ECONOMICS

**Director of undergraduate studies:** Ebonya Washington, ebonya.washington@yale.edu, (ebonya.washington@yale.edu) Rm. 36, 37 Hillhouse Ave., 432-9901; registrar: Qazi Azam, qazi.azam@yale.edu, Room 101A, 28 Hillhouse Ave., 432-3574; economics.yale.edu/undergraduate-program

Economics is much broader than the study of recessions and inflation or stocks and bonds. Economists study decision making and incentives and how taxes create incentives for labor market and savings behavior. Many current public policy debates concern questions of economics, including causes and consequences of inequality and gender and racial wage gaps; how to address poverty; the impact of immigration and trade on the well-being of a country’s citizens; the cause of the Great Recession and how to predict future downturns.

Those with economics training find employment in government agencies, non-profits, and of course economic consulting and investment banking. In addition to pursuing advanced degrees in economics, economics majors go on to do graduate work in law and business.

**INTRODUCTORY COURSES**

Introductory courses serve students considering a major in Economics as well as others who seek an introduction to the subject. Most students enroll in ECON 115 and 116, lecture courses with accompanying discussion sections. ECON 115 is concerned with microeconomics and includes such topics as markets, prices, production, distribution, and the allocation of resources. ECON 116 covers such macroeconomic issues as unemployment, inflation, growth, and international economics; it has a microeconomics prerequisite.

First-year students and sophomores looking for smaller, slightly more discussion-oriented versions of introductory microeconomics and macroeconomics may enter a lottery for admission to ECON 110 and 111. Those with little or no experience in calculus may be better served by ECON 108, which covers microeconomics with greater discussion of quantitative methods and examples. ECON 108, 110, and 115 are similar in substance; ECON 111 and 116 are similar in substance as well. A student may receive credit for only one course each in introductory microeconomics and introductory macroeconomics.

The department recommends that students interested in majoring in Economics take introductory economics in the first year. In order to make the introductory courses available to all first-year students and to students majoring in other subjects, the introductory courses do not have a mathematics requirement.

**PLACEMENT AND EXEMPTIONS FOR INTRODUCTORY COURSES**

In the summer before they enter, all first-year students receive, through the university’s electronic bulletin board, a personalized recommendation for a first course in economics, based on application data and AP (and equivalent) exam scores.

The department recommends that students with little or no calculus enroll in ECON 108. Those with a stronger background should enroll in ECON 110 (if successful in the lottery) or ECON 115. In general, students who receive a score of 5 on the Microeconomics or Macroeconomics AP exam and a score of 5 on the AP Calculus BC exam are allowed to place out of the corresponding introductory course and instead enroll in intermediate-level courses (ECON 121 or ECON 125 for microeconomics, ECON 122 or ECON 126 for macroeconomics). Students who have the requisite AP Economics score but not the corresponding AP Calculus score may take calculus (e.g., MATH 115, MATH 118, or MATH 120) and then place out of the corresponding introductory economics course. Students may substitute a score of 7 on the International Baccalaureate higher-level Economics examination or A on the GCE A-level Economics examination for AP test scores of 5 in economics. In addition, a score of 7 on the International Baccalaureate higher-level Mathematics examination or A on the GCE A-level Mathematics examination may be substituted for a qualifying AP Calculus score.

**REQUIREMENTS OF THE MAJOR**

Students majoring in Economics are required to take twelve term courses. Two of these may be introductory courses, one in microeconomics and one in macroeconomics. All majors must take the following courses: one term of intermediate microeconomics (ECON 121 or 125); one term of intermediate macroeconomics (ECON 122 or 126); one term of econometrics (ECON 131, 132, or 136); and one Yale mathematics course, usually selected from MATH 112, 115, 118, or 120. All of the aforementioned required courses should be completed prior to the senior year. Majors must also take two courses numbered ECON 400–491, at least one of which must be taken in the senior year.

Subject to approval by the director of undergraduate studies, students may count toward the major one course related to economics but taught in another field, in addition to the required course in mathematics.

**Mathematics** Students are advised to meet the mathematics requirement for the major during their first year. To fulfill the requirement, the department recommends that majors take MATH 118 or MATH 120. Students who place out of these mathematics courses must take a higher-level mathematics course at Yale and should consult the director of undergraduate studies for help choosing a course. Students who intend to pursue a graduate degree in economics should take additional math courses, including linear algebra (MATH 222 or MATH 225) and real analysis (MATH 300 or MATH 301).

**Econometrics** Students are strongly advised to take a two-term sequence of statistics and econometrics courses, especially if they are considering writing a senior essay or are interested in research experience on or off campus. The statistical analysis of economic data has become central to the work of economists and the ability to analyze large data sets is a skill that will serve students in the job market both...
inside and outside of academia. One option is to take ECON 131 followed by 132. Students with a stronger mathematics background or who plan to pursue a graduate degree in economics are encouraged to take either ECON 135 or S&DS 241 and S&DS 242, followed by ECON 136. Prospective majors are urged to start their econometrics sequence in the fall of sophomore year.

