

# ECONOMICS

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### DEGREES OFFERED: BA, MA, PHD

Undergraduates may major in either economics or mathematical economic analysis. The latter is recommended for students who intend to continue on to graduate work in economics or pursue a business or governmental job in which analytical and quantitative skills are required.

The 8 major fields available for graduate study are econometrics, economic development, economic theory, industrial organization and regulation, international trade and finance, labor, macroeconomics and/or monetary theory, and public finance.

### REQUIREMENTS FOR MAJORING IN ECONOMICS

1. All economics majors must complete a minimum of 10 courses with a grade point average of at least 2.0. When students repeat courses or complete more than the minimally required number of courses, the departmental GPA will be based on the set of courses that (i) satisfies all requirements for the degree and (ii) results in the highest GPA for the student. Major requirements are not reduced for multiple majors, although some courses can satisfy the requirements for more than 1 major. (Please note that students may not pursue a double major in economics and mathematical economic analysis.)
2. The following courses are required for all economics majors:\*

ECON 211 *Principles of Economics I*

ECON 370 *Microeconomic Theory*

ECON 375 *Macroeconomic Theory*

STAT 280 *Elementary Applied Statistics* (or STAT 310/ECON 382)

ECON 446 *Applied Econometrics* (or ECON 400).

Please note that ECON 370 requires MATH 101 (or both MATH 111 and 112) as prerequisites. We suggest that economics majors take ECON 211, ECON

370, MATH 101, STAT 280 (or STAT 310/ECON 382), and ECON 446 (or ECON 400) as early as possible. Please note that failure to take prerequisite courses in earlier years may cause scheduling problems in later years.

3. Given that item 2 has been satisfied, the 5 remaining required economics courses must be selected from the following:

ECON 340 <i>Introduction to Game Theory</i>	ECON 450 <i>World Economy and Social Development</i>
ECON 348 <i>Organization Design</i>	ECON 451 <i>Economy of Latin America</i>
ECON 355 <i>Financial Markets</i>	ECON 452 <i>Religion, Ethics, and Economics</i>
ECON 400 <i>Econometrics</i>	ECON 455 <i>Money and Financial Markets</i>
ECON 403/404 <i>Senior Independent Research</i>	ECON 461 <i>Urban Economics</i>
ECON 415 <i>Labor Economics</i>	ECON 475 <i>Integer and Combinatorial Optimization</i>
ECON 420 <i>International Trade</i>	ECON 477 <i>Mathematical Economics</i>
ECON 421 <i>International Finance</i>	ECON 479 <i>Applied General Equilibrium Modeling</i>
ECON 435 <i>Industrial Organization</i>	ECON 480 <i>Environmental Economics</i>
ECON 436 <i>Regulation</i>	ECON 481 <i>Health Economics</i>
ECON 437 <i>Energy Economics</i>	ECON 482 <i>Distributive Justice</i>
ECON 438 <i>Business, Law, and Economics</i>	ECON 483 <i>Public Finance Tax Policy</i>
ECON 439 <i>Torts, Property, and Contracts</i>	ECON 484 <i>Public Finance Expenditure</i>
ECON 440 <i>Advanced Game Theory</i>	ECON 485/486 <i>Contemporary Economic Issues</i>
ECON 445 <i>Managerial Economics</i>	ECON 495/496 <i>Senior Seminar</i>
ECON 448 <i>Corporate Finance</i>	
ECON 449 <i>Basics/Financial Engineering</i>	

4. No more than 3 of the 10 economics courses may be transferred from other schools. Additional transfer credits in economics may count toward meeting university graduation requirements but not toward fulfillment of the departmental major requirements. AP credits do not count against the 3 allowed transfer credits. In order to transfer ECON 211, the student must pass a qualifying examination. Students wishing to take the ECON 211 qualifying examination must apply to the economics department office in Baker Hall 266A. For additional information on transfer credits, consult "Procedures for Transfer Credit," available in the economics department office.
5. Students may graduate with honors in economics by achieving a B+ (3.33) average in all economics courses and completing 2 semesters of independent research (for details, consult Economics 403/404—*Senior Independent Research*, available in the economics department office).
6. For additional course information, consult Economics Course Descriptions, compiled by the Rice chapter of the Omicron Delta Epsilon National Economics Honor Society.
7. Please note that it is primarily the responsibility of the student to satisfy all degree requirements, including the University Credit Requirements and University Distribution Requirements specified in the General Announcements. Students are advised that the relevant departmental requirements are those in effect on the day that the student declares economics as their major. Consult with the appropriate departmental advisor, who must sign all registration forms for each major.

