Economics (ECO)

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Degrees awarded: Ph.D. in Economics

The Ph.D. program in Economics, in the College of Arts and Sciences, emphasizes rigorous training in economic theory and quantitative methods and their creative application. Both theoretical and empirical work is heavily based on mathematical modeling. The goal is to develop the capability of each student to conduct independent research and analysis. To this end the program has three phases: (1) a general foundation in economic theory and quantitative methods, starting from the basic but done in a very mathematical way, (2) specialization in two or more fields of theoretical or applied economics, and (3) independent research culminating in the doctoral dissertation. These are not totally distinct phases but indicate the natural order of progression. Coursework is supplemented by independent study and research seminars. Throughout the program students have advisors to consult in developing a study plan that best meets their needs.

In addition to core courses, students choose elective courses from the variety of fields offered in theoretical and applied economics. It is through these courses that breadth of economic knowledge is gained.

The program of study does not depend on prior knowledge of economics, though that is useful. Because of its emphasis on mathematical modeling, the Ph.D. program is highly suitable for those whose undergraduate degrees are in engineering, mathematics, and physics. Those whose undergraduate degrees are in economics usually have to take a number of mathematics courses at a level not usually required for their undergraduate degree to be prepared for a Ph.D. program.

Admission

The Department of Economics normally admits students for the Ph.D. program. All students are eligible to receive the M.A. degree if they have met the degree requirements listed later in this section, but there is no separate M.A. program. Students are normally admitted to start in the fall semester only.

Minimum requirements to be consid-ered for admission, in addition to the minimum Graduate School requirements, are as follows, although exceeding these requirements increases the probability of admission:

A. A bachelor's degree, with an average of at least B in the undergraduate major subject, which need not be economics (applicants with majors in engineering, mathematics, or the physical sciences are encouraged);

B. At least one year of introductory differential and integral calculus and at least one semester of linear algebra in courses whose level is that required for physics majors in research universities, with proficiency demonstrated by a grade of at least B in the courses. Additional semesters of multivariate calculus are highly recommended, and further mathematics such as real analysis and topology are very helpful;

C. Letters of recommendation from three instructors or academic advisors. The referees should be sure to evaluate the mathematical preparation and ability of the applicant;

D. Submission of results of the Graduate Record Examination (GRE) General Test (verbal, quantitative, and analytical parts); applicants with quantitative scores below the 80th percentile are generally not admitted;

E. Foreign students only: submission of results of the TOEFL examination, with a minimum score of 550. In addition, a score of at least 40 in the TSE, which can be taken upon arrival. Scores below 550 require taking and passing language courses in addition to regular coursework;

F. Acceptance by the Department of Economics and by the Graduate School.

Students should be aware that admitted students generally exceed these requirements. However, students who do not meet or exceed all these requirements may apply if they think that their preparation as a whole shows they are capable of succeeding in the graduate program. Application for admission in the academic year starting in September should ordinarily be submitted before the preceding March 1. Applicants seeking financial aid are required to apply by January 15.

Faculty

Professors

Dubey, Pradeep, Ph.D., 1975, Cornell University: Game theory; mathematical economics.

Montgomery, Mark, Ph.D., 1982, University of Michigan: Economic demography; development economics; econometrics.

Muench, Thomas J., Ph.D., 1965, Purdue University: Mathematical economics; macroeconomics; econometrics; urban economics.

Rizzo, John (joint with the Department of Preventive Medicine), Ph.D., 1985, Brown University: Health economics; public health.

Sanderson, Warren C., *Chair*, Ph.D., 1974, Stanford University: Economic demography; economic history; labor economics.

Tauman, Yair, Ph.D., 1978, Hebrew University, Jerusalem: Industrial organization; game theory.

Zweig, Michael, Ph.D., 1967, University of Michigan: Political economy; labor economics.

Associate Professors

Beniteez-Silya, Hugo, Ph.D., 2000, Yale University: Labor economics, computational economics.

Brusco, Sandro, *Graduate Program Director*, Ph.D., 1993, Stanford University: Mechanism design; corporate finance; political economy.