**Intermediate microeconomics and macroeconomics** Along with econometrics, intermediate microeconomics and macroeconomics form the core of the major. Two options are available in both microeconomics and macroeconomics. The standard intermediate courses are ECON 121 and 122. Students with a stronger mathematics background are encouraged to take ECON 125 and 126 instead. The intermediate courses need not be taken in sequence: in particular, ECON 125 is not required for 126.

**Field courses** The department offers a wide selection of upper-level courses that explore in greater detail material presented in introductory courses. Advanced fields of economics include theoretical, quantitative, and mathematical economics; market organization; human resources; finance; international and development economics; public policy and the public sector; and economic history. Some field courses have only introductory microeconomics as a prerequisite. Others apply intermediate-level theory or econometrics to economic problems and institutions, and for this reason list one or more of the theory or econometrics courses as prerequisites.

**Advanced lecture courses** Advanced lecture courses, generally numbered ECON 400–449, are limited-enrollment courses that cover relatively advanced material in more depth than regular field courses. Prerequisites usually include two of intermediate microeconomics, intermediate macroeconomics, and econometrics or a mathematics course such as MATH 120. Advanced lecture courses may be applied toward the senior requirement. While these courses vary in approach, they share features of other Economics courses: like field courses, they devote some time to traditional lecturing, and like seminars, they emphasize class interaction, the writing of papers, and the reading of journal articles.

**Seminars** Although there is diversity in approaches in the various seminars (courses generally numbered ECON 450–489), all have in common an emphasis on class interaction, the writing of papers, and the reading of journal articles. Seminars represent an opportunity for students to apply and extend the economics they have learned through their earlier course work. Seminars may be applied toward the senior requirement.

Enrollment in seminars and advanced lecture courses is limited. Senior Economics majors who have not yet completed the senior requirement for the major are given priority for these courses and may preregister; see the departmental website for instructions. Students must take two of three core courses in intermediate microeconomics, intermediate macroeconomics, and econometrics before enrolling in a seminar. Underclassmen in the major and nonmajors may also enroll in Economics seminars and advanced lecture courses as space permits, but they may not preregister.

**Distinction in the Major** To be considered for Distinction, students must meet the appropriate grade standards as described in this bulletin under Honors and submit a senior essay to the Economics department. Students who fail to submit an essay will not be considered for Distinction. Grade computation for Distinction does not include the introductory economics courses, the required mathematics course, or courses taken outside Yale.

**Credit/D/Fail** Courses taken Credit/D/Fail and residential college seminars may not be counted toward the requirements of the major.

**SENIOR REQUIREMENT**

Majors are required to take two departmental courses numbered ECON 400–491, at least one of which must be taken in the senior year. The senior requirement must be met by taking Yale Economics courses.

**Senior essay** Only those majors who submit a senior essay earning a grade of A or A- are eligible for Distinction in the Major. There are four types of senior essays: (1) students may write a one-term essay in the fall of the senior year as an independent project on a topic of their own design under the close and regular supervision of a faculty adviser (ECON 491); (2) students may write a two-term essay starting in the fall and continued into the spring of the senior year as an independent project on a topic of their own design under the close and regular supervision of a faculty adviser (ECON 491 and ECON 492); (3) students may write a one-term essay in an advanced departmental course (numbered 400–489) taken during the fall term of the senior year; or (4) students may write a two-term essay beginning in an advanced departmental course (numbered 400–489) taken during the fall term and completed in the spring of the senior year as an independent project under the close and regular supervision of a faculty adviser (ECON 492). Under this final option the instructor of the advanced departmental course taken in the fall term typically serves as the faculty adviser.

Note that the essay must be written during the senior year and that students may submit a senior essay only if they have an approved prospectus and a senior essay adviser. Senior essays that are not submitted on time will receive a grade of Incomplete. Senior essays with grades of Incomplete without permission of the residential college dean are subject to grade penalties when submitted.

Meetings for seniors to discuss the senior essay guidelines and requirements will be held on Tuesday, August 29, 2017 at 10 a.m. and Wednesday, August 30, 2017 at 4:00 p.m. in Room 106, 28 Hillhouse Avenue. Senior essay prospectus forms are due Monday, October 2, 2017.

**ADVISING**

The Economics department has faculty representatives/advisers for each residential college, typically fellows of that college. Students majoring in Economics should consult with and secure written approval of their course selection from one of their college representatives.
Questions concerning the major or programs of study should also be directed to the college representative. College representatives can be found on the department website.

