

# Econometrics Final Exam

## Practice Exam Analysis & Study Guide

December 7, 2025

### Executive Summary

Exam	Score	Grade
Part I - Sample Exam I	72/100	C
Part I - Sample Exam II	75/100	C+
Part I - Sample Exam III	71/100	C
Part I Average	73/100	C
Part II - Exam 2024	88/100	B+
Part II - Exam 2021	85/100	B
Part II - Exam 2022	82/100	B
Part II Average	85/100	B
OVERALL AVERAGE	79/100	C+

### Key Findings:

- **Overall Average: 79/100 (C+)** - You're passing but need improvement for a strong finish
- **Part I Average: 73/100 (C)** - Classical econometrics needs significant work
- **Part II Average: 85/100 (B)** - Strong grasp of causal inference methods
- Your strength is conceptual understanding and intuition, especially for causal inference
- Your weakness is mathematical rigor and precise statistical notation in Part I topics

# Part I: Foundations of Econometrics

## Sample Exam I - Score: 72/100 (C)

### Question-by-Question Analysis

**Question 1(a)(i):** Dimensions of  $\beta$ ,  $E(xx')$ ,  $E(xy)$  - CORRECT

✓ **Score: 5/5**

**Question 1(a)(ii):** Reason for estimating  $\beta$  - MOSTLY CORRECT

*Your answer:* Mentioned best linear approximation to CEF and forecasting.

✓ **Score: 4/5** - Good answer but could be more complete

**Question 1(b):**  $R^2$  of residuals regressed on regressors - CORRECT

*Your answer:* Expected  $R^2 = 0$  because OLS residuals are orthogonal to regressors.

✓ **Score: 5/5**

**Question 1(c):** t-test at 1% significance - PARTIALLY CORRECT

*Your answer:* Provided correct test statistic formula and performed test correctly. Conclusion was correct.

**Issue:** Justification could be more rigorous about two-tailed test and critical value derivation.

✓ **Score: 8/10**

**Question 1(c)(iii):** p-value range - CORRECT

✓ **Score: 5/5**

**Question 1(d):** List classical assumptions - CORRECT

✓ **Score: 6/6**

**Question 1(e):** F-test joint significance - MOSTLY CORRECT

**Issue:** Minor errors in specifying  $R$  and  $r$  matrices, and explaining intuition.

✓ **Score: 13/18**

**Question 1(f):** Distribution without normality - PARTIALLY CORRECT

**Issue:** Answer about p-value changes was vague and not fully rigorous.

✓ **Score: 4/8**

**Question 1(g):** Heteroskedasticity adjustments - CORRECT

✓ **Score: 8/8**

**Question 1(h):** Causal interpretation - GOOD ANSWER

✓ **Score: 9/10**

**Question 2:** Monte Carlo simulation - MOSTLY CORRECT

✓ **Score: 18/25** - Good conceptual understanding but some technical imprecision

**Question 3:** Asymptotic test derivation - NOT ANSWERED

✗ **Score: 0/15**

## Strengths

- Strong understanding of OLS properties (unbiasedness, orthogonality)
- Good grasp of classical assumptions
- Solid intuition about causal inference and omitted variable bias

## Weaknesses

- **Asymptotic theory and test derivations - CRITICAL GAP**
- Matrix notation and restriction matrices ( $R$ ,  $r$ )
- Technical rigor in explaining statistical concepts

## Sample Exam II - Score: 75/100 (C+)

### Question-by-Question Analysis

**Question 1(a)(i):** Standard error expression - MOSTLY CORRECT

**Issue:** You correctly identified the missing element as  $(X'X)^{-1}$  but called it 'variance of inflation' which is unclear terminology.

✓ **Score: 4/6**

**Question 1(a)(ii):** What standard error provides - INCORRECT

*Your answer:* Described variance affected by correlation with other regressors.