Dawes, William, *Chair*, Ph.D., 1972, Purdue University: Econometrics; economic history.

Assistant Professors

Anagnostopoulos, Alexis, Ph.D., 2005, London Business School: Macroeconomics; computational economics.

Carceles-Poveda, Eva, Ph.D., 2001, Universidad Pompeu Fabra: Macroeconomics; financial economics; international economics.

Li, Shanjun, Ph.D., 2007, Duke University, Industrial organization, applied microeconomics, environmental economics.

Rendon, Silvio, Ph.D., 1997, New York University, Labor economics, dynamic modeling.

Tan, Wei, Ph.D. 2005, Johns Hopkins University: Industrial organization; applied econometrics; health economics.

Degree Requirements
Requirements for the M.A. Degree in Economics

In addition to the minimum Graduate School requirements, the Department has specific degree requirements. The M.A. degree requires a minimum of 30 resident graduate course credits in economics (500 level or above, not including ECO 698) with an average grade of B or higher. Evening or part-time programs are not available. Note: All these courses are Ph.D.-level courses.

Requirements for the Ph.D. Degree in Economics

The Ph.D. degree requirements are as follows:

A. Course Requirements

A minimum of 15 courses in economics (including core courses) must be completed, with a grade of B or better in each elective course. Included in the elective courses must be at least two in each of two approved pairs of courses forming fields (listed below). However, the Ph.D. committee may approve a waiver of part of the 15-course requirement for students with graduate work elsewhere.

1. Core Courses: Those courses that provide the foundation in economic theory (micro and macro) and quantitative analysis (econometrics, mathematical methods, and statistics) are referred to as core courses. Comprehensive examinations are taken in econometrics, macroeconomics, and microeconomics beginning at the end of the first year of study, and are to be completed by the beginning of the fourth semester. Comprehensive examinations are written but may be supplemented by oral examinations at the discretion of the examining committee.

2. Elective Courses and Fields of Specialization: In addition to core courses, normally at least six elective courses must be taken, including two pairs of courses, where each pair forms an approved field. It is usual but not necessary that a dissertation topic be chosen from one of these fields of specialization.

The two elective fields must be satisfactorily completed by the end of the sixth semester. One field may be completed on the basis of an average grade of B+ or higher in the courses in that field. At least one field must be completed by passing a written comprehensive exam.

Fields currently offered by the Department are composed of courses in applied econometrics, computational macroeconomics, computational methods, demographic economics, game theory, health economics, industrial organization, and labor economics.

B. Second-Year Paper, Seminars, and Workshops

Each student must write a successful research paper during the second year.

Each student takes a research workshop in the fifth semester. The purpose of this workshop is to provide a structured introduction to research methodology.

In addition, participation in program seminars and research workshops is considered an essential part of a student's progress toward the doctorate. Seminars in economic theory and applied economics are presented on a regular basis by faculty, graduate students, and visitors. Workshops oriented toward thesis research are conducted by faculty and students working in related areas.

C. Advancement to Candidacy

Advancement to candidacy for the Ph.D. is achieved by satisfactory completion of most course requirements specified in item A, above, and successful work on the second-year paper. Advancement to candidacy normally must be achieved by the end of the fourth semester.

D. Dissertation

A dissertation, presenting the results of original and significant research, must be approved. An examination on dissertation proposal research must be passed by the end of the sixth semester of study. The examination is both written and oral, and its syllabus is to be determined by the student's dissertation committee in consultation with the student. Final approval of the dissertation will be by a committee including the candidate's principal advisor, two other Department members, and one member from another department. The results of the dissertation will be presented at a colloquium convened for that purpose.

E. Teaching

The program is committed to achieving a high quality of teaching and encourages all graduate students to acquire teaching experience during their graduate studies. The Department operates a training program to prepare teaching assistants for classroom instruction.

F. Time Limit

If the degree requirements have not been met within five years of entry into the program, Departmental approval is required for continuation in the program.