**Transfer Credits** Students who take a term abroad or take summer courses outside of Yale may petition the DUS to count at most two courses from outside Yale toward the requirements of the major. Students who take a year abroad may petition to count at most three courses. Many economics courses taken outside Yale do not meet the requirements of the Economics major; students should consult with the DUS before taking such courses. Courses taken outside Yale may not be counted toward the major requirements in intermediate microeconomics, intermediate macroeconomics, or econometrics. See the departmental website section on transferring credits.

**Graduate courses** Well-qualified students who have acquired the requisite background in undergraduate courses may, with written permission of the instructor, the DUS, and the director of graduate studies, be admitted to graduate courses and seminars. Descriptions of courses are available on the department website.

Students who are planning graduate work in economics should take additional mathematics courses beyond the one-term course required for the major. Many graduate programs in economics require courses in multivariate calculus, linear algebra and real analysis. Please see the department website on PhD program preparation. Students are urged to discuss their plans for graduate work with the DUS as early in their college careers as possible.

**REQUIREMENTS OF THE MAJOR**

**Prerequisites** None

**Number of courses** 12 term courses (incl senior req)

**Specific courses required** ECON 121 or 125; ECON 122 or 126; ECON 131, 132, or 136

**Distribution of courses** 2 introductory classes (or equivalents with DUS permission); 3 core courses (intermediate micro, intermediate macro and econometrics); 2 courses numbered 400-491; 1 math course, as specified

**Substitution permitted** 1 related course in another dept, with DUS approval

**Senior requirement** 2 courses numbered ECON 400-491, at least 1 in senior year

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**FACULTY OF THE DEPARTMENT OF ECONOMICS**


**Associate Professors** Costas Arkolakis, Eduardo Faingold, Amanda Kowalski

**Assistant Professors** Timothy Armstrong, Jose-Antonio Espin-Sanchez, Mira Frick, Zhen Huo, Mitsuru Igami, Ryota Iijima, Daniel Keniston, Ilse Lindenlaub, Yusuke Narita, Michael Peters, Nicholas Ryan, Joseph Shapiro

**Senior Lecturers** Evangelia Chalioti, Tolga Koker, Maria Saez Marti

**Lecturers** Michael Boozer, William Hawkins, Katerina Simons

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**Introductory Courses**

* ECON 108a or b, *Quantitative Foundations of Microeconomics*  Tolga Koker
  Introductory microeconomics with a special emphasis on quantitative methods and examples. Intended for students with limited or no experience with calculus. Enrollment limited. Online preregistration is required; visit economics.yale.edu/undergraduate-program for more information. May not be taken after ECON 110 or 115. QR, SO

* ECON 110a or b, *An Introduction to Microeconomic Analysis*  Staff
  Similar to ECON 115, but taught as a lecture discussion with limited enrollment. Enrollment limited to first-years and sophomores. Online preregistration is required; visit economics.yale.edu/undergraduate-program for more information. May not be taken after ECON 108 or 115. QR, SO

* ECON 111a or b, *An Introduction to Macroeconomic Analysis*  Staff
  Similar to ECON 116, but taught as a lecture discussion with limited enrollment. Enrollment limited to first-years and sophomores. Online preregistration is required; visit economics.yale.edu/undergraduate-program for more information. May not be taken after ECON 116. Prerequisite: ECON 108, 110, or 115. SO

ECON 115a or b, *Introductory Microeconomics*  Staff
  An introduction to the basic tools of microeconomics to provide a rigorous framework for understanding how individuals, firms, markets, and governments allocate scarce resources. The design and evaluation of public policy. May not be taken after ECON 108 or 110. QR, SO
ECON 116a or b, Introductory Macroeconomics  Staff
An introduction that stresses how the macroeconomy works, including the determination of output, unemployment, inflation, interest rates, and exchange rates. Economic theory is applied to current events. May not be taken after ECON 111. Prerequisite: ECON 108, 110, or 115.  SO

Intermediate Courses

ECON 121a or b, Intermediate Microeconomics  Staff
The theory of resource allocation and its applications. Topics include the theory of choice, consumer and firm behavior, production, price determination in different market structures, welfare, and market failure. After introductory microeconomics and completion of the mathematics requirement for the major or its equivalent. Elementary techniques from multivariate calculus are introduced and applied, but prior knowledge is not assumed. May not be taken after ECON 125.  QR, SO

ECON 122a or b, Intermediate Macroeconomics  Staff
Contemporary theories of employment, finance, money, business fluctuations, and economic growth. Their implications for monetary and fiscal policy. Emphasis on empirical studies, financial and monetary crises, and recent policies and problems. Enrollment limited in the fall term. After two terms of introductory economics and completion of the mathematics requirement for the major or its equivalent. May not be taken after ECON 126.  QR, SO

ECON 125a, Microeconomic Theory  Eduardo Faingold
Similar to ECON 121 but with a more intensive treatment of consumer and producer theory, and covering additional topics including choice under uncertainty, game theory, contracting under hidden actions or hidden information, externalities and public goods, and general equilibrium theory. Recommended for students considering graduate study in economics. After introductory economics, and MATH 118 or 120 or equivalent. May not be taken after ECON 121.  QR, SO