\* The Department of Statistics has advised that it may introduce a new class especially for economics majors in place of STAT 280. If and when it does, STAT 280 will be replaced by that new class. In the meantime, students should take STAT 280 (or STAT 310/ECON 382) before taking ECON 446 (or ECON 400).

- Students who are considering either graduate work in economics or a business or governmental job in which analytical and quantitative skills are required should seriously consider obtaining the alternative major in mathematical economic analysis.

## REQUIREMENTS FOR MAJORING IN MATHEMATICAL ECONOMIC ANALYSIS

- The major in mathematical economic analysis (MTEC) is designed for students who are interested in either graduate work in economics or a business or governmental job in which analytical and quantitative skills are required.
- Students must choose between the 2 majors offered by the economics department; that is, students may not double major in economics and mathematical economic analysis. Major requirements are not reduced for students with multiple majors.
- All MTEC majors must complete a minimum of 16 courses in 6 areas with a grade point average of at least 2.0. These courses must include:

### **(a) 4 courses in economic theory:**

ECON 211 *Principles of Economics I*  
 ECON 370 *Microeconomic Theory*  
 ECON 375 *Macroeconomic Theory*  
 ECON 477 *Mathematical Economics*

### **(b) 4 courses in applied economics, selected from:**

ECON 340 *Introduction to Game Theory*  
 ECON 348 *Organizational Design*  
 ECON 355 *Financial Markets*  
 ECON 415 *Labor Economics*  
 ECON 420 *International Trade*  
 ECON 421 *International Finance*  
 ECON 435 *Industrial Organization*  
 ECON 436 *Regulation*  
 ECON 437 *Energy Economics*  
 ECON 438 *Business, Law, and Economics*  
 ECON 439 *Torts, Property, and Contracts*  
 ECON 440 *Advanced Game Theory*  
 ECON 445 *Managerial Economics*  
 ECON 446 *Applied Econometrics*  
 ECON 448 *Corporate Finance*  
 ECON 449 *Basics of Financial Engineering*  
 ECON 450 *World Econ and Social Development*  
 ECON 451 *Economy of Latin America*  
 ECON 452 *Religion, Ethics, and Economics*  
 ECON 455 *Money and Financial Markets*  
 ECON 461 *Urban Economics*  
 ECON 475 *Integer and Combinatorial Optimization*

ECON 479 *Applied General Equilibrium Modeling*

ECON 480 *Environmental Economics*

ECON 481 *Health Economics*

ECON 482 *Distributive Justice*

ECON 483 *Public Finance Tax Policy*

ECON 484 *Public Finance Expenditure*

ECON 485/486 *Contemporary Economic Issues*

### **(c) 1 additional 400-level course in applied economics as listed in (b) or a course in advanced analysis, selected from:**

CAAM 452 *NUM Methods for PDES*

CAAM 453 *Numerical Analysis I*

CAAM 454 *Numerical Analysis II*

CAAM 460 *Optimization Theory*

CAAM 475 *Integer and Combinatorial Optimization*

STAT 421 *Computation Finance II*

STAT 450 *Statistical Modeling*

STAT 486 *Computation Finance I: Market Models*

or an equivalent or higher-level course approved in advance by the chair of the undergraduate committee.

