: Random effects model is not consistent, but fixed effects model is still consistent

2.2 NON-LINEAR REGRESSION

- $\text{Log}(\text{GDP}_{i,\,t}) = \alpha + \beta_i * \text{Log}(\text{X}_{i,\,t})$

3 RESULT

- Coefficient of determination:
  - Linear regression: 98.68%
  - Non-linear regression: 96.74%

- Final model:
  - Linear regression with panel data using fixed effect

$$GDP_{i,\,t} = 1.85*10^{11} - 1.8*10^{11} * CO2\ emission + 2.39 * foreign\ investment + 238.13 * labor\ force + 3.22*10^{7} * technical\ articles$$