* ECON 126b, Macroeconomic Theory  Staff
Similar to ECON 122 but with a more intensive treatment of the mathematical foundations of macroeconomic modeling, and with rigorous study of additional topics. Recommended for students considering graduate study in economics. After two terms of introductory economics, and MATH 118 or 120 or equivalent. May not be taken after ECON 122.  QR, SO

Econometrics and Statistics Courses

ECON 131a or b, Econometrics and Data Analysis I  Staff
Basic probability theory and statistics, distribution theory, estimation and inference, bivariate regression, introduction to multivariate regression, introduction to statistical computing. After introductory microeconomics and MATH 112 or equivalent.  QR, SO

ECON 132a or b, Econometrics and Data Analysis II  Staff
Continuation of ECON 131, with a focus on multivariate regression. Topics include statistical inference, choice of functional form, heteroskedasticity, serial correlation, two-stage least squares, qualitative choice models, time series models, and forecasting. Emphasis on statistical computing and the mechanics of how to conduct and present empirical research. After two terms of introductory economics, completion of the mathematics requirement for the major, and ECON 131 or 135 or a course in the STAT 101–106 series.  QR, SO

ECON 135a, Introduction to Probability and Statistics  Donald Andrews
Foundations of mathematical statistics: probability theory, distribution theory, parameter estimation, hypothesis testing, regression, and computer programming. Recommended for students considering graduate study in economics. After introductory microeconomics and either (1) MATH 118; or (2) MATH 120 and either MATH 222 or MATH 225.  QR, SO

ECON 136b, Econometrics  Yuichi Kitamura
Continuation of ECON 135 with a focus on econometric theory and practice: problems that arise from the specification, estimation, and interpretation of models of economic behavior. Topics include classical regression and simultaneous equations models; panel data; and limited dependent variables. Recommended for students considering graduate study in economics. After ECON 135 or STAT 241 and 242.  QR, SO

Field Courses

ECON 159a, Game Theory  Maria Saez Marti and Marina Halac
An introduction to game theory and strategic thinking. Ideas such as dominance, backward induction, Nash equilibrium, evolutionary stability, commitment, credibility, asymmetric information, adverse selection, and signaling are applied to games played in class and to examples drawn from economics, politics, the movies, and elsewhere. After introductory microeconomics. No prior knowledge of game theory assumed.  QR, SO

ECON 170a, Health Economics and Public Policy  Howard Forman
Application of economic principles to the study of the U.S. health care system. Emphasis on basic principles about the structure of the U.S. system, current problems, proposed solutions, and the context of health policy making and politics. After introductory microeconomics.  SO
ECON 171b / AFAM 469b / EDST 271b, Urban Inequalities and Educational Inequality  
Gerald Jaynes
Analysis of contemporary policy problems related to academic under performance in lower income urban schools and the concomitant achievement gaps among various racial and ethnic groups in United States K-12 education. Historical review of opportunity inequalities and policy solutions proposed to ameliorate differences in achievement and job readiness. Students benefit from practical experience and interdisciplinary methods, including a lab component with time spent in a New Haven high school. Prerequisites: Any course offered by Education Studies, or one course in history or any social science, either: Anthropology, Economics, Political Science, Psychology, Sociology. EDST 110 is preferred, although not required.  

ECON 182b / HIST 135b, American Economic History  
Staff
The growth of the American economy since 1790, both as a unique historical record and as an illustration of factors in the process of economic development. The American experience viewed in the context of its European background and patterns of industrialization overseas. After introductory microeconomics.  

WR, SO

ECON 184b / GLBL 234b, International Economics  
Peter Schott
Introduction to conceptual tools useful for understanding the strategic choices made by countries, firms, and unions in a globalized world. After two terms of introductory economics.  

SO

ECON 210b / EDST 201b, Economics of Education  
Joseph Altonji
Application of basic economic concepts and empirical methods to the analysis of education. Topics include the economic return to secondary and postsecondary education, the quality of elementary and secondary education, the market for teachers, inequality in education attainment, and school choice. Prerequisites: ECON 108, 110, or 115. A prior course in statistics or econometrics is helpful but not required.  

SO

ECON 211b / GLBL 211b / SAST 278b, Economic Performance and Challenges in India  
Rakesh Mohan
India’s transition from being one of the poorest countries in the world to having one of the fastest-growing economies. Economic reform processes, trade and policy implications, and changes within the agriculture, industry, and service sectors. Prerequisites: introductory microeconomics and macroeconomics.  

SO

ECON 215b, Financial Theory  
John Geanakoplos
Study of the financial system as part of the global economy, rather than only the financial world. Topics include bond pricing, the capital asset pricing model, option pricing, the social security system, the mortgage market, hedge funds, collateral, default, and financial crises. Prerequisite: After introductory microeconomics.  