### **(d) 1 course in econometrics:**

ECON 400 *Econometrics*

### **(e) 5 courses in mathematics and statistics:**

MATH 101 *Single Variable Calculus I*,

MATH 102 *Single Variable Calculus II*, and

MATH 211 *ORD Differential Equations*, or  
 MATH 355 *Linear Algebra*, or  
 CAAM 335 *Matrix Analysis*, and  
 MATH 212 *Multivariable Calculus* or  
 221 *Honors Calculus III*, and  
 ECON 382/STAT 310 *Probability and Statistics*, STAT 410 *Introduction to Regression and Statistical Computing*, or STAT 431 *Overview Mathematical Statistics*

**(f) 1 semester of senior independent research or senior seminar (if offered):**

ECON 495/496 or ECON 403/404

4. No more than 3 of the required economics courses and 2 of the required mathematics (or computational and applied mathematics or statistics) courses may be transferred from other schools. Additional transfer credits in economics, mathematics, computational and applied mathematics, or statistics may count toward meeting university graduation requirements, but not toward fulfillment of the departmental major requirements. AP credits do not count against the allowed transfer credits. In order to transfer ECON 211, the student must pass a qualifying examination. Students wishing to take the ECON 211 qualifying examination must apply to the economics department office in Baker Hall 266A. For additional information on transfer credits, consult Procedures for Transfer Credit, available in the economics department office.
5. Students may graduate with honors in mathematical economic analysis by achieving a B+ (3.33) average in the 16 courses required for the major. When students repeat courses or complete more than the minimally required number of courses, the departmental GPA will be based on the set of courses that (i) satisfies all requirements for the degree and (ii) results in the highest GPA for the student.
6. For additional course information, consult Economics Course Descriptions, compiled by the Rice chapter of the Omicron Delta Epsilon National Economics Honor Society.
7. Please note that it is primarily the responsibility of the student to satisfy all degree requirements, including the University Credit Requirements and University Distribution Requirements specified in the *General Announcements*. Students are advised that the relevant departmental requirements are those in effect on the day that the student declares mathematical economic analysis as his or her major. Consult with the appropriate departmental advisor, who must sign all registration forms for each major.

## CONCENTRATION IN BUSINESS ECONOMICS

Students who complete the requirements for a major in economics or a major in mathematical economics analysis also may request certification from the department that they have completed the requirements for a concentration in business economics if they complete the following courses with a minimum grade point average of at least 2.0:

1. ACCO 305 *Introduction to Accounting*
2. The following electives for the economics or mathematical economics analysis major:  
 ECON 348 *Organizational Design* or ECON 355 *Financial Markets and Institutions*  
 ECON 438 *Business, Law, and Economics*  
 ECON 445 *Managerial Economics*  
 ECON 448 *Corporate Finance*

3. Note that to complete their major requirements, economics majors will need to choose 1 additional elective beyond those chosen to satisfy requirement 2, and this could include either ECON 348 or ECON 355 if not taken already. Similarly, mathematical economic analysis majors can choose either ECON 348 and ECON 355, if not taken already, to fulfill the remaining requirements of their major. If students complete both ECON 348 and ECON 355, their grade point average for the concentration in business economics will include the course that results in the highest grade point average for the student.

**Substituting Economics Graduate Courses for Undergraduate Courses**—Undergraduate majors satisfying the course prerequisites may, subject to the approval of the instructor and of the departmental undergraduate committee chair, substitute certain graduate courses for undergraduate courses. Only highly motivated students with excellent aptitudes for economics and a strong background in mathematics should consider making such substitutions. Typically, but not necessarily, such students will be majors in mathematical economic analysis. Permitted substitutions are as follows:

- ECON 501 for ECON 370 (if student has completed ECON 211 at Rice)
- ECON 502 for ECON 375
- ECON 504 for ECON 382
- ECON 510 for ECON 400
- Furthermore, ECON 505 and ECON 508 also may be taken by undergraduates and may be used toward satisfying MTEC requirements. Specifically, ECON 505 could be used as 1 of the courses in the applied economics category or in the advanced analysis category, while ECON 508 could be used only in the advanced analysis category.

Note that this set of substitutable graduate courses includes 6 of the 7 courses required during the 1st year of the PhD program at Rice. Accordingly, such advanced course work would be excellent preparation for graduate study in economics or in some related field such as finance. Taking such graduate courses also should open more opportunities for the student who will be seeking employment immediately after graduation.

