Overview
This course provides an introduction to theory and data designed to meet the needs of students interested in economic science. It provides an introduction to consumer choice, the theory of the firm and general equilibrium models, with an overview of the main results and tools used in these subjects, both directly and indirectly as used in a variety of fields. This includes analysis of consumer and producer decisions, partial and general equilibrium analysis, insurance, the welfare theorems and failures of these theorems as with externalities but with resolutions, contract theory and mechanism design, policy analysis, the content of theory for data, and the design of media of exchange as with Bitcoin and markets made possible by distributed ledgers.

If you’ve had an economics class before, you’re probably used to the following drill: learn some theory; if time permits, consider some stylized evidence that may or may not test the theory; repeat. That’s not what we’ll be doing in 14.04. The purpose of theory is to help us to think about how the world actually works. We’re going to test them and learn from these tests, both when the data confirm the theory and when they reject it. John Maynard Keynes wrote, “Economics is a science of thinking in terms of models, joined to the art of choosing models which are relevant.”

The Econometric Society and the Cowles Foundation framed economics as a science running in the laboratory of model economies. So, we are interested in inference, how do we measure, how do we estimate models, how to make welfare statements for actual policies as implemented and counter factual policies which might be undertaken.

In sum the class is organized around two intertwined themes:

1. Economic theory: what does it predict, and in what ways is it useful?
2. Empirical applications: Economic theory is a way of organizing facts and interpreting and patterns in the world. This class will use data to test theory and use theory to interpret data.
Prerequisites
This is an intermediate course in microeconomic theory and its application to real world phenomena and policy problems. The class assumes proficiency with economic theory at the 14.01 level as well as multivariate calculus. It is also quite helpful if you have taken some linear algebra, statistics or econometrics and are somewhat familiar with basic notions algorithms and computing, but for those who are not familiar with these additional tools, the TAs will provide a primer or fill in gaps for this material.

Textbooks
All class readings including relevant textbook chapters will be available on the class website. The four books listed at the top of the reading list will also be on reserve in the MIT library.

Required readings
Each lecture has an associated set of readings listed on the class schedule. These readings will be featured in lectures, exams and problem sets. If a reading is marked required, with *, you are responsible for it. For professional papers as opposed to textbook chapters, here are some guidelines:

a) What is the paper’s research question?

b) What methodology is used to answer the question (e.g., an experiment, a quasi-experiment, a set of correlations, etc.)?

c) What are the key findings?

d) What is the economic interpretation of these findings?

Recommended readings
You will find a number of recommended readings on the syllabus for your education and entertainment. These papers should be useful—and in many cases fun—but you will not be tested on their content.

Class attendance
14.04 is not a by-the-book micro-theory class. A significant portion of the class will focus on applications from empirical and theoretical papers. It will be difficult to master this material unless you attend both the lectures and recitations. Thus you will have name cards and attendance will be part of your grade.

Laptop/tablet/phone use during class
I strongly discourage you against texting, tweeting, emailing, blogging, posting, browsing, Instagramming, Googling, shopping, etc., during class. It wastes your class-time—since you won’t learn anything during lecture if you’re distracted. And it’s frequently distracting to your classmates. I’m sympathetic to your desire to use your laptop or tablet to view the online lecture notes and take notes of your own. I would encourage you instead to print out the online lecture notes the night before class, and to write your notes directly on the paper lecture notes. In my experience, it’s still faster and more accurate to take notes in class using paper and pen than to mark up a PDF file on your device. Of course, you may be faster with a tablet than I am. When I walk around the class during lecture, I will see what’s on your screen. If I notice that you are engaging in distracting technology use, I will ask you to close it down or take it elsewhere.
Grading
The class is not graded on a curve. It’s possible for everyone to do well, and I’d be happy to have a reason to assign mostly A’s. That said, if you make minimal effort, you will probably receive a C or worse. If I think you are headed for a D or F, I will try to warn you before the drop date.