QJR, SO

ECON 252b, Financial Markets  
Robert Shiller
An overview of the ideas, methods, and institutions that permit human society to manage risks and foster enterprise. Description of practices today and analysis of prospects for the future. Introduction to risk management and behavioral finance principles to understand the functioning of securities, insurance, and banking industries. After two terms of introductory economics.  

SO

ECON 255a, Introduction to Corporate Finance  
Michael Pascutti
Introduction to the concepts and techniques necessary to analyze and implement optimal investment decisions. Prerequisite: introductory microeconomics and introductory macroeconomics.  

SO

ECON 262b / ECON 726, Advanced Development Economics  
Daniel Keniston
Comprehensive overview of the most influential theories of development microeconomics and consideration from contemporary empirical research on the validity of these theories. Prerequisites: After ECON 121 or ECON 125; ECON 325, ECON 327, or GLBL 225; ECON 131 or 136 or equivalent; MATH 118, 120, or equivalent.  

SO

ECON 330b / EVST 340b, Economics of Natural Resources  
Robert Mendelsohn
Microeconomic theory brought to bear on current issues in natural resource policy. Topics include regulation of pollution, hazardous waste management, depletion of the world’s forests and fisheries, wilderness and wildlife preservation, and energy planning. After introductory microeconomics.  

QJR, SO

ECON 338a / EAST 338a / GLBL 318a, The Next China  
Stephen Roach
Economic development in China since the late 1970s. Emphasis on factors pushing China toward a transition from its modern export- and investment-led development model to a pro-consumption model. The possibility of a resulting identity crisis, underscored by China’s need to embrace political reform and by the West’s long-standing misperceptions of China. Prerequisite: introductory macroeconomics.  

SO

ECON 339b, Advance Competition Economics and Policy  
Fiona Scott Morton
Limits that antitrust laws, as applied and interpreted by agencies, courts, and competitors, place on firm behavior. Economic theories underlying antitrust enforcement. Whether legal rules restricting competitive behavior increase social welfare and how they affect managerial choices. The evidence and reasoning advanced in key antitrust cases; how outcomes may affect social welfare and firm strategies. Goals and procedures of US and EU antitrust agencies.  

SO

ECON 350a, Mathematical Economics: General Equilibrium Theory  
Truman Bewley
An introduction to general equilibrium theory and its extension to equilibria involving uncertainty and time. Discussion of the economic role of insurance and of intertemporal models, namely, the overlapping generations model and the optimal growth theory.
model. Recommended for students considering graduate study in economics. After MATH 118 or 120, and intermediate microeconomics. Q8, SO

ECON 351b, Mathematical Economics: Game Theory  Johannes Horner
Introduction to game theory and choice under uncertainty. Analysis of the role of information and uncertainty for individual choice behavior, as well as application to the decision theory under uncertainty. Analysis of strategic interaction among economic agents, leading to the theory of auctions and mechanism design. Recommended for students considering graduate study in economics. After MATH 118, 120, and intermediate microeconomics. Q8, SO

* ECON 360b, Capital Markets  Gary Gorton
Topics related to capital markets, with emphasis on the financial crisis of 2007–2008. The design, pricing, and trading of corporate bonds, credit derivatives, and money market instruments; bond restructuring, bond ratings, and financial crises; basic tools used to address such issues, including fixed income mathematics, binomial option pricing, and swaps. Prerequisites: intermediate microeconomics and econometrics.
Note: Econ 360a “Capital Markets” is cross-listed with SOM MGT 947a and has space for up to five undergraduates.

ECON 361a or b, Corporate Finance  Staff
Financial management from inside the corporation or operating entity. Topics include capital budgeting and valuation, optimal capital structure, initial public offerings, mergers, and corporate restructuring. Cases and problem sets provide applications. Prerequisites: intermediate microeconomics and econometrics.

* ECON 363a, Global Financial Crisis  Andrew Metrick
Comprehensive survey of the causes, events, policy responses, and aftermath of the recent global financial crisis. Study of the dynamics of financial crises in a modern economy. Prerequisite: Successful completion of a course in introductory economics.

ECON 375a / GLBL 219, Monetary Policy  William English
Introduction to modern macroeconomic models and how to use the models to examine some of the key issues that have faced monetary policymakers during and after the global financial crisis of 2008–2009. Prerequisites: Intermediate level macroeconomics (ECON 122 or 126) and introductory econometrics (ECON 131 or 135). WR, SO

Advanced Lecture Courses

Senior Economics majors may preregister for advanced lecture courses; see the departmental website for instructions. Other interested students may enroll with permission of the instructor during the course selection period.