G. Dismissal Policy

A student may be dismissed from the program at the end of any semester in which he or she does not achieve a semester or cumulative B average or fails to meet the pertinent requirements for the Ph.D. as specified.

Courses

ECO 500 Microeconomics I
The first semester of a one-year course in microeconomic theory. Deals with decision-making of economic agents in different choice environments using the analytical approach of duality theory. Topics include theory of the consumer, theory of the firm, decision-making under risk and uncertainty, intertemporal choice, aggregation, and capital theory.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Fall, 3 credits, ABCF grading

ECO 501 Microeconomics II
A continuation of ECO 500, focusing on theories of equilibrium and market structure. Topics include general competitive equilibrium, imperfect competition and game theory, imperfect information, theory of public goods, and social choice.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Spring, 3 credits, ABCF grading

ECO 510 Macroeconomics I
The first semester of a one-year course in macroeconomic theory. Deals with theories and determinants of income, employment, and inflation. Topics include static equilibrium models, theories of money demand and monetary phenomena, theories of the labor market and unemployment, rational expectations and stabilization policy, consumption, and investment.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Fall, 3 credits, ABCF grading

ECO 511 Macroeconomics II
A continuation of ECO 510, focusing on dynamic models. Topics include models of economic growth, optimal growth and efficiency, overlapping-generations models, rational expectations, and optimal policy.
Prerequisite: ECO 510, graduate standing in the Department of Economics or permission of the graduate director
Spring, 3 credits, ABCF grading

ECONOMICS

ECO 520 Mathematical Statistics

The first semester of a one-year course in quantitative methods. Statistical methods and their properties of particular usefulness to economists. Topics include probability theory, univariate and multivariate distributions, limiting distributions, point and interval estimation, hypothesis testing.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Fall, 3 credits, ABCF grading

ECO 521 Econometrics

A continuation of ECO 520. The application of mathematical and statistical methods of economic theory, including the concept of an explanatory economic model, multiple regression, hypothesis testing, simultaneous equations models, and estimating techniques.
Prerequisite: ECO 520; graduate standing in the Department of Economics or permission of the graduate director
Spring, 3 credits, ABCF grading

ECO 522 Applied Econometrics

A continuation of ECO 521. The application and extension of econometric techniques developed in ECO 521. Emphasis on the relationship among economic theory, econometric modeling and estimation, and empirical inference. Computer usage for calculation of estimators. Critical examination of econometric studies in current journals.
Prerequisite: ECO 521; graduate standing in the Department of Economics or permission of the graduate director
Fall, 3 credits, ABCF grading

ECO 590 Mathematical Foundations of Contemporary Economic Theory

A one-semester course dealing with mathematical concepts and techniques relevant to economic theory. Topics in set theory, topology, linear algebra, and optimization theory. Applications to economic theory developed as time permits.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Fall, 3 credits, ABCF grading

ECO 599 Research in Special Topics

Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Fall and spring, 1-12 credits, S/U grading
May be repeated for credit

ECO 604 Game Theory I

Elements of cooperative and noncooperative games. Matrix games, pure and mixed strategies, and equilibria. Solution concepts such as core, stable sets, and bargaining sets. Voting games, and the Shapley and Banzhaff power indices. This course is offered as both ECO 604 and AMS 552.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
0-3 credits, ABCF grading

ECO 605 Game Theory II

Refinements of strategic equilibrium, games with incomplete information, repeated games with and without complete information, and stochastic games. The Shapley value of games with many players, and NTU-values. This course is offered as both ECO 605 and AMS 555.
Prerequisite for AMS 555: AMS 552/ECO 604.
Prerequisites for ECO 605: ECO 604 and graduate standing in the Department of Economics or permission of the graduate director.
Spring, 0-3 credits, ABCF grading

