

Undergraduate Economics Program

Dennis Epple, Head of Economics
 Carol B. Goldberg, Director of Undergraduate Economics
<http://www.tepper.cmu.edu/economics>
 E-mail: econprog@andrew.cmu.edu

At its most fundamental level, economics is the study of how scarce resources are allocated. What will be produced and consumed, how much, and by whom? These questions, central to the well-being of people throughout the world, are the focus of economics. Economists identify, model, and analyze problems, developing meaningful solutions for the challenges confronting society. Economists are also active participants in the processes and institutions through which the pressing concerns of society are addressed. Economists help businesses, political bodies, and other organizations make better decisions through the development of market strategies, the promulgation of regulatory structures, and the formulation of appropriate government policies. Increasingly, economists are taking advantage of new technologies to design and implement new markets and exchange mechanisms.

Carnegie Mellon University enjoys a rich history of innovative research in the field of Economics. By bringing together rigorous theoretical and empirical work, the University supports some of the very best research. Six of our past and present faculty have been awarded the Nobel Prize in Economics. In the classroom, we bring the same rigorous, innovative approach to enable our students to develop their talents and realize the potential of their tremendous analytical skills.

At Carnegie Mellon University, the Undergraduate Economics Program is supported by both the Tepper School of Business and the College of Humanities and Social Sciences. Economics majors are considered members of both colleges and enjoy their full support and services.

Degree Options

In order to accommodate students' wide variety of goals, three primary degree programs are available: Bachelor of Arts in Economics, Bachelor of Science in Economics, and Bachelor of Science in Economics and Statistics (jointly administered by the Department of Statistics and the Undergraduate Economics Program).

For students who major in other academic fields, an additional major program and a minor degree program in Economics are available. This information can be found following the discussions about the major curricula and schedules.

The three degree programs have been designed to provide students with a solid understanding of the central theories and analytical tools of the field of economics, while maintaining the flexibility necessary to meet the needs of a diversity of career paths. The three degrees produce strong analytical thinkers who are able to model and analyze complex problems. Graduates of the Undergraduate Economics Program gain employment as economic analysts in both the private and public sectors; pursue advanced professional degrees in business, law, and public policy; as well as enter into Ph.D. programs in economics, statistics, finance, and related fields.

First-year students are not expected to know which degree option they wish to pursue. For this reason, the first-year curricula are identical. As students become involved in their course work, participate in the extra- and co-curricular activities sponsored by the Undergraduate Economics Program, and talk with an economics advisor, the decision of which degree to pursue becomes quite evident.

The B.A. in Economics Curriculum and The B.S. in Economics Curriculum are designed to provide students with a solid understanding of the economic theory and quantitative economic analysis. The introductory core disciplinary sequences in economic theory and quantitative analysis are identical: both rely on the same knowledge base of calculus and statistics. Where these two degree programs differ is in their emphases of study in the advanced levels. The advanced data analysis component of the **B.A. in Economics Curriculum** pays additional attention to ordinal data and the study of surveys. The flexibility of the "Special Electives" requirement allows students the opportunity to study political, historical, cultural, and social institutions. In the advanced levels

of the economic theory component of the **B.S. in Economics Curriculum**, the foundations of modern economics are examined, using mathematically sophisticated models. The capstone of this degree program is the Senior Project course where students use their qualitative and quantitative skills to contribute to the body of knowledge in empirical, experimental, and/or theoretical studies.

The B.S. in Economics and Statistics Curriculum is a collaborative effort between the Department of Statistics and the Undergraduate Economics Program. It provides an interdisciplinary course of study aimed at students with a strong interest in the empirical analysis of economic data. The major's curriculum provides students with a solid foundation in the theories and methods of both fields. Students in this major are trained to advance the understanding of economics issues through the analysis, synthesis, and reporting of data using the advanced empirical research methods of statistics and econometrics.