* ECON 403b / GLBL 332b, Trade and Development  Staff
Comparison of selected developing countries, where international trade has brought about rapid growth and large-scale reductions in poverty, with other countries, where global trade has increased inequality and brought little growth. Both theoretical models and empirical evidence are used. Prerequisites: intermediate microeconomics and an econometrics or statistics course.

* ECON 407a / GLBL 310a, International Finance  Zhen Huo
A study of how consumers and firms are affected by the globalization of the world economy. Topics include trade costs, the current account, exchange rate pass-through, international macroeconomic co-movement, multinational production, and gains from globalization. Prerequisite: intermediate macroeconomics or equivalent. SO

* ECON 408b / GLBL 238b, International Trade Policy  Giovanni Maggi
Analysis of issues concerning international trade policy and agreements, including recent academic research. Welfare analysis of trade policy; the political economy of trade policy; international trade agreements. Attention to both theoretical methods and empirical research. Prerequisites: intermediate microeconomics and ECON 184. SO

ECON 409a, Firms, Markets, and Competition  Evangelia Chalioti
Analysis of imperfectly competitive markets, focusing on the interactions among firm behavior, market structure, and market outcomes. Topics include oligopoly, collusion, predation, firm entry, advertising, and price discrimination as well as public policy implications of market behavior. After intermediate microeconomics or equivalent. Q8, SO

* ECON 411b, Economics of Uncertainty and Information  Eduardo Faingold
Individual and collective choice in the presence of uncertainty and asymmetric information. Implications of such decision making for economic phenomena. Basic analytical tools for studying decisions under uncertainty. Asset markets, adverse selection, screening, signaling, moral hazard, incomplete contracts, bilateral trade with asymmetric information, and mechanism design. Prerequisites: intermediate microeconomics and econometrics. SO

* ECON 413a / AMTH 437a / EENG 437a / S&DS 430a, Optimization Techniques  Sekhar Tatikonda
Fundamental theory and algorithms of optimization, emphasizing convex optimization. The geometry of convex sets, basic convex analysis, the principle of optimality, duality. Numerical algorithms: steepest descent, Newton's method, interior point methods, dynamic programming, unimodal search. Applications from engineering and the sciences. Prerequisites: MATH 120 and 222, or equivalents. May not be taken after AMTH 237. QR
**ECON 414a, Economic Models of New Technology**  Evangelia Chalioti
Analysis of firms’ incentives to innovate, focusing on the effects of market power on the intensity of innovative activity. Topics include strategic investment in innovation, patent races, the diffusion of knowledge, intellectual property (IP) protection systems, IP licensing, research joint ventures, litigation, venture capital, and conflicts between IP rights and antitrust regulation. Prerequisites: intermediate microeconomics and econometrics.  SO

**ECON 417b, Computational Methods in Economics**  Anthony Smith
Introduction to the basic tools of numerical analysis and how to apply them to the study of economic models in a variety of subdisciplines, including macroeconomics, labor economics, industrial organization, public finance, and environmental economics. Prerequisite: intermediate microeconomics, intermediate macroeconomics, and econometrics.  SO

**ECON 420a, Applied Microeconometrics**  Timothy Armstrong
Advanced study of econometric theory and applied econometrics, providing students opportunity and ability to conduct high-level empirical research, combining economics, econometrics, and data. Recommended for students planning to write or currently writing an empirical senior essay. Econ121 (Intermediate Micro), and either Econ 132 (Econometrics and Data Analysis II) or Econ 136 (Econometrics).  SO

* ECON 421a / CPSC 412a, Designing the Digital Economy  Eric Weyl
Digitization is transforming a variety of markets from personal transportation services to advertising. This course explores the economic tools (market design, price theory, causal inference, etc.) and technical tools from computer science (machine learning, the analysis of algorithms, user interface design, etc.) students need to contribute meaningfully to this transformation. Prerequisites: elementary training in both economics and computer science and some intermediate/advanced training in at least one relevant field.  SO

* ECON 422a, Neuroeconomics for Economists  Ifat Levy
Study of neuroscience, neuroimaging, and the tools and training needed by economics students to join neuroscientists and psychologists in the emerging field of neuroeconomics. Critical reading of neuroeconomics papers, translating economics models into neuroeconomics paradigms, and use of neuroscientific data in economics research. Prerequisite: intermediate microeconomics and econometrics.  SO

**ECON 424b / GLBL 308, Central Banking**  William English
Introduction to the different roles and responsibilities of modern central banks, including the operation of payments systems, monetary policy, supervision and regulation, and financial stability. Discussion of different ways to structure central banks to best manage their responsibilities. Prerequisites: Intermediate Microeconomics, Intermediate Macroeconomics, and Introductory Econometrics.  SO

**ECON 433b, Economics of Space**  Konstantinos Arkolakis
Analyzation of how space affects economic behavior. Development of the required tools and the quantitative techniques to understand how space shapes economic activity and leads to regional disparities in income and population. Prerequisites: intermediate microeconomics and econometrics.  SO

**Seminars**
Senior Economics majors may preregister for departmental seminars; see the departmental website for instructions. Other interested students may enroll with permission of the instructor during the course selection period.

