

Undergraduate Economics Program

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Advising Appointment Online Scheduler: <https://meetme.so/TepperAdvising>
www.cmu.edu/tepper/programs/undergraduate-economics (<http://www.cmu.edu/tepper/programs/undergraduate-economics/>)

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 are central to the well-being of people throughout the world. Economists identify, model, and analyze problems with the objective of developing practical and efficient solutions to challenges confronting society. Economists are also active participants in the processes and institutions through which economic policies are implemented. In the public arena sphere, economists contribute to the design of programs and incentive systems to foster efficient implementation of policies. In the private sector, economists use modeling and data-analytic skills, both in identifying ways to enhance productive efficiency within the firm and in developing strategies to enhance effectiveness of the firm as it competes in the global marketplace.

Upon major declaration, students pursuing the Bachelor of Arts in Economics or Bachelor of Science in Economics are affiliated with the Tepper School of Business. This means that students complete the Tepper general education requirements and are subject to all Tepper School policies and procedures. Students interested in the Bachelor of Science in Economics+Mathematics first declare the Bachelor of Science in Economics degree and are then able to apply for Economics+Mathematics major. The academic college affiliation for students pursuing majors in Economics +Politics and Economics+Statistics is the Dietrich College of Humanities and Social Sciences.

EDUCATIONAL OBJECTIVES

The Economics majors are designed to develop strong analytical skills and a solid foundation in the discipline of economics. More specifically, measurable objectives for our economics curriculum are the following:

- Students should be able to identify, explain, and use economic concepts, theories, models, and data-analytic techniques.
- Students should acquire and use knowledge of economics, mathematics, statistics, and computing flexibly in a variety of contexts, providing the foundation for success in graduate studies and careers in the public and private sectors.
- Students should be able to apply their economic tools to formulate positions on a wide range of social and economic problems and engage effectively in policy debates.
- Students should use the investigative skills necessary for conducting original economic research and participating effectively in project teams.
- Students should be able to deliver effective presentations in which they combine visual communication design with oral arguments and/or the written word.

Degree Options

In order to accommodate students' wide variety of goals, three primary degree majors are available in the Tepper School of Business:

- Bachelor of Arts in Economics
- Bachelor of Science in Economics
- Bachelor of Science in Economics and Mathematical Sciences (jointly administered with the Department of Mathematics)

The Dietrich College of Humanities and Social Sciences administers two interdisciplinary Economics majors:

- Bachelor of Science in Economics and Politics
- Bachelor of Science in Economics and Statistics

For students who major in other academic fields, additional major programs in Economics, Economics and Politics, and Economics and Statistics, and a minor degree program in Economics are available.

B.A. in Economics

To receive the B.A. degree in Economics, students must complete at least 360 units, consisting of the requirements for Mathematics, Quantitative Analysis, Economic Core, Economic Electives, Senior Requirement, University Core, and a Minor.

Mathematics Prerequisites

Courses		Units
21-120	Differential and Integral Calculus	10-20
or 21-111 & 21-112	Calculus I and Calculus II	
21-256	Multivariate Analysis	9-10
or 21-259	Calculus in Three Dimensions	

Economic Theory Requirements

		Units
73-102	Principles of Microeconomics	9
or 73-104	Principles of Microeconomics Accelerated	
73-103	Principles of Macroeconomics	9
73-230	Intermediate Microeconomics	9
73-240	Intermediate Macroeconomics	9
70-340	Business Communications	9
70-345	Business Presentations	9

Quantitative Analysis Requirements

		Units
70-207	Probability and Statistics for Business Applications	9
or 36-200	Reasoning with Data	
73-265	Economics and Data Science	9
73-274	Econometrics I	9

Economics Electives (36 Units)

Students must take four economics elective courses. Economics elective courses are those numbered 73-300 or higher.

Special Electives (18 Units)

Students must take two special elective courses. Students should consult the degree audit system for courses that satisfy the special electives requirement.