ECO 606 Advanced Topics in Strategic Behavior in Economics

An analysis of varying topics in strategic behavior in economics. One or more of the following topics and others will be dealt with each week: repeated games with incomplete information; stochastic games; bounded rationality complexity and strategic entropy; values of non-atomic games; strategic aspects in the telecommunication industry; general equilibrium and financial markets; auction mechanisms; knowledge, common knowledge, and strategic equilibria.
Prerequisites: ECO 501, ECO 604, ECO 605, or permission of instructor, graduate standing in the Department of Economics or permission of the graduate director.
Spring, 1-3 credits, ABCF grading
May be repeated for credit

ECO 610 Advanced Macroeconomic Theory I

Topics in macroeconomic theory, including microfoundations of macroeconomics, temporary general equilibrium and disequilibrium, monetary theory, equilibrium theory of business cycles, implicit contracts, rational expectations, and econometric implications.
Prerequisites: ECO 501, ECO 511; graduate standing in the Department of Economics or permission of the graduate director
0-3 credits, ABCF grading

ECO 612 Computational Economics and Dynamic Modeling

An analysis of the theory and applications of the dynamic modeling literature using computational methods, and on the methods themselves. Dynamic Modeling and Computational Economics are possibly the fastest-growing areas of interest in the profession due to its suitability to model, solve, and also estimate realistic decision-making problems in most areas of economics.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Fall, 0-3 credits, ABCF grading

ECO 613 Computational Macroeconomics

A concentration on numerical methods commonly used to solve dynamic macroeconomic models. These include methods relying on dynamic programming techniques, linear approximation methods, and non-linear methods that can be applied to models with distortions and heterogeneous agents. The different methods will be explained and their application to macroeconomics will be illus-

trated with examples from various areas such as Real Business Cycles, Asset Pricing with Complete and Incomplete Markets, and Recursive Contracts.
Prerequisite: ECO 612; graduate standing in the Department of Economics or permission of the graduate director
Spring, 0-3 credits, ABCF grading

ECO 623 Data Analysis and Economic Applications

Survey of major sources of data in economics and theoretical hypotheses and statistical methods for organizing and analyzing such data. Statistical models for quantitative data as well as qualitative choices are presented. Computer usage is expected.
Prerequisite: ECO 521; graduate standing in the Department of Economics or permission of the graduate director
Spring, 0-3 credits, ABCF grading

ECO 629 Studies in Quantitative Methods

Prerequisites: ECO 521; graduate standing in the Department of Economics or permission of the graduate director
Fall, 0-3 credits, ABCF grading

ECO 636 Industrial Organization I

Applications of microeconomic theory to the determinants of market structure. Relationships between market structure, firm behavior, and allocational efficiency. Econometric estimation and testing of some hypotheses suggested by the theory.
Prerequisite: ECO 501, ECO 521; graduate standing in the Department of Economics or permission of the graduate director
Fall, 0-3 credits, ABCF grading

ECO 637 Industrial Organization II

This course is a continuation of ECO 636. It deals with the same questions and tools as ECO 636, and provides an introduction to antitrust policy and to public policy toward industry, including regulation and deregulation, the design of optimal regulation, and the effectiveness of current regulation.
Prerequisite: ECO 501, ECO 521; graduate standing in the Department of Economics or permission of the graduate director
Spring, 0-3 credits, ABCF grading

ECO 640 Labor Economics I

This is the first course in the graduate sequence in labor economic theory and empirical applications. Topics include human capital theory, labor supply, life cycle behaviors, and the behavioral effects of social insurance programs. The emphasis is on up-to-date treatments of these topics in the literature.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Fall, 3 credits, ABCF grading

ECO 641 Labor Economics II

This is an advanced course in labor economics which continues ECO 640. Topics include both theory and estimation of job search, matching, dynamic discrete and continuous choice models of the labor market. Special emphasis will be given to the role of economic

theory in specification and testing econometric models.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Spring, 3 credits, ABCF grading

ECO 642 Demographic Economics I
This course deals with the economics of the family. It utilizes recently developed techniques in economics and demography to deal with questions concerning marriage, divorce, fertility, contraception, the intrafamily distribution of resources, and the intergenerational distribution of resources. Students will do original theoretical and empirical research under the professor's supervision.
Prerequisite: ECO 510; graduate standing in the Department of Economics or permission of the graduate director
Spring, 0-3 credits, ABCF grading