* ECON 441a, Economics of Information, Learning, and Communication  Mira Frick
A theoretical introduction to economic models of social learning and strategic information transmission, using tools from game theory and probability theory. The irrationality of individual behavior as affected by pathologies such as herding, informational cascades, or strategic delays; the effectiveness of communication in settings in which an informed agent communicates information to a less informed agent. Prerequisites: intermediate microeconomics, a course in probability theory, and completion of the mathematics requirement for the Economics major.  SO

* ECON 442b, Microfoundations of Growth in China  Xiaoxue Zhao
A comprehensive overview of the challenges China faces as it transitions from a centrally planned economy to adopting a greater reliance on market-based mechanisms. Review of microeconomic literature on China’s recent economic and institutional transformation to provide a general analytical framework for understanding the economic implications of the process. Prerequisites: intermediate microeconomics and econometrics.  SO

* ECON 444b, Market Inefficiencies and the Limits of Arbitrage  Michael Pascutti
The role of hedge funds in the United States financial markets and hedge fund behavior; understanding what hedge funds do, why they exist, and how they are different from other investment vehicles. Study of investment strategies that provide opportunity and risk for investors and study of academic papers analyzing (risky) arbitrage strategies. Prerequisite: intermediate microeconomics and econometrics.  SO

* ECON 450a, Investment Analysis  Dean Takahashi
Examination of investment management in theory and practice. Discussion of asset allocation, investment strategy, and manager selection from the perspective of an institutional investor. Focus on the degree of market efficiency and opportunity for generating attractive returns.  SO
* ECON 454a / EP&E 254a / GLBL 331a, Evolution of Central Banking  Rakesh Mohan
Changes in the contours of policy making by central banks since the turn of the twentieth century. Theoretical and policy perspectives as well as empirical debates in central banking. The recurrence of financial crises in market economies. Monetary policies that led to economic stability in the period prior to the collapse of 2007–2008. Changes in Monetary Policies since the Great Financial Crisis. Prerequisite: ECON 122. SO

* ECON 456b, Private Equity Investing  Michael Schmertzler
A case-oriented study of principal issues and investment types found in substantial private equity portfolios. Discussion of enterprise valuation, value creation, business economics, negotiation, and legal structure, based on primary source materials and original cases. Prerequisites: intermediate microeconomics and econometrics. SO

* ECON 457b / EP&E 221b, Economics, Politics, and History: Institutional Design and Institutional Change  Jose-Antonio Espin-Sanchez
The efficiency and distributive consequences of institutions’ governing of human relationships. Efficiency concerns with the size of the "pie"; ways in which different institutions generate a bigger "pie" than others. Distribution concerns with who gets a bigger piece of the "pie." Why "bad" institutions persist over time; what can be done to change from bad/old institutions to good/new institutions. Prerequisites: intermediate micro- or macroeconomics, and a course in statistics and probability. SO

* ECON 459a, Behavioral Mechanisms Design and Contract Theory  Philipp Strack
Introduction to mechanism design with non-rational agents. Consideration of how optimal institutions are structured when agents are non-rational and how they differ from their counterparts with rational agents. Prerequisites: ECON 115 or equivalent; ECON 121. SO

* ECON 461b, Economics, Addiction, and Public Policy  Jody Sindelar
Smoking, alcoholism, illicit drugs, and obesity studied from economic and policy perspectives. Focus on causes of and solutions to problems. After introductory microeconomics. SO

* ECON 462a / EP&E 224a / GLBL 330a, Debating Globalization  Ernesto Zedillo
Facets of contemporary economic globalization, including trade, investment, and migration. Challenges and threats of globalization: inclusion and inequality, emerging global players, global governance, climate change, and nuclear weapons proliferation. Prerequisite: background in international economics and data analysis. Preference to seniors majoring in Economics or EP&E. SO RP

* ECON 463b / GLBL 307b, Economic Evolution of the Latin American and Caribbean Countries  Ernesto Zedillo
Economic evolution and prospects of the Latin American and Caribbean (LAC) countries. Topics include the period from independence to the 1930s; import substitution and industrialization to the early 1980s; the debt crisis and the "lost decade"; reform and disappointment in the late 1980s and the 1990s; exploration of selected episodes in particular countries; and speculations about the future. Prerequisites: intermediate microeconomics and macroeconomics. SO

* ECON 464b, Institutions and Incentives in Economic Development  Mark Rosenzweig
Assessment of alternative policies and programs designed to promote economic development; examination of fundamental problems of underdeveloped areas and consideration of how and whether such programs resolve them. The roles of indigenous institutions in alleviating problems of underdevelopment. Prerequisites: intermediate microeconomics and econometrics. SO