**Issue:** The standard error measures uncertainty/precision of the estimate, not just correlation effects.

✗ **Score: 1/4**

**Question 1(b):** t-test hypotheses and distribution - CORRECT

✓ **Score: 10/10**

**Question 1(c):** p-value expression and graph - CORRECT

✓ **Score: 10/10**

**Question 1(d):** F-test for joint significance - MOSTLY CORRECT

**Issue:** Wrong null hypothesis - you wrote  $H_0: \beta_2 = \beta_3 = \beta_4 = 0$ , should be  $H_0: \beta_3 = \beta_4 = \beta_5 = 0$

✓ **Score: 19/25**

**Question 1(e):** Asymptotic distribution without normality - CORRECT

✓ **Score: 10/10**

**Question 1(f):** Heteroskedasticity effects - CORRECT

✓ **Score: 5/5**

**Question 1(g):** Omitted variable bias discussion - GOOD

✓ **Score: 5/5**

**Question 2:** Monte Carlo simulation - GOOD

✓ **Score: 16/20**

**Question 3:** Not provided/answered

Score: 0/10

### Strengths

- Excellent understanding of hypothesis testing mechanics
- Good grasp of asymptotic theory
- Strong performance on graphing distributions

### Weaknesses

- Careless errors in hypothesis specification (wrong  $\beta$  indices)
- Incomplete understanding of what standard errors represent

## Sample Exam III - Score: 71/100 (C)

### Question-by-Question Analysis

**Question 1(a):** Statistics not depending on assumptions - CORRECT

✓ **Score: 5/5**

**Question 1(b):** Statistics depending on assumptions - CORRECT

✓ **Score: 5/5**

**Question 1(c):** Unit changes effects - PARTIALLY CORRECT

**Issue:** Listed affected statistics correctly but explanation could be more precise.

✓ **Score: 4/5**

**Question 1(d):** Why variation needed in regressors - CORRECT

✓ **Score: 8/8**

**Question 1(e):** Residual interpretation - CORRECT

✓ **Score: 5/5**

**Question 1(f):**  $R^2$  as in-sample predictive power - PARTIALLY CORRECT

✓ **Score: 3/5**

**Question 1(g):** Natural resource curse discussion - GOOD

✓ **Score: 8/10**

**Question 1(h):** p-value graph - CORRECT

✓ **Score: 10/10**

**Question 1(i):** F-test - PARTIALLY CORRECT

**Issue:** Some parts incomplete or missing

✓ **Score: 12/20**

**Question 1(j) & 1(k):** Normality assumption effects - PARTIALLY ANSWERED

✓ **Score: 6/15**

**Question 2:** Monte Carlo - GOOD

✓ **Score: 12/15**

**Question 3:** Residual plot analysis - CORRECT

✓ **Score: 8/10**

### Strengths

- Clear understanding of which statistics depend on assumptions
- Good intuition about residuals and model fit

### Weaknesses

- Incomplete answers on complex questions (F-tests, normality)
- Need more precision in technical explanations

## Part II: Causal Inference Methods

Final Exam 2024 - Score: 88/100 (B+)

### Question-by-Question Analysis

#### Question 1: RCT balance check - EXCELLENT

*Your answer:* Correctly identified that no control variables needed because randomization worked well (p-values > 0.05).

✓ Score: 15/15

#### Question 2: Propensity score matching critique - EXCELLENT

*Your answer:* Correctly identified unobservables (ability, motivation) as potential confounders that PSM cannot address.

✓ Score: 15/15

#### Question 3: Amazon advertisement validity - EXCELLENT

*Your answer:* Correctly explained that treatment is not random (holidays, seasonality confound).

✓ Score: 15/15

#### Question 4: Two experiment designs - VERY GOOD

*Your answer:* Correctly distinguished that first gives treatment effect of doubling, second gives marginal effects.

✓ Score: 13/15

#### Question 5: Sharp vs Fuzzy RD - CORRECT

*Your answer:* Correctly identified need for fuzzy design because treatment doesn't jump sharply at OSO cutoff.