Dual Degree in Economics

A student pursuing a primary degree outside of the department may obtain a dual degree in economics by completing all of the requirements for a B.S. in Economics. In addition, the student's total units complete must be at least 90 units in excess of the requirement for the student's other degree(s) or at least 450 units, whichever is greater. Interested students should meet with an economics advisor.

Honors Programs

Outstanding students are eligible for the honors programs in both the Tepper School of Business and the College of Humanities and Social Sciences. The Senior Honors Programs in Economics provide qualified students with the opportunity to engage in original research during their senior year at Carnegie Mellon. Invited students demonstrate and further develop their skills in economic analysis and research through the completion of a senior honors thesis. For many, this process of intellectual inquiry and knowledge creation is the highlight and culmination of their undergraduate academic experience. In addition to submitting a Senior Honors Thesis, the students present their work at Carnegie Mellon's annual undergraduate research symposium *Meeting of the Minds*. Students who successfully complete the Honors Program graduate with "College Honors". For more details about the Tepper Seniors Honors Program in Economics, visit the "Curricula" section of the Undergraduate Economics Program website. For details about the H&SS Honors Program, visit the "Advising & Careers" section of the H&SS Website.

Accelerated Master's Degree Programs

Accelerated Master's Degree programs enable exceptional students to earn both an undergraduate degree and a masters degree by remaining one additional year at Carnegie Mellon. The Heinz School of Public Policy and Management offers two professional accelerated masters degree programs: a Master of Science in Public Policy and Management and a Master of Information Systems Management. The Tepper School of Business offers one accelerated professional degree, Master in Business Administration, and one accelerated academic degree, Master in Quantitative Economics. Interested students should consult with their economics advisor for further information. For more details about Accelerated Master's Degree Programs, visit the "Curricula" section of the Undergraduate Economics Program website.

Degree Requirements

In addition to completing at least 360 units, the H&SS General Education requirements, and University requirements, recipients of an undergraduate degree in economics must complete courses in mathematics, probability and statistics, writing, economics theory, and economic analysis, as well as a set of advanced electives and other specialized courses. For more information, please visit the

"Curriculum" section of the Undergraduate Economics Program's website. Specific requirements for the degrees are as follows:

B.A. in Economics Curriculum

Mathematics Prerequisites	19 Units
21-120 Differential and Integral Calculus	10
21-256 Multivariate Analysis and Approximation	9
Programming Requirement	10 Units
15-100 Introductory/Intermediate Programming	10
Writing Requirement	9 Units
<i>Choose one:</i>	
73-270 Professional Writing for Economists	9
76-270 Writing in the Professions	9
76-271 Introduction to Professional and Technical Writing	9
Economic Theory Requirements	27 Units
73-100 Principles of Economics	9
73-150 Microeconomics	9
73-200 Macroeconomics	9
Economic History Requirement	9 Units
73-310 History of Economic Issues and Analysis	9
Quantitative Analysis Requirements	45 Units
36-201 Statistical Reasoning and Practice	9
36-202 Statistical Methods	9
36-303 Sampling, Survey, and Society	9
36-310 Fundamentals of Statistical Modeling	9
73-261 Econometrics	9

Advanced Economics Electives 36 Units

Students must take four advanced elective courses. Advanced elective courses are those numbered 73-300 through 73-495, as well as courses designated by the Program offered by other departments/programs. Additionally, students may work with their advisor to structure alternative sets of courses to meet these requirements based on their particular interests, subject to course availability.

Special Electives 27 Units

Students must take three special elective courses in the humanities and social sciences. The list of courses designated as special electives is maintained and revised from time to time by the Undergraduate Economics Program.