Here are the grading mechanics:

- Best four out of five problem set grades: 30%
- Three exams: 60%
- Class attendance 5% and participation including pop questions: 5% = 10% total

Problem sets (30%):  
I will assign five problem sets. Problem sets typically include a set of pure theory questions and a set of application questions, often based on readings. You must submit your problem sets in PDF form using Stellar. Late problem sets will not be accepted. No exceptions. In order to accommodate unanticipated events, illness, or conflicts in your schedule, I will automatically drop the problem set with the lowest score (for example, the one that you don’t hand in). You may collaborate with other students on problem sets, but you must write up all solutions independently and in your own words. If you submit a problem set that is a direct copy of another student’s, this will be considered academic dishonesty and will be dealt with accordingly. If you are stuck on a question, feel free to come to either of the TA’s office hours. We will do our best to point you in the right direction, but we will not fully answer the question for you. This is to ensure that you have adequate opportunity to master the material. After the problem set has been graded and handed back we are happy to go over solutions with you if they are still unclear.

Three exams (20% each, 60% total)  
There will be two in-class, closed-book exams of 80 minutes in length. There will also be a closed book final exam during the finals period. You will have 120 minutes to complete the final. You should have extra time to help you to relax. It will count the same as each of the prior two exams. The date of the final exam is set by the MIT Registrar’s office, which strategically withholds announcing the exam dates until late in the semester so that you cannot pick your classes based on final exam schedules. Each exam will tend to focus on the new material since the previous exam, although of course you will need to understand the older material to apply the new material. The final will be comprehensive, from the beginning of the class, as the material is cumulative. The exams will be based on the lecture notes, problem sets, assigned readings, classroom discussion and TA sessions.

Performance on exams is highly correlated with performance on problem sets. If you miss an exam for an excused reason, I will offer a written makeup or an oral exam on the blackboard. Students typically find oral exams painful. But, I will not write a new exam for only one or two students—so, an oral exam is reasonably likely.

Class participation (10%)  
If you participate regularly in class, I will learn your name and count your participation towards
your grade. I also cold call in class to help overcome your natural shyness and ward off your natural sleepiness. Though only 10%, from past experience this component has a lot of variation across students and matters significantly for final grades.

Questions regarding grading
Questions on grading should go first to the grading TA. Your grading TA must receive questions on exam or p-set grades no more than one week after the assignment/p-set has been handed back. To have the grading reconsidered, take the following steps:

1) Take the material to the grading TA along with a note describing specifically what you believe the problem to be. (Make a copy of your note and the problem set/exam for your own safekeeping.) Leave this along with your email address.
2) After the TA has contacted you by email, schedule a face-to-face meeting to discuss the question.

This procedure is designed to facilitate fair and consistent grading. Please note that regrade requests for problem sets and exams should be submitted only for obvious grading errors (e.g. adding up points incorrectly, failing to see a correctly answered question, etc.) We are very unlikely to honor requests of the form “I think I deserve more points on this question because...” Furthermore, note that if you do request a regrade, we reserve the right to regrade your entire problem set or exam. Therefore, your final grade may increase or decrease as a result of the regrade request.

Getting help outside of class
If you have questions on the class material or problem sets, there are four ways to get help:

1. Use the class web site. We’ll have threaded discussions there (monitored by TAs and professor as needed) for all problem sets and class topics. You should get a pretty quick response—and a good answer.
2. Drop in during TA office hours.
3. Drop in during Prof. Townsend’s office hours.
4. Ask question during recitation (and in class as appropriate).

Please do not send us your class-related questions by email (except for personal class-related matters). The Stellar wiki is a more efficient way for us to communicate with you, and it is also benefits your classmates. If you email class related questions to us, we may respond, but we will be irritated.