### THE 5-YEAR MA PROGRAM

Advanced undergraduate students can, subject to the approval of the departmental 5-year MA advisor, enter our 5-year MA program. In this program, a student who has taken advantage of the full menu of graduate course substitutions available could, with an additional year of study at Rice, earn an MA in economics.

To obtain the MA degree, students must satisfy all of the requirements for PhD candidacy. In particular, students must pass general examinations in microeconomic theory and in macroeconomic theory and econometrics, must pass an examination in a specialized field of study in economics, and must complete an original research project (a dissertation prospectus) that could be developed into a PhD dissertation under the supervision of a faculty member. This work could be an extension of a paper written as a senior independent research project (ECON 403/404). In some cases, at the discretion of the independent research advisor, the paper produced in ECON 403/404 may fulfill this requirement. Finally, the 1st-year graduate requirement to take ECON 507 Mathematical Economics would be waived with the approval of the departmental 5-year MA advisor.

Note that any student who subsequently decides to enter the economics PhD program at Rice would be given graduate credit for all 500-level economics

courses completed while an undergraduate. The completion of the PhD dissertation typically requires at least 1 additional year of research (but no additional courses) beyond the MA degree.

Students who opt for the 5-year MA degree program will have different backgrounds and interests on entering Rice and will choose to pursue this option at different stages in their academic careers. The following illustrates 2 (of many) possible paths to satisfying the MTEC major requirements, while at the same time completing all of the requirements for the MA degree over a 5-year period.

### COURSES: SAMPLE PATH ONE

The student enters with AP credit for ECON 211 and MATH 101/102 and has an early interest in the 5-year MA program.

#### *Freshman Year*

ECON 370, 375, 477, and MATH 211/212

#### *Sophomore Year*

ECON 501; 1 course from Applied Economics category; and MATH 355 or CAAM 310

#### *Junior Year*

ECON 502, 504, 505, 510, and 1 course from Applied Economics category

#### *Senior Year*

ECON 403/404 and ECON 508

#### *5th Year*

Complete all remaining graduate courses and pass all remaining examinations required to achieve PhD candidacy.

(Note that with AP credit for MATH 101/102, but not for ECON 211, the student could substitute ECON 370 for ECON 211 in the freshman year.)

### COURSES: SAMPLE PATH TWO

The student has no relevant AP credit and/or decides to enter the 5-year MA program only near the end of the sophomore year.

#### *Freshman Year*

ECON 211 and MATH 101/102

#### *Sophomore Year*

ECON 370, 375, 477, and 1 course from applied economics category; MATH 211/212

#### *Junior Year*

ECON 501, 502, 505, 508; MATH 355 or CAAM 310

#### *Senior Year*

ECON 504, 510, 403/404, and 1 course from applied economics category

#### *5th Year*

Complete all remaining graduate courses and pass all remaining examinations required to achieve PhD candidacy.

## DEGREE REQUIREMENTS FOR PHD IN ECONOMICS

**Preparation for PhD Program.** Applicants to the PhD program should have had at least 2 semesters in calculus and 1 in linear algebra. Students who have not met these requirements may complete these prerequisites as Class III students (pages 75–76) before being admitted to the graduate program. All applicants are required to take the Graduate Record Exam.

**Requirements.** For general university requirements, see Graduate Degrees (pages 57–58). Candidates for the PhD degree usually spend from 2 to 2 and 1-half years in full-time course work and at least 1 year writing the dissertation; 4 to 5 years is a reasonable goal for completing the program. For the PhD, students must:

- Complete an approved program of at least 14 courses, not including ECON 593/594 *Workshop in Economics I* and ECON 595/596 *Workshop in Economics II*

- Complete an approved program of at least 4 sections of ECON 593/594 *Workshop in Economics I* and ECON 595/596 *Workshop in Economics II*
- Perform satisfactorily on written general examinations in economic theory and econometrics
- Demonstrate proficiency in a major field by taking the relevant courses in that field and performing satisfactorily on a written examination
- Complete and defend orally a doctoral dissertation setting forth in publishable form the results of original research

**See ECON in the Courses of Instruction section.**