B.S. in Economics Curriculum

Mathematics Requirements	29 Units
Complete all of following:	
21-120 Differential and Integral Calculus	10
21-122 Integration, Differential Equations and Approximation	10
21-259* Calculus in Three Dimensions	9
*21-256 (Multivariate Analysis and Approximation) can be substituted for 21-259.	
Programming Requirement	10 Units
15-100 Introductory/Intermediate Programming	10
Quantitative Analysis Requirements	45 Units
<i>Choose one option:</i>	
Option 1:	
36-202 Statistical Methods	9
36-310 Fundamentals of Statistical Modeling	9
73-261 Econometrics	9
Option 2:	
36-225* Introduction to Probability and Statistics I	9
36-226 Introduction to Probability and Statistics II	9
73-261 Econometrics	9

*Acceptable equivalents for 36-225 are 21-325 and 36-217.

Writing Requirement 9 Units

<i>Choose one:</i>	
73-270 Professional Writing for Economists	9
76-270 Writing in the Professions	9
76-271 Introduction to Professional and Technical Writing	9

Economic Theory Requirements 39 Units

<i>Complete all of following:</i>	
73-100 Principles of Economics	9
73-150 Microeconomics	9
73-200 Macroeconomics	9
73-252 Advanced Microeconomic Theory	6
73-253 Advanced Macroeconomic Theory	6

Advanced Economics Electives 45 Units

Students must take five advanced elective courses, at least two of which have 73-252 or 73-253 as a prerequisite. Advanced elective courses are those numbered 73-300 through 73-495. For the purpose of these requirements, the Undergraduate Economics Program may also designate as advanced electives courses from other departments/programs. Additionally, students may work with their advisor to structure alternative sets of courses to meet these requirements based on their particular interests, subject to course availability.

Senior Project 9 Units

73-497 Senior Project	9
-----------------------	---

B.S. in Economics and Statistics Curriculum

I. Prerequisites

Mathematics Foundations 38 Units

<i>Complete all of the following:</i>	
21-120 Differential and Integral Calculus	10
21-122 Integration, Differential Equations, and Approximations	10
21-259* Calculus in Three Dimensions	9
21-241 Matrix Algebra	9

*21-256 (Multivariate Analysis and Approximation) can be substituted for 21-259.

Statistical Foundations 18 Units

<i>Complete all of the following:</i>	
36-201* Introduction to Statistical Reasoning and Practice	9
and one of the following:	
36-202 Statistical Methods	9
36-208 Regression Analysis	9
36-309 Experimental Design for Behavioral and Social Sciences	9

* Acceptable equivalents for 36-201 are 36-207, 36-220, 36-247, and 70-207

Writing Requirement 9 Units

<i>Choose one:</i>	
73-270 Writing for Economists	9
76-270 Writing in the Professions	9
76-271 Introduction to Professional and Technical Writing	9

II. Disciplinary Core

Economics Core 39 Units

73-100 Principles of Economics	9
73-150 Microeconomics	9
73-200 Macroeconomics	9
73-252 Advanced Microeconomic Theory	6
73-253 Advanced Macroeconomic Theory	6
73-261 Econometrics	9

Statistics Core 36 Units

36-225 Introduction to Probability and Statistics I	9
36-226 Introduction to Probability and Statistics II	9
36-401 Modern Regression	9
36-402 Advanced Data Analysis (Project Course)	9

Economic Electives 18 Units

Students must take two advanced economic elective courses. Advanced elective courses are those courses numbered 73-300 through 73-495.

Statistics Electives 18 Units

Students must take two courses at the 36-300 level or above.

Additional Major in Economics Curriculum

The requirements for an additional major in Economics are the same as those for the B.S. in Economics, except that the H&SS general education requirements are waived. In order to avoid "double counting" issues, students are encouraged to meet with an economics advisor.

Minor in Economics

The requirements for a minor in Economics consist of mathematics requirements, probability and statistics requirements, and economics courses listed below. In order to avoid "double counting" issues, students are encouraged to meet with an economics advisor.