Course List

Sample List of Special Elective Courses	Units
19-402 Telecommunications Technology and Policy for the Internet Age	12
19-403 Policies of Wireless Systems	12
19-411 Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech	9
19-421 Emerging Energy Policies	9
19-425 Sustainable Energy for the Developing World	9
66-221 Topics of Law: Introduction to Intellectual Property Law	9
79-245 Capitalism and Individualism in American Culture	9
79-262 Modern China: From the Birth of Mao ... to Now	9
79-266 Russian History and Revolutionary Socialism	9
79-280 Coffee and Capitalism	9
79-283 Hungry World: Food and Famine in Global Perspective	9

79-288	Bananas, Baseball, and Borders: Latin America and the United States	9
79-300	History of American Public Policy	9
79-315	Thirsty Planet: The Politics of Water in Global Perspective	9
79-320	Women, Politics, and Protest	9
79-343	Education, Democracy, and Civil Rights	9
79-383	The History of Capitalism	9
80-136	Social Structure, Public Policy & Ethics	9
80-249	AI, Society, and Humanity	9
80-305	Game Theory	9
80-321	Causation, Law, and Social Policy	9
80-324	Philosophy of Economics	9
80-335	Social and Political Philosophy	9
80-348	Health, Human Rights, and International Development	9
84-310	International Political Economy	9
84-318	Politics of Developing Nations	9
84-362	Diplomacy and Statecraft	9
84-387	Remote Systems and the Cyber Domain in Conflict	9
88-411	Rise of the Asian Economies	9

Senior Work

		Units
73-497	Senior Project	9
or 73-500 & 73-501	Tepper College Honors Thesis I and Tepper College Honors Thesis II	

Note: Students in the BA in Economics who complete an Honors Thesis in economics may use 73-497 (Senior Project) as an economics elective.

MINOR

In order to obtain the degree, students must complete a minor from another academic department. For students electing to complete an additional major or dual degree, the minor is waived.

UNIVERSITY CORE

Students are required to complete the Tepper University Core, general education coursework in the liberal arts and sciences.

COMPUTING @ CARNEGIE MELLON

All undergraduate students are required to take 99-101 (<http://coursecatalog.web.cmu.edu/search/?P=99-101>) Computing @ Carnegie Mellon to graduate (usually taken prior to the start of the first year or during the first year). The course focuses on Carnegie Mellon tools and technologies.

B.S. in Economics

To receive the B.S. degree in Economics, students must complete at least 360 units, consisting of the requirements for Mathematics, Quantitative Analysis, Economic Core, Economic Electives, Senior Requirement, University Core, and a Minor.

Mathematics Requirement

		Units
21-120	Differential and Integral Calculus	10-20
or 21-111 & 21-112	Calculus I and Calculus II	
21-256	Multivariate Analysis	9
or 21-259	Calculus in Three Dimensions	
21-240	Matrix Algebra with Applications	10
or 21-241	Matrices and Linear Transformations	

Quantitative Analysis Requirements

		Units
73-265	Economics and Data Science	9

73-274	Econometrics I	9
73-374	Econometrics II	9
or 73-423	Forecasting for Economics and Business	
or 70-467	Machine Learning for Business Analytics	

Economic Core Requirements

		Units
73-102	Principles of Microeconomics	9
or 73-104	Principles of Microeconomics Accelerated	
73-103	Principles of Macroeconomics	9
73-230	Intermediate Microeconomics	9
73-240	Intermediate Macroeconomics	9
70-340	Business Communications	9
70-345	Business Presentations	9

Economics Electives (54 Units)

Students must take six economics elective courses. Economics elective courses are those numbered 73-300 or higher.

Senior Requirement

		Units
73-497	Senior Project	9
or 73-500 & 73-501	Tepper College Honors Thesis I and Tepper College Honors Thesis II	

Note: Students in the BS in Economics who complete an Honors Thesis in economics may use 73-497 (Senior Project) as an economics elective.

MINOR

In order to obtain the degree, students must complete a minor from another academic department. For students electing to complete an additional major or dual degree, the minor requirement is waived.

UNIVERSITY CORE

Students are required to complete Tepper University Core, general education coursework in the liberal arts and sciences.

COMPUTING @ CARNEGIE MELLON

All undergraduate students are required to take 99-101 (<http://coursecatalog.web.cmu.edu/search/?P=99-101>) Computing @ Carnegie Mellon to graduate (usually taken prior to the start of the first year or during the first year). The course focuses on Carnegie Mellon tools and technologies.