Schedule
Class topics and readings are subject to revision. It is possible that some topics and readings will be dropped if time runs short.
A Brief Guide to this Reading List

Required readings are marked by an asterisk (*). Most readings can be found on the Stellar course website. We use the following acronyms and shorthand:


**Lectures 1–4, Introduction: Motivation for the Course, Basics for Studying Real Economies**


Ragnar Frisch (1926) "On a Problem in Pure Economics: Translated by JS Chipman." Preferences, Utility, and Demand: A Minnesota Symposium. 1926."


*Medville, Chapter 1 “Introduction”

*Emerging Thailand: The Spirit of Small Enterprise
https://www.youtube.com/watch?v=b_rEmiu71Pk


Lecture 3: Consumer Choice: Consumption Set, Rational Preferences, Utility Functions, Some Properties of Preferences, Indifference Curves, Marginal Rates of Substitution, Example Indifference Curves and Functions; Application: Utility Maximization subject to Budget,
first order conditions, Major Method: General Constrained Optimization and Lagrangian Programs. Cobb-Douglas and expenditure shares

*Kreps Appendix A “Constrained Optimization”

*NS Chapter 3 “Preferences and Utility”

*NS Chapter 4 “Utility Maximization”

Lecture 4: Technology, Production Possibilities Sets and Properties, Returns to Scale, Aggregation over Production Sets; Major Application: Profit Maximization, Properties of Profit function, Hotelling Lemma, Isoquants, Cost Minimization and properties of cost curves; Method: Envelope Theorem. Illustrative example of basics onto modern systems: Input/Output and Google Search

*Kreps 7 “The Neoclassical Firm”

Lectures 5-9, Pareto Optimality; Risk Sharing and Dynamics; Application to Village Economies; Social Networks and Supply Chains in Villages and in the US and Japan

Lecture 5: Pareto Optimal Allocations and Model Prediction: Pareto Optimality, Pareto Dominance and Pareto Set, Utility Possibilities Frontier, Welfare function and a Programming Problem for determination of Optimal Allocations; Method: Separating Hyperplanes and theorems; Leading Example: Uncertainty and example in state space of the optimal allocation of risk with implications for data

*Kreps 5.1-4 (up to and including “the production and allocation of private goods”)

Lecture 6: Risk sharing: Village India with ex post consumption and income data, ex ante Land Division in the Medieval Village Economy

*NS Chapter 8 “Expected Utility and Risk Aversion”

*Townsend, R.M. “Risk and insurance in village India.” *Econometrica*, 62(3), 539-591

Medville, Chapter 2 “Uncertainty and Land-holding Patterns”

Lecture 7: Dynamic Optimization—Application: Storage, Seed and Starvation in Medieval Villages; Methods: Dynamic Programming, Value Functions

*Varian 19.1-3 “Time”
Lecture 8: Risk Sharing Applications, continued: in Thai Villages, Risk and Return in Production Choice, using data on production and consumption, Idiosyncratic and aggregate risk; the Role of Gifts, Social Networks and the Transmission of Shocks in Villages: Informal Networks in US city neighborhoods, Fukushima Shock and Supply Chains in Japan


DLT: Section on “e-Payments and e-messages”

---

**Lectures 10-11, Private Information, Contracts, Mechanism Design**

Lecture 10: Contracts and Mechanism Design, Concepts and Methods: Motivation from rents and spatially scattered Medieval estates; the Revelation Principle, Optimal Multi-period Contracts and Inter-temporal Tie-ins, Costly State Verification and Audits; the Space of Lotteries, Smart Contracts on Distributed Ledgers, Implementation of Mechanism Design

*Medville, Chapter 5 “Rentals with Unobserved Outputs”

DLT: Section on “Contract theory and smart contracts: Mechanism design”

Lecture 11: Contracts and Mechanism Design continued, Applications: occupation choice and business starts, distinguishing obstacles (limited commitment versus moral hazard), rural versus urban Thailand and a battery of tests across information/financial regimes, linear programs to compute solutions to models and maximum likelihood for estimation in data


Lectures 12-13, Walrasian Equilibrium As Prediction; Application to International Trade, Tariffs, Real and Financial Liberalization