* ECON 465a / EP&E 224a / GLBL 330a, Health Inequality and Development  Nicoli Nattrass
Economic analysis of the interactions between health, inequality, and development. Growth and development; health and well-being; burden of disease and funding for health; the relationship between growth and health; international health policy. Prerequisite: introductory microeconomics and macroeconomics. SO

* ECON 466b, Strategies for Economic Development  Rakesh Mohan
How strategies for economic development have changed over time and how dominant strands in development theory and practice have evolved. Students trace the influence of the evolution in thinking on actual changes that have taken place in successful development strategies, as practiced in fast growing developing countries, and as illustrated in case studies of fast growth periods in Japan, South Korea, Brazil, China, and India. Prerequisites: introductory microeconomics and macroeconomics.

* ECON 471b / EP&E 297b, Topics in Cooperative Game Theory  Pradeep Dubey
The theory and applications of cooperative games. Topics include matching, bargaining, cost allocation, market games, voting games, and games on networks. Prerequisite: intermediate microeconomics.

* ECON 474b / EAST 454b / GLBL 312b, Economic and Policy Lessons from Japan  Stephen Roach
An evaluation of modern Japan’s protracted economic problems and of their potential implications for other economies, including the United States, Europe, and China. Policy blunders, structural growth impediments, bubbles, the global economic crisis of 2008, and Abenomics; risks of secular stagnation and related dangers to the global economy from subpar post-crisis recoveries. Focus on policy remedies to avert similar problems in other countries. Prerequisite: an introductory course in macroeconomics. SO

* ECON 475a / EP&E 286a, Discrimination in Law, Theory, and Practice  Gerald Jaynes
How law and economic theory define and conceptualize economic discrimination; whether economic models adequately describe behaviors of discriminators as documented in court cases and government hearings; the extent to which economic theory and econometric techniques aid our understanding of actual marketplace discrimination. Prerequisites: introductory microeconomics and at
least one additional course in Economics, African American Studies, Ethnicity, Race, and Migration, or Women’s, Gender, and Sexuality Studies.

* ECON 476a, The Theory and Application of Corporate Credit Investing  John Rapaport
Exploration of the theory and practical application of investing in corporate debt, particularly U.S. credit markets from the perspective of a market participant. Course work based on economic theory, with focus on original cases and primary materials. Prerequisites: ECON 122 and 136 or permission of instructor.

* ECON 478a, Bounded Rationality  Ryota Iijima
Introduction to decision theory, which emphasizes the limitations individuals face when making economic decisions. The imperfect ability of decision makers to reason and remember, to calculate with precision, and to ignore the context or framing of a problem. Defining economic rationality; deviations from rationality and their influence on markets; approaches to modeling bounded rationality. Prerequisite: intermediate microeconomics.

* ECON 481a / EP&E 298a, Empirical Microeconomics  Jessica Reyes
Introduction to empirical microeconomics and its methodologies. Academic research in the field explored using tools from economic theory and econometrics. Topics include approaches to identification, environmental effects on health, and the economics of crime, gender, and race. Prerequisites: intermediate microeconomics and econometrics.

Senior Essay and Directed Reading Courses

* ECON 491a and ECON 492b, The Senior Essay  Ebonya Washington
Students deciding to write one-term senior essays by enrolling in ECON 491, or two-term senior essays by enrolling in ECON 491 and 492, must choose their topics and advisers by Monday, October 2, 2017. One-term senior essays are due at the end of the last week of classes in the fall term. Two-term senior essays are due by 4:30 p.m. on Wednesday, April 4, 2018. Students writing senior essays who would like to be considered for Distinction in the Major must submit three copies of their essay to the Economics department office by 4:30 p.m. on Wednesday, April 4, 2018. Advisers are chosen with the assistance of the DUS. The format and character of the departmental senior essay may vary to suit the interest of the student and the demands of the topic, but it is expected that the tools and concepts of economic analysis will be employed and that the essay will contain original research. Paper lengths may vary; the normal expectation is thirty pages. Students may receive up to two credits for the senior essay, though it counts as only one departmental seminar whether one or two terms are taken. Meetings for seniors to discuss the senior essay guidelines and requirements will be held on Tuesday August 29, 2017 at 10 a.m. and Wednesday, August 30, 2017 at 4:00 p.m. in Room 106, 28 Hillhouse Avenue. Senior essay prospectus forms are due Monday, October 2, 2017.

* ECON 498a and ECON 499b, Directed Reading  Ebonya Washington
Junior and senior economics majors desiring a directed reading course in special topics in economics not covered in other graduate or undergraduate courses may elect this course, usually not more than once, with written permission of the director of undergraduate studies and of the instructor. The instructor meets with the student regularly, typically for an hour a week, and the student writes a paper or a series of short essays. Junior and senior majors may take this course for a letter grade, but it does not meet the requirement for a department seminar.