ECO 643 Demographic Economics I
This course is a continuation of ECO 642. It deals with the same questions and tools as ECO 642, but emphasizes developing economies. The connections between population growth and development are stressed.
Prerequisites: ECO 501; graduate standing in the Department of Economics or permission of the graduate director
0-3 credits, ABCF grading

ECO 645 Health Economics I
Critical reviews of research in health economics topics of current interest, such as empirical and conceptual models of physician behavior, competition in the pharmaceutical industry, the economic impacts of managed care, and the causes and consequences of unhealthy behaviors. Students will present and critique original research and produce a research paper on a topic of their interest.
Prerequisites: ECO 501, ECO 521; graduate standing in the Department of Economics or permission of the graduate director
0-3 credits, ABCF grading

ECO 646 Health Economics II
Theoretical and econometric analysis of selected aspects of the health-care delivery system, such as the demand for medical services, the supply and distribution of physician services, the utilization of non-physician medical personnel, alternative models of hospital behavior, third-party insurance reimbursement, national health insurance and cost, and price inflation in the hospital and long-term care sectors. Co-scheduled as ECO 646 or HPH 664.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Spring, 0-3 credits, ABCF grading

ECO 647 Research Methods in Applied Microeconomics
Presentation, discussion, and analysis of student and faculty research in the areas of applied microeconomics, labor economics, health economics, and industrial organization, as well as applied econometrics. The purpose of the course is to provide skills and feedback to students at various levels in the program

that assist them toward the completion of their second-year paper, dissertation proposals and thesis. It is a course in research and presentation methods that provides an effective mechanism for learning about current areas of research interest.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Fall or spring, 0-3 credits, ABCF grading

ECO 690 Seminar in Applied Economics
Preparation, presentation, and discussion of student and faculty research in applied economics. Topics covered by student papers are usually related to students' long-term research interests.
Fall or spring, 1-6 credits, S/U grading

ECO 695 Research Workshop
Designed to direct students to the selection of dissertation topics. Oral and written presentation of student papers with active faculty participation. Several sections may be offered each semester in areas of broad research interest.
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate program director and three semesters of coursework in the Ph.D. program
Fall, 0-6 credits, S/U grading
May be repeated for credit

ECO 698 Practicum in Teaching
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
Spring, 1-6 credits, S/U grading
May be repeated for credit

ECO 699 Dissertation Research On Campus
Prerequisite: Have declared thesis advisor in Economics Ph.D. program (G5); major portion of research must take place on SB campus, at Cold Spring Harbor, or at Brookhaven National Lab
Fall, spring, and summer, 1-9 credits, S/U grading
May be repeated for credit

ECO 700 Dissertation Research Off Campus–Domestic
Prerequisite: Must be advanced to candidacy (G5); major portion of research will take place off-campus, but in the U.S. and/or U.S. provinces (Brookhaven National Lab and Cold Spring Harbor Lab are considered on campus); all international students must enroll in one of the graduate student insurance plans and should be advised by an International Advisor
Fall, spring, and summer, 1-9 credits, S/U grading
May be repeated for credit

ECO 701 Dissertation Research Off Campus–International
Prerequisite: Must be advanced to candidacy (G5); major portion of research will take place outside the U.S. and/or U.S. provinces; domestic students have the option of the health plan and may also enroll in MEDEX;

international students who are in their home country are not covered by mandatory health plan and must contact the Insurance Office for the insurance charge to be removed; international students who are not in their home country are charged for the mandatory health insurance (if they are to be covered by another insurance plan, they must file a waiver by the second week of classes; the charge will only be removed if the other plan is deemed comparable); all international students must receive clearance from an International Advisor
Fall, spring, and summer, 1-9 credits, S/U grading
May be repeated for credit

ECO 800 Summer Research
Prerequisite: Graduate standing in the Department of Economics or permission of the graduate director
0 credit, S/U grading
May be repeated