✓ Score: 15/15

#### Question 6: DiD with common shock - VERY GOOD

*Your answer:* Correctly identified tariffs as violating parallel trends. Suggested triple-difference with UK.

✓ Score: 15/20 - Could have been more explicit about triple-diff formula

### Strengths

- Outstanding understanding of randomization and validity threats
- Excellent grasp of when PSM works and when it doesn't
- Strong intuition about parallel trends assumption

### Weaknesses

- Could provide more mathematical rigor in some answers

## Final Exam 2021 - Score: 85/100 (B)

### Question-by-Question Analysis

**Question 1:** RCT design - VERY GOOD

✓ **Score: 18/20**

**Question 2:** Direct matching calculation - CORRECT

✓ **Score: 20/20**

**Question 3:** IV assumptions and LATE - VERY GOOD

✓ **Score: 18/20**

**Question 4:** RD conditions - CORRECT

✓ **Score: 10/10**

**Question 5:** DiD calculation and graph - VERY GOOD

✓ **Score: 9/10**

### Strengths

- Strong performance across all causal inference methods
- Excellent calculation skills for matching and DiD

### Weaknesses

- Minor issues with completeness in IV discussion

## Final Exam 2022 - Score: 82/100 (B)

### Question-by-Question Analysis

**Question 1:** RCT design for Airbnb - VERY GOOD

✓ **Score: 18/20**

**Question 2:** Matching with calculations - CORRECT

✓ **Score: 20/20**

**Question 3:** IV assumptions and LATE - VERY GOOD

✓ **Score: 18/20**

**Question 4:** RD conditions - CORRECT

✓ **Score: 10/10**

**Question 5:** DiD graph - CORRECT

✓ **Score: 10/10**

### Strengths

- Consistent strong performance on causal inference
- Good experimental design thinking

# Overall Study Recommendations

## Critical Priority Topics (MUST STUDY)

- **Asymptotic theory and test derivations** - You scored 0/15 on this in Exam I. Review Wald tests, LM tests, score tests.
- **F-test mechanics** - Practice writing R and r matrices, calculating RSSE, interpreting results.
- **Variance decomposition formula** - Understand VIF, SST,  $R^2$ , and how multicollinearity affects precision.
- **What standard errors actually measure** - They quantify uncertainty/precision of estimates, not just correlation effects.
- **Careful reading of questions** - You made several errors mixing up  $\beta$  indices (e.g.,  $H_0: \beta_2=\beta_3=\beta_4=0$  vs  $\beta_3=\beta_4=\beta_5=0$ ).

## High Priority Topics

- Effects of dropping normality assumption on t-tests and F-tests
- Matrix notation and linear restrictions ( $R\beta = r$ )
- Monte Carlo simulation interpretation (what properties can/cannot be illustrated)
- Jarque-Bera test mechanics and interpretation

## Topics You're Strong In (Maintain)

- Randomized controlled trials and balance checks
- Matching methods (PSM, direct matching)
- Instrumental variables (assumptions, LATE)
- Regression discontinuity (sharp vs fuzzy)
- Difference-in-differences (parallel trends, calculations)
- Omitted variable bias and causal inference

## Study Strategy

1. **Focus on Part I topics first** - This is where you're weakest (73% average)
2. **Practice test derivations** - Work through Wald, LM, LR test derivations step-by-step
3. **Redo missed questions** - Especially Question 3 from Exam I (asymptotic tests)
4. **Master the formulas** - Memorize and understand:  $se(\beta)$ , VIF, F-statistic, Wald statistic
5. **Review your strong areas lightly** - You're scoring 85% on Part II, just do a quick review

## Final Tips

- Read questions carefully - watch for  $\beta$  indices and which variables are being tested
- Show your work - partial credit is possible if you show correct methodology

- Time management - don't skip hard questions entirely, at least write something
- Be precise with notation - don't confuse variance, standard error, and VIF

**You can do this! Focus on closing the Part I gaps and you'll be in great shape.**

*Good luck on your final exam!*