B.S. in Economics and Mathematical Sciences

The B.S. in Economics and Mathematical Sciences is an interdisciplinary major that provides students with courses that complement and develop depth of understanding of economic theory, applied economics, and applied mathematics. The major equips students with the mathematical tools that are essential for success in Ph.D. programs in economics, mathematics, and key functional areas of business including finance, accounting, marketing, and information systems. Students must be enrolled in the B.S. in Economics major to apply for the Economics and Mathematics major. Acceptance into the major is based on meeting the following requirements:

- Cumulative QPA of at least 3.5
- Earned a "B" or better in 21-127 Concepts of Mathematics or 21-128 Mathematical Concepts and Proofs
- Earned a "B" or better in 21-241 Matrices and Linear Transformations
- Completed Principles of Microeconomics waiver, 73-102 Principles of Microeconomics or 73-104 Principles of Microeconomics Accelerated
- Earned a "B" or better in 73-103 Principles of Macroeconomics
- Earned a "B" or better in either 73-230 Intermediate Microeconomics or 73-240 Intermediate Macroeconomics
- Personal statement

B.S. in Economics and Mathematical Sciences**Economic Theory Requirements**

		Units
73-102	Principles of Microeconomics *	9
or 73-104	Principles of Microeconomics Accelerated	
73-103	Principles of Macroeconomics	9
73-230	Intermediate Microeconomics	9
73-240	Intermediate Macroeconomics	9

Quantitative Analysis Requirements

		Units
70-207	Probability and Statistics for Business Applications	9
or 36-200	Reasoning with Data	
36-225	Introduction to Probability Theory	9
or 36-235	Probability and Statistical Inference I	
or 36-217	Probability Theory and Random Processes	
or 21-325	Probability	
73-265	Economics and Data Science	9
73-274	Econometrics I	9
73-374	Econometrics II	9

Mathematical Sciences Requirements

		Units
21-120	Differential and Integral Calculus	10-20
or 21-111 & 21-112	Calculus I and Calculus II	
21-122	Integration and Approximation	10
21-127	Concepts of Mathematics	12
21-228	Discrete Mathematics	9-12
or 15-251	Great Ideas in Theoretical Computer Science	
21-241	Matrices and Linear Transformations	11
21-259	Calculus in Three Dimensions	9-11
or 21-256	Multivariate Analysis	
or 21-268	Multidimensional Calculus	
or 21-269	Vector Analysis	
21-260	Differential Equations	9
21-355	Principles of Real Analysis I	9
21-356	Principles of Real Analysis II	9

Programming Requirement (10 Units)

		Units
15-110	Principles of Computing	10

Writing Requirement

		Units
70-340	Business Communications	9

Economic Electives (27 Units)

Students must take three economics elective courses. Economics elective courses are those courses numbered 73-300 through 73-495, (excluding 73-374 Econometrics II). Students are encouraged to work with their advisors to structure a set of courses which meet these requirements based on their particular interests, subject to course availability.

Recommended Economics Electives:

73-315	Market Design	9
73-338	Financial Crises and Risk	9
73-347	Game Theory Applications for Economics and Business	9
73-365	Firms, Market Structures, and Strategy	9
73-421	Emerging Markets	9

Mathematical Science Depth Electives (27 Units)

Students must take three advanced mathematics depth courses. Students are encouraged to work with their advisors to structure a set of courses

which meet these requirements based on their particular interests, subject to course availability.

Recommended Mathematical Science Depth Electives:

21-270	Introduction to Mathematical Finance	9
21-292	Operations Research I	9
21-301	Combinatorics	9
21-341	Linear Algebra	9
21-369	Numerical Methods	12
21-370	Discrete Time Finance	9
21-371	Functions of a Complex Variable	9
21-393	Operations Research II	9
21-420	Continuous-Time Finance	9
21-484	Graph Theory	9

Note: Only one of the following courses may count towards the required Mathematical Sciences Depth Electives: 21-365 Projects in Applied Mathematics or 21-366 Topics in Applied Mathematics.