Mathematics Requirements 19 Units

21-120 Differential and Integral Calculus 10

Choose one:

21-256 Multivariate Analysis and Approximation 9
21-259 Calculus in Three Dimensions 9

Economic Theory Requirements 27 Units

Complete all of the following:

73-100 Principles of Economics 9
73-150 Microeconomics 9
73-200 Macroeconomics 9

Quantitative Analysis Requirements 27 Units

Choose one option:

Option 1:

36-202 Statistical Methods 9
36-310 Fundamentals of Statistical Modeling 9
73-261 Econometrics 9

^a Acceptable equivalents for 36-201 are 36-207, 36-330, 36-247, and 70-207.

Option 2:

36-225^b Introduction to Probability and Statistics I 9
36-226 Introduction to Probability and Statistics II 9
73-261 Econometrics 9

^b Acceptable equivalents for 36-225 are 21-325 and 36-217.

Advanced Economics Electives 18 Units

Students must take two advanced elective courses. Advanced elective courses are those numbered 73-300 through 73-495, as well as courses designated by the program offered by other departments/programs. Additionally, students may work with their advisor to structure alternative sets of courses to meet these requirements based on their particular interests, subject to course availability.

Sample Course Schedules

What follows are sample four-year course schedules for a student pursuing undergraduate degrees in Economics. As there are many different ways of completing the requirements, students are strongly encouraged to meet with an economics advisor to tailor their courses to their own particular needs. It is the responsibilities of the students to ensure that they understand all of the program requirements and that they meet the necessary conditions for graduation. When planning course schedules, students must give consideration to all prerequisite and corequisite requirements. Course descriptions, prerequisites, and corequisites can be found at the back of this catalog.

Sample Schedule for B.A. in Economics**First Year**

	Fall	49 Units
21-120	Differential and Integral Calculus	10
36-201	Statistical Reasoning	9
73-100	Principles of Economics	9
76-101	Interpretation and Argument	9
99-101	Computing @ Carnegie Mellon	3
xx-xxx	Freshman Seminar	9

Spring 46 Units

15-100	Introductory/Intermediate Programming	10
21-259	Calculus in Three Dimensions	9
36-202	Statistical Methods	9
73-150	Microeconomics	9
79-104	World History	9

Second Year

	Fall	45 Units
36-310	Fundamentals of Statistical Modeling	9
73-200	Macroeconomics	9
xx-xxx	"Special" elective	9
xx-xxx	elective	9
xx-xxx	elective	9

Spring 45 Units

36-303	Sampling, Survey and Society	9
73-270	Writing for Economists	9
73-310	History of Economic Issues and Analysis	9
xx-xxx	elective	9
xx-xxx	elective	9

Third Year

	Fall	45 Units
73-261	Econometrics	9
xx-xxx	Advanced Economics Elective	9
xx-xxx	"Special" elective	9
xx-xxx	Advanced Economics Elective	9
xx-xxx	elective	9

Spring 45 Units

xx-xxx	Advanced Economics Elective	9
xx-xxx	"Special" Elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9

Fourth Year

	Fall	45 Units
xx-xxx	Advanced Economics Elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9

Spring 45 Units

xx-xxx	Advanced Economics Elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9

Sample Schedule for B.S. in Economics

First Year		
Fall		49 Units
21-120	Differential and Integral Calculus	10
36-201	Statistical Reasoning	9
73-100	Principles of Economics	9
76-101	Interpretation and Argument	9
99-101	Computing @ Carnegie Mellon	3
xx-xxx	Freshman Seminar	9
Spring		46 Units
15-100	Introductory/Intermediate Programming	10
21-259	Calculus in Three Dimensions	9
36-202	Statistical Methods	9
73-150	Microeconomics	9
79-104	World History	9
Second Year		
Fall		46 Units
21-122	Integration, Differential Equations and Approximation	10
73-200	Macroeconomics	9
36-310	Fundamentals of Statistical Modeling	9
xx-xxx	elective	9
xx-xxx	elective	9
Spring		48 Units
73-252/3	Advanced Economic Theory ^c	12
73-270	Writing for Economists	9
xx-xxx	Advanced Economics Elective	9
xx-xxx	elective	9
xx-xxx	elective	9

^c A semester-long sequence consisting of two mini-courses, 73-252 Advanced Microeconomic Theory and 73-253 Advanced Macroeconomic Theory.

