

Final Review

Introduction to Econometrics, Spring 2026

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- **Final Exam Date and Time:** Next Monday, June 22, 14:00-16:00PM
- **Location:** Xian I Building, Room 207.

Important Guidelines

1. **Books and notes** are not permitted.
2. All electronic devices are **prohibited**. Only **paper dictionaries** are allowed.
3. **All questions are in English. You may answer in Chinese, English, or both.**
Writing in English will earn **a bonus of 5-10 points**.
4. **Time Management** is crucial. Avoid spending excessive time on any single question.
5. **Conduct:** Maintain academic integrity. **Cheating or any form of misconduct will result in disciplinary action.**

Review Lecture 0

- What is econometrics?
 - Main missions: **Causality** v.s. **Forecasting**
- The Axioms of Data Analysis
- Data Structure:
 - **Cross section**
 - **Times series**
 - **Panel Data**
 - Pool-Cross sections
- *Micro-Econometrics* v.s. *Macro-Econometrics*

Review Lecture 1

- The Central Question of Causality
 - **Rubin Causal Model:** Potential Outcome Framework
 - Experimental Design as a Benchmark
 - What is the RCT?
 - RCT does not work in reality?
- Basic Probability and Statistics
 - **Iterated Expectations Law**
 - **LLN** and **CLT**
 - **Statistical Inference**
 - Point estimation: Estimator and Estimate
 - Three Characteristics of an estimator
 - Properties of the sample mean and the sample variance
 - Hypothesis Testing and P-Value
 - Confidence Interval and significance level
- Estimate and Hypothesis Tests for the Difference Between Two Means

Review Lecture 2

- From Randomized Control Trials to Observational Studies
 - Unconditional Independence to CIA
- Simple OLS:
 - **The Ordinary Least Squares Estimator**(β)
 - R squares/the coefficient of determination
- The Least Squares Assumptions:
 - Assumption 1
 - Assumption 2
 - Assumption 3
- Properties of the OLS estimator
 - The OLS estimator is **unbiased**, **consistent** and has asymptotically normal sampling distribution.

Review Lecture 3

- Multiple OLS Regression: Estimation
 - **OV**B Bias
 - **Perfect multicollinearity**: Assumption 4
 - Interpretation of coefficients
 - Partitioned regression: **FWL theorem**
 - Adjusted R^2
 - Categorical variables as regressors

Review Lecture 4

- Statistical Inference of β
 - *Standard error of β*
 - Hypothesis concerning β
 - Confidence interval
- Multiple Regression: Hypotheses tests
 - Heteroskedasticity & homoskedasticity
 - Testing hypothesis on 2 or more coefficients: **F-test**

Review Lecture 5: Nonlinear Regression

- Polynomials, Logarithmic transformations and Interactions
 - How to explain these estimate coefficients?

Review Lecture 6: Discrete Choice Dependent Variables

- LPM, Logit, Probit and Multinomial Logit
 - Coefficient interpretation and interpretation of marginal effects
 - Marginal effects
 - Pseudo- R^2

Review Lecture 7: Assessing Regression Studies(I)

- Internal validity v.s External validity
- Threats to internal validity
 1. **Omitted variables bias**
 - **Control variables**
 - Irrelevant variables
 - Relevant variables
 - Highly correlated variables
 - Bad Controls
 - **DAGs and Causal Diagrams**
 2. **Measurement error**
 - ME in Y
 - ME in X

Review Lecture 8 Assessing Regression Studies(II)

- Threats to internal validity
 3. Function form misspecification
 4. **Simultaneous causality**
 5. **Missing Data and Sample Selection**
 - Missing Data: X and Y
 - Limited Dependent Variable: **Truncated/Censored/Sample Selection**
 6. Heteroskedasticity and/or correlated error terms
 7. **Economic significant**

Review Lecture 9: Matching Methods

- Matching: basic idea and assumption
- Propensity Score Matching
- Matching v.s OLS

Review Lecture 10: Instrumental Variables

- Two assumptions:
- Statistical properties of 2SLS estimator
- Checking Instrument Validity
 - first stage: weak instrument
 - institutional background to argue
 - reduced form: exclusive restriction
 - more IVs: overidentification test
- The nature of IV: Heterogeneous effect and LATE

Review Lecture 11: Regression Discontinuity Design

- RDD: Basic Ideas and Types
- Basic assumptions
- Check Validity of RDD

Review Lecture 12: Fixed Effects Model

- Fixed effect: assumption and estimation
- Fixed effect model meets measurement error
- IV in **FE** model

Review Lecture 13: DID: basic and extensions

- DID: basic idea and assumption
- TWFE variations and DID specifications.
- SCM: basic idea and assumptions
- Extensions: DID+Matching, DID+IV, DID+RDD, DDD, Staggered DID...

Putting It Together: Which Method?

Method	Key Identifying Assumption	Data / Typical Setting
OLS (CIA)	Selection on observables ($E[u X] = 0$)	Cross-section; rich controls
Matching/PSM	Same CIA + common support	Cross-section; treat vs. control
IV / 2SLS	Relevance + Exogeneity (exclusion)	Valid instrument Z ; LATE
RDD	Continuity of potential outcomes	Running variable + cutoff c
FE	Confounders time-invariant	Panel data; within variation
DID	Parallel trends	Panel/repeated cross-sec; pre/post



- The Final Exam is a milestone, not the destination, of your econometric journey!!!

Stay hungry. Stay foolish.

Steve Jobs

quote fancy