

## Econ 306 (Section 1) — Introduction to Econometrics

104 Rackley Building, Monday to Friday 11:10–12:25 pm

**Zhiyuan (Ryan) Chen**

202 Willard Building, Wednesdays and Fridays 14:00–15:00

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### Course description

This course introduces the basic quantitative methods used to analyze economic data, focusing on *linear models* which establish a linear relationship between two or more variables of interest. We will study linear models from both theoretical and practical perspectives, and we will discuss a series of simple economic applications. During the first part of the course, we will study how to measure and interpret the magnitudes of linear relations, and how to test some hypothesis about their nature. The second part of the course focuses on the specification of linear models. We will discuss how to choose which variables to include in our models, and how to transform them so that the relations are linear. We will also discuss the problem of endogeneity and the use of instrumental variables to overcome it.

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### Prerequisites

This course has a prerequisite of Statistical Foundations for Econometrics (ECON106 at Penn State or an equivalent course, STAT200 is not enough). This means that the material in this course is presented assuming the students have a working knowledge of prerequisite material. If you have not had the prerequisite class, you will probably struggle with many of the topics presented here and will not fare well in this course. The department strongly recommends completing the necessary prerequisites before enrolling in this course. In particular, you should be familiar with high-school level algebra, and basic concepts from probability theory (random variables, probability distributions, expectation, variance, correlation and independence) and statistics (random samples, estimators, hypothesis testing). If you have any issues with these topics, please contact me as soon as possible.

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### References

Most of the course follows the textbook:

- Studenmund (2011) *Using Econometrics: a practical guide*. Addison Wesley. 6th edition.

You are also required to read the class slides and lecture notes. Also, on Fridays we will discuss research papers in Economics, which will be assigned as the course progresses. The technical details of some of these papers are beyond the scope of this course. You are encouraged (but not required) to read the papers skipping the technical parts. A good alternative reference for those interested in Econometrics is:

- Stock & Watson (2011) *Introduction to Econometrics*. Addison Wesley. 3rd edition.

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### Tentative Course Outline

#### 1. Review of probability and statistics

Random variables · Moments · Correlation · Random samples · Estimation · Hypothesis testing

#### 2. Estimation of linear models [1 · 2 · 3]

Linear models · OLS · Interpretation · ANOVA ·  $R^2$

#### 3. Inference in linear models [4 · 5]

Sampling distribution · Gauss-Markov theorem ·  $t$ -test ·  $F$ -test

#### 4. Model specification [6 · 7 · 11]

Irrelevant variables · Omitted Variables · Variable transformation · Specification search · Empirical projects

#### 5. Specification problems [8 · 9 · 10]

Multicollinearity · Heteroskedasticity · Serial correlation

## 6. Instrumental variables [14]

Endogeneity · Simultaneous equations · Instrumental Variables · 2SOLS

## 7. Binary variables [13 · 16]

Dummy variables · LPM/Probit/Logit · Selection bias · Random sampling

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### Grading

Numerical grades will be assigned based on a term paper (40%), weekly quizzes (40%) and a final exam (20%).

- **Quizzes** Short weekly quizzes will be administered on Fridays during class. If you miss one quiz for any reason, I will just average the rest of the quizzes, no questions asked. However, if you miss more than one quiz I will *strictly* apply the department policy on missed examinations (see Valid Excuses below).
- **Final exam** A *cumulative* final exam will be held on Monday, June 25. The date is set by the University and I cannot change it. Also, university policies do not allow me to have make-up exams prior to this date. *Those of you who plan to leave State College must make travel plans accordingly.*
- **Term paper** You are required to use one of the data sets provided to conduct an empirical analysis of an economic problem. The project will be conducted in teams of 4–5 students. Groups are required to submit a written report on Thursday, June 21<sup>st</sup>, and to give a 10 minute presentation of their results on the last two days. In addition, each student must individually submit an executive summary of the project. Details for this project are provided in a separate document.

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### Communication

Class slides, research papers and other materials will be published online on the course website . Grades will be posted on canvas. The best way to contact me is via e-mail messages sent to [zxc5109@psu.edu](mailto:zxc5109@psu.edu). The subject line should begin with "ECON306". Please feel free to contact me if you have concerns or comments about the course. In special circumstances, you may contact the Director of Undergraduate Studies in Economics or provide feedback via a comment box that the Department maintains in 608 Kern.

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### Disability Access Policy

The Pennsylvania State University encourages qualified persons with disabilities to participate in its programs and activities and is committed to the policy that all people shall have equal access to programs, facilities, and admissions without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. If you anticipate needing any type of accommodation in this course or have questions about physical access, please tell me as soon as possible.

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### Academic Integrity

Students must observe the policies from the College of Liberal Arts (Faculty Senate Policy 49-20) and from the Economics Department regarding academic integrity. These policies, including the procedure to be followed when a student is charged with any violations, can be found online at [senate.psu.edu/policies/](http://senate.psu.edu/policies/) and [www.econ.psu.edu/undergraduate/academic-integrity](http://www.econ.psu.edu/undergraduate/academic-integrity).

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### Valid Excuses

During the course, many possible situations may arise that would result in your inability to attend class, attend exams, or perform at a minimally acceptable level during an examination. Illness or injury, family emergencies, certain University-approved curricular and extra-curricular activities, and religious holidays can be legitimate reasons to miss class or to be excused from a scheduled examination. The Economics Department policy regarding absence, including the student's responsibility to document an excuse, is available online at [www.econ.psu.edu/undergraduate/valid-excuses](http://www.econ.psu.edu/undergraduate/valid-excuses).