Senior Work (9 units; 18 units for students completing an honors thesis in economics)

73-497	Senior Project	9
or 73-500 & 73-501	Tepper College Honors Thesis I and Tepper College Honors Thesis II	

Note: Students in the BS in Economics and Math who complete an Honors Thesis in economics may use 73-497 (Senior Project) as an economics elective.

DOUBLE-COUNTING RESTRICTION

The 3 economics electives and 3 math electives cannot double count with another major or minor.

UNIVERSITY CORE

Students are required to complete University Core, general education coursework in the liberal arts and sciences.

COMPUTING @ CARNEGIE MELLON

All undergraduate students are required to take 99-101 (<http://coursecatalog.web.cmu.edu/search/?P=99-101>) Computing @ Carnegie Mellon to graduate (usually taken prior to the start of the first year or during the first year). The course focuses on Carnegie Mellon tools and technologies.

Additional Major in Economics

Students are eligible to apply for the Additional Major in Economics after completion of the Minor in Economics.

Mathematics Requirement

21-120	Differential and Integral Calculus	10
or 21-111 & 21-112	Calculus I and Calculus II	
21-256	Multivariate Analysis	9
or 21-259	Calculus in Three Dimensions	
or 21-254	Linear Algebra and Vector Calculus for Engineers	
21-240	Matrix Algebra with Applications	10
or 21-241	Matrices and Linear Transformations	

Quantitative analysis requirement

73-265	Economics and Data Science	9
73-274	Econometrics I	9
73-374	Econometrics II	9
or 73-423	Forecasting for Economics and Business	
or 70-467	Machine Learning for Business Analytics	

Economic Core Requirement

73-102	Principles of Microeconomics *	9
or 73-104	Principles of Microeconomics Accelerated	
73-103	Principles of Macroeconomics	9
73-230	Intermediate Microeconomics	9

73-240	Intermediate Macroeconomics	9
70-340	Business Communications	9
70-345	Business Presentations	9

If a student is pursuing the additional major and receives a prerequisite waiver for 73102, 9 additional units of elective course work (73xxx) is required.

Economics Electives Requirement (54 units)

Senior Requirement

73-497	Senior Project *	9
or 73-500 & 73-501	Tepper College Honors Thesis I and Tepper College Honors Thesis II	

Note: Students who complete an Honors Thesis in economics may use 73-497 (Senior Project) as an economics elective.

double count restriction

Students pursuing the additional major may double-count two economics electives with any other major or minor requirements. There are no double counting restrictions between the additional major and a student's home college general education requirements.

Dual Degree

Students intending to pursue a Dual Degree in Economics are required to apply for the dual degree and encouraged to consult with the Assistant Dean about their interests and application process. In addition to the student's primary degree requirements, a student accepted for Dual Degree in Economics is required to complete an overall number of units that exceeds the minimum unit requirement for the degree with the smaller unit requirement, by at least 90 units. Further, they must meet all requirements for the economics major including the Tepper's University Core requirement. The student's primary major will substitute for the minor requirement. The student's primary major must be completed prior to or at the same time as the dual degree in Economics to satisfy the minor requirement.

Minor in Economics

Students are eligible to apply for a minor upon completion of two required courses for the minor wherein they earn a 2.0 QPA or higher in said coursework.

While there are no double counting restrictions between the minor and the student's home college general education requirements, 73-265 Economics and Data Science and the 3 economics electives must be unique for the minor and cannot double count with any other major or minor.

Mathematics Requirements

	Units	
21-120	Differential and Integral Calculus	10-20
or 21-111 & 21-112	Calculus I and Calculus II	
21-256	Multivariate Analysis	9
or 21-254	Linear Algebra and Vector Calculus for Engineers	
or 21-259	Calculus in Three Dimensions	
or 21-268	Multidimensional Calculus	
or 21-269	Vector Analysis	

Economic Theory Requirements (27 Units)

	Units	
73-102	Principles of Microeconomics *	9
or 73-104	Principles of Microeconomics Accelerated	
73-103	Principles of Macroeconomics	9
73-230	Intermediate Microeconomics	9
or 73-240	Intermediate Macroeconomics	

If a student is pursuing an economics minor and receives a prerequisite waiver for 73102, 9 additional units of elective course work (73xxx) is required to ensure 54+ units are met in the minor curriculum.