*Kreps 6.1 “Pure Exchange and Price Equilibrium”

*MWG 15.D, “The 2 X 2 Production Model”

Lecture 13: Creating village, regional and national income and product accounts, GDP and NI-PA; Flow of funds and balance of payments; Openness and prices in regional Thailand; Model of a small open economy with obstacles to trade, Calibration of the Model, Model-predicted and actual data compared at both village-level and individual-level; parallels for US economy: state-level trade and financial flows and impact of the China shock in the US


Lectures 14-16, Prediction with Alternative Concepts, Core and Nash Bargaining; the Fundamental Welfare Theorems and Market Failures, and Contract Theory in Extended Commodity Spaces

Lecture 14: Model Prediction Continued: Core, Nash Bargaining; inter-relationships among Pareto Optima, Core, Nash Bargaining and Walrasian Equilibrium, equivalence or lack thereof; N-replication economies, finite and continuum agent economies; Applications: the core in industrial organization and an example of non-existence, Nash bargaining in Thai villages

Telser, Lester G. “The Usefulness of Core Theory in Economics” *Journal of Economic Perspectives*, Volume 8 (2) – May 1, 1994


Lecture 15: Fundamental Welfare Theorems: Competitive equilibria are Pareto optimal; any Pareto Optimum can be supported as equilibrium with Transfers; Sufficient Assumption and proofs, with first order conditions and with supporting hyperplanes; finite dimensional Euclidean Space and extension to Valuation Equilibria in more general spaces

*Kreps 6.3 “The Efficiency of a General Equilibrium”*


Lecture 16: Welfare Theorems in Extended Commodity Space—Application to incentive constrained contracts; the space of lotteries; welfare theorems extensions and qualifications


**Lectures 17-18, Existence of Equilibria: Walras, Nash and Applications**

Lecture 17: Existence of Competitive Equilibria: Fixed Point Theorems, Negishi Algorithm Using second welfare theorem, Gross Substitutes, Recent Computer Science Contributions

*Kreps 6.4 “Existence and The Number of Equilibria”*


Lecture 18: Existence of Nash Equilibria: Nash equilibria in Mixed Strategies; Application to Financial Markets


Asu Ozdaglar’s Lecture material from Course 6.254. “Existence of a Nash equilibrium”


Lectures 19-21, Microeconomics and Macro Aggregation, Theory and Data; Welfare Statements, Identification and Falsification

Lecture 19: Consumer Behavior, Demand Functions, Homogeneity, Income and Substitute Effects, Engle Curves and Giffin Goods, Compensated (Hicks) and Uncompensated (Marshall) Demands, a first look at the Slutsky Equation, indirect utility and the expenditure function, Duality of Utility Maximization and Expenditure Minimization, properties of the expenditure function and Hicksian demand

*NS Chapter 5 “Income and Substitution Effects”


Lecture 20: Gorman Aggregation, the positive and normative representative consumer for prediction and welfare respectively, indirect utility and properties, Roy’s identity, Gorman Polar forms, Linear expansion paths and data, critical review of traditional and new founda-
Lectures 21-23, Failures of the Welfare Theorems and Some Market Structure Remedies

Lecture 22: Failure of the Second Welfare Theorem – Nonconvexity; Failure of the First Welfare Theorem - Local Satiation, Pollution but Fixed with Markets in Rights, Externalities generally, rights for assignment to others, Infinite Horizon and Infinite wealth


Lectures 24, Bitcoin, Blockchain, and Distributed Ledgers

Lecture 24: Bitcoin Values, Overlapping Generations and Bubbles, Lessons from Monetary Theory, Efficiency questions, is the bubble large enough in actual economies, the value of money as from cash-in-advance, removing indeterminacy in practice, a fintech application in Southeast Asia, Commitment and a Digital Reserve Bank, activist monetary and token policy
DLT, Section on “Token Valuation”