Third Year		
Fall		45 Units
73-261	Econometrics	9
xx-xxx	Advanced Economics Elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9
Spring		45 Units
xx-xxx	Advanced Economics Elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9
Fourth Year		
Fall		45 Units
79-497	Senior Project	9
xx-xxx	Advanced Economics Elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9
Spring		45 Units
xx-xxx	Advanced Economics Elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9
xx-xxx	elective	9

Sample Schedule for B.S. in Economics and Statistics

Year	Fall	Spring
Freshman	21-120 36-201 ----- ** ----- -----	21-122 36-202 73-150 ----- -----
Sophomore	21-256 36-225 73-200 ----- -----	21-241 36-226 73-252/3 ----- -----
Junior*	36-401 73-261 Writing Req. Econ Elective -----	36-402 Stats Elective ----- ----- -----
Senior	Stats Elective ----- ----- ----- -----	Econ Elective ----- ----- ----- -----

* A student could spend, for example, year 3 abroad and move year 3 courses to year 4.

** In each semester, ----- represents other courses (not related to the major) which are needed in order to complete the 360 units that the degree requires.

Faculty

LAURENCE ALES, Assistant Professor of Economics — Ph.D., University of Minnesota; Carnegie Mellon, 2008—.

STEPHEN M. CALABRESE, Associate Professor of Economics — Ph.D., Carnegie Mellon University; Carnegie Mellon, 2005—.

KAREN B. CLAY, Associate Professor of Economics and Public Policy — Ph.D., Stanford University; Carnegie Mellon, 1998—.

DANIELLE COEN PIRANI, Associate Professor of Economics — Ph.D., University of Rochester; Carnegie Mellon, 2000—.

ROBERT M. DAMMON, Professor of Financial Economics and Associate Dean, Education — Ph.D., University of Wisconsin; Carnegie Mellon, 1984—;

JUAN M. DUBRA, Visiting Associate Professor of Economics — Ph. D., New York University; Carnegie Mellon (Spring Only), 2006—.

KENNETH B. DUNN, Professor of Financial Economics and Dean — Ph.D., Purdue University; Carnegie Mellon, 2003—;

DENNIS N. EPPLE, Thomas Lord Professor of Economics; Head, Economics Programs — Ph.D., Princeton University; Carnegie Mellon, 1974—.

MARIA FERREYRA, Assistant Professor of Economics — Ph.D., University of Wisconsin; Carnegie Mellon, 2002—.

CHRISTINA FONG, Research Scientist — Ph.D., University of Massachusetts; Carnegie Mellon, 2001—.

DAVID L. FULLER, Visiting Assistant Professor of Economics — Ph.D., University of Iowa; Carnegie Mellon, 2008—.

GEORGE-LEVI GAYLE, Assistant Professor of Economics — Ph.D., University of Pittsburgh; Carnegie Mellon, 2003—.

MARTIN GAYNOR, E.J. Barone Professor of Economics and Health Policy — Ph.D., Northwestern University; Carnegie Mellon, 1995—.

LIMOR GOLAN, Assistant Professor of Economics — Ph.D., University of Wisconsin-Madison; Carnegie Mellon, 2002—.

CAROL B. GOLDBURG, Adjunct Professor of Economics and Director, Undergraduate Economics Program — Ph.D., Carnegie Mellon University; Carnegie Mellon, 2005—.

MARVIN GOODFRIEND, Professor of Economics and President, Gailliot Center for Public Policy, Ph.D., Brown University, Carnegie Mellon, 2005 —.

RICHARD C. GREEN, Richard M. and Margaret S. Cyert Professor of Economics and Management and Associate Dean, Research- Ph.D., University of Wisconsin; Carnegie Mellon, 1982 —.