Quantitative Analysis Requirements (18 Units)

Students who have taken coursework in intermediate-level regression analysis and data visualization may petition to substitute 73-274 Econometrics I or 73-423 Forecasting for Economics and Business for 73-265 Economics and Data Science.

	Units	
70-207	Probability and Statistics for Business Applications	9
or 36-200	Reasoning with Data	
or 15-259	Probability and Computing	
or 21-325	Probability	
or 36-218	Probability Theory for Computer Scientists	
or 36-219	Probability Theory and Random Processes	
or 36-220	Engineering Statistics and Quality Control	
or 36-225	Introduction to Probability Theory	
or 36-247	Statistics for Lab Sciences	
73-265	Economics and Data Science	9

Economics Electives (27 Units)

Students must take three economics elective courses. Economics elective courses are those numbered 73-3xx through 73-49x. Students are encouraged to work with their economics advisor to structure a set of courses to meet these requirements based on their particular interests, subject to course availability.

Economics Policies and Procedures

Course double counts

Students cannot double count courses within the Economics curriculum. When choosing to double-count courses between Tepper and other academic departments, the double-count policies are determined by the other academic department for a minor, additional major, and/or dual degree. There are no double-counting restrictions between the minor and the student's home college general education requirements.

Non-Tepper students earning a minor, additional major, or dual degree in Economics must adhere to the policies listed in the catalog for double counting courses. Students pursuing multiple Tepper minors cannot double count beyond one course across the minors. There are no double-counting restrictions between the minor or additional major and the student's home college general education requirements.

External Transfer Credit

Courses taken at higher education institutions outside of Carnegie Mellon can be considered for transfer credit through the Tepper School course equivalency process.

BA in Economics: May transfer a maximum of 18 units of economics elective course credit;
 BS in Economics: May transfer a maximum of 18 units of economics elective course credit;
 BS in Economics and Math: May transfer a maximum of 9 units of economics elective course credit;
 Additional Major in Economics: May transfer a maximum of 18 units of economics;
 Minor in Economics: May transfer a maximum of 18 units of economics elective course credit.

FIRST YEAR ACADEMIC ADVISING

First-year students interested in economics begin as Dietrich College students and are assigned a Dietrich College Academic Advisory Center (<http://www.cmu.edu/hss/advisory-center/>) (AAC) advisor. While the AAC advisors are the advisors of record until students formally declare their majors, students who are considering majoring in economics are encouraged to speak with the Tepper School Economics advisors so that they will have access to program resources, advising, and the community of faculty, staff, and students.

MINIMUM GRADE STANDARD

All economics courses (73-xxx and higher) counting towards an economics degree must be completed with a grade of "C" or higher. Students who fail to receive a grade of "C" or better in an economics course prerequisite will be dropped or not permitted to enroll in the associated economics course.

senior Experience

The senior experience curriculum requirement can be met through completion of 73-497 Senior Project or the honors thesis. The senior project course 73-497 can be an upper-level economics elective if students are completing an Honors Thesis and earning the BA in Economics, BS in Economics, BS in Economics and Math, or BS in Economics and Politics. 73-497 does not count as an upper-level economics elective for students pursuing the BS in Economics and Statistics.

Transferring into Economics

The Economics program accepts applications for transfer admission from any academic institution outside of Carnegie Mellon University on a limited basis. Students interested in transfer should contact Carnegie Mellon's Office of Admission.

The program also accepts applications for a major change from current Carnegie Mellon students who are in other academic programs to begin in either the fall or spring semester. To be considered, a student must have successfully completed a Carnegie Mellon math course required in the economics program (21-256 Multivariate Analysis 21-256 Multivariate Analysis 21-254 Linear Algebra and Vector Calculus for Engineers 21-254 Linear Algebra and Vector Calculus for Engineers or 21-259 Calculus in Three Dimensions 21-259 Calculus in Three Dimensions) and 73-102 Principles of Microeconomics or 73-104 Principles of Microeconomics Accelerated 73-104 Principles of Microeconomics Accelerated and 73-103 Principles of Macroeconomics. The application also requires a resume and personal statement. CMU students interested in changing to a Tepper major must complete the internal transfer application by the deadline which is always the last day of class in the semester preceding the desired semester for transfer. Successful transfer is limited by space.