ELIF INCEKARA HAFALIR, Visiting Assistant Professor of Economics — Ph.D., Penn State University; Carnegie Mellon, 2007—.

ISA E. HAFALIR, Assistant Professor of Economics — Ph.D., Penn State University; Carnegie Mellon, 2007—.

BURTON HOLLIFIELD, Professor of Financial Economics — Ph.D., Carnegie Mellon University; Carnegie Mellon, 1999—.

CHRISTIAN JULLIARD, Visiting Assistant Professor of Economics — Ph.D., Princeton University; Carnegie Mellon, 2008—.

ONUR KESTEN, Assistant Professor of Economics — Ph.D., University of Rochester; Carnegie Mellon, 2005 —.

STEVEN KLEPPER, Arthur Arton Hamerschlag Professor of Economics and Social Science — Ph.D., Cornell University; Carnegie Mellon, 1980—.

YAROSLAV KRYUKOV, Visiting Assistant Professor of Economics — Ph.D., Northwestern University; Carnegie Mellon, 2008—.

FINN KYDLAND, Professor of Economics — Ph.D., Carnegie Mellon University; Carnegie Mellon, 1977—.

LESTER B. LAVE, Harry B. and James H. Higgins Professor of Economics and University Professor; Director, Carnegie Mellon Green Design Initiative; Co-Director, Carnegie Mellon Electricity Industry Center — Ph.D., Harvard University; Carnegie Mellon, 1963—.

BENNETT T. MCCALLUM, H. J. Heinz Professor of Economics — Ph.D., Rice University; Carnegie Mellon, 1981—.

ALLAN H. MELTZER, The Allan H. Meltzer University Professor of Political Economy — Ph.D., University of California, Los Angeles; Carnegie Mellon, 1957—.

ROBERT A. MILLER, Professor of Economics and Strategy — Ph.D., University of Chicago; Carnegie Mellon, 1982—.

JOHN R. O'BRIEN, Associate Professor of Accounting and Experimental Economics — Ph.D., University of Minnesota; Carnegie Mellon, 1984—.

FREDERICK H. RUETER, Adjunct Professor of Economics — Ph.D., Carnegie Mellon University; Carnegie Mellon, 1988—.

DUANE J. SEPPI, Professor of Financial Economics — Ph.D., University of Chicago; Carnegie Mellon, 1986—.

HOLGER SIEG, Professor of Economics— Ph.D., Carnegie Mellon University; Carnegie Mellon, 2001—.

PATRICK W. SILEO, Adjunct Professor of Economics — Ph.D., Carnegie Mellon University; Carnegie Mellon, 2000—.

CHRISTOPHER SLEET, Associate Professor of Economics - Ph.D., Stanford University; Carnegie Mellon, 2005—.

CHESTER S. SPATT, Mellon Bank Professor of Finance; Director, Center for Financial Markets — Ph.D., University of Pennsylvania; Carnegie Mellon, 1979—.

FALLAW B. SOWELL, Associate Professor of Economics — Ph.D., Duke University; Carnegie Mellon, 1988—.

STEPHEN E. SPEAR, Professor of Economics — Ph.D., University of Pennsylvania; Carnegie Mellon, 1982—.

CHRIS I. TELMER, Associate Professor of Financial Economics — Ph.D., Queen's University (Canada); Carnegie Mellon, 1992—.

ROBERTO WEBER, Associate Professor of Economics and Social and Decision Sciences — Ph.D., California Institute of Technology; Carnegie Mellon, 2000—.

SEVIN YELTEKIN, Associate Professor of Economics — Ph.D., Stanford University; Carnegie Mellon, 2005—.

STANLEY E. ZIN, The Richard M. Cyert and Morris H. DeGroot Professor of Economics and Statistics; Professor of Economics and Finance, — Ph.D., University of Toronto; Carnegie Mellon, 1988—.