Faculty

LAURENCE ALES, Associate Professor of Economics – Ph.D., University of Minnesota; Carnegie Mellon, 2008-

SERRA BORANBAY AKAN, Assistant Teaching Professor of Economics – Ph.D., Northwestern University; Carnegie Mellon, 2013-

JAMES A. BEST, Assistant Professor of Economics – Ph.D., University of Edinburgh; Carnegie Mellon, 2018-

DAVID CHILDERS, Assistant Professor of Economics – Ph.D., Yale University; Carnegie Mellon, 2016-

KAREN B. CLAY, Professor of Economics and Public Policy, H. J. Heinz III College – Ph.D., Stanford University; Carnegie Mellon, 1998-

ROBERT M. DAMMON, Richard C. Green Professor of Financial Economics – Ph.D., University of Wisconsin; Carnegie Mellon, 1984-

KENNETH B. DUNN, Professor of Financial Economics, Emeritus – Ph.D., Purdue University; Carnegie Mellon, 1979-

DENNIS N. EPPLER, Thomas Lord University Professor of Economics – Ph.D., Princeton University; Carnegie Mellon, 1974-

SELMAN EROL, Assistant Professor of Economics – Ph.D., University of Pennsylvania; Carnegie Mellon, 2016-

CHRISTINA FONG, Senior Research Scientist in Social and Decision Sciences, Dietrich College of Humanities and Social Sciences – Ph.D., University of Massachusetts; Carnegie Mellon, 2001-

JOHN GASPER, Associate Teaching Professor of Economics – Ph.D., Carnegie Mellon University; Carnegie Mellon, 2010-

MARTIN GAYNOR, E.J. Barone University Professor of Economics and Health Policy, H. J. Heinz III College – Ph.D., Northwestern University; Carnegie Mellon, 1995-

BURTON HOLLIFIELD, Associate Dean, Undergraduate Programs; PNC Professor of Finance; Professor of Financial Economics – Ph.D., Carnegie Mellon University; Carnegie Mellon, 1999-

KARAM KANG, Associate Professor of Economics – Ph.D., University of Pennsylvania; Carnegie Mellon, 2012-

ALEXEY KUSHNIR, Associate Professor of Economics – Ph.D., Pennsylvania State University; Carnegie Mellon, 2014-

FINN KYDLAND, The Richard P. Simons Distinguished Professorship; University Professor of Economics, Emeritus; Nobel Laureate (2004) – Ph.D., Carnegie Mellon University; Carnegie Mellon, 1977-

REBECCA LESSEM, Associate Professor of Economics – Ph.D., University of Wisconsin-Madison; Carnegie Mellon, 2011-

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

ROBERT A. MILLER, Richard M. Cyert and Morris DeGroot Professor of Economics and Statistics – Ph.D., University of Chicago; Carnegie Mellon, 1982-

NICHOLAS Z. MULLER, Professor of Economics, Engineering, and Public Policy – Ph.D., Yale University; Carnegie Mellon, 2017-

ANH NGUYEN, Assistant Professor of Economics – Ph.D., Columbia University; Carnegie Mellon, 2018-

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

MARGARITA PORTNYKH, Distinguished Service Professor of Economics – Ph.D., Clemson University; Carnegie Mellon, 2018-

MARYAM SAEEDI, Assistant Professor of Economics – Ph.D., University of Minnesota; Carnegie Mellon, 2016-

ALI SHOURIDEH, Associate Professor of Economics – Ph.D., University of Minnesota; Carnegie Mellon, 2016-

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

CHESTER S. SPATT, Pamela R. and Kenneth B. Dunn Professor of Finance – Ph.D., University of Pennsylvania; Carnegie Mellon, 1979-

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

ARIEL ZETLIN-JONES, Associate Professor of Economics – Ph.D., University of Minnesota; Carnegie Mellon, 2012-