14.04 INTERMEDIATE MICROECONOMIC THEORY

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Grading TA: Ali Palida, apalida@mit.edu

Recitation TA: Michael B. Wong, mbwong@mit.edu

Hours

Lecture: Mondays and Wednesdays 2:30-4:00pm, E51-372
Recitation: Fridays 11am-12pm, E51-085
Professor Townsend office hours: Mondays after class, 4-5:00pm, E52-538
Ali Palida office hours: Wednesdays after class 4-5:00pm, E52-416
Michael Wong office hours: Friday after recitation 12-1:00pm, E52-516

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 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, including the basics of real analysis. 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. For those who are not familiar, 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 feature in lectures, exams and problem sets. If a reading is marked required, with *, you are responsible for it. For professional papers as opposed to text 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. 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 per se. 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 five out of six problem set grades: 30%
- Three exams: 60%
- Class attendance and participation including pop questions: 10%

Problem sets (30%):
I will assign six 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, but it won't have more material (or count for more) than the prior two exams. The extra time is only to help you to relax. 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 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 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.

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:

Kreps: Kreps, David M. 1990. *A Course in Microeconomic Theory.* Princeton: Princeton University Press

Medville: Townsend, Robert M. 1993. *The Medieval Village Economy: A Study of the Pareto Mapping in General Equilibrium Models.* Princeton: Princeton University Press.

NS: Nicholson, W., and C.M. Snyder. 2016. *Microeconomic Theory: Basic Principles and Extensions.* Boston: Cengage Learning.

Varian: Varian, Hal. 1992. *Microeconomic Analysis.* Third Edition. New York: Norton.

Lectures 1-3, Introduction and Motivation for the Course

Lecture 1: Economics Science – overall motivation and objectives of the course: Economics as Experiments, Models as Fully Articulated Systems and Laboratories, Prediction and Validation, Theory and Measurement Unified, Actual and Counterfactual Policy and Welfare, Big Data, Computation, and Review of the Syllabus

*Koopmans, T., 1947. "Measurement without theory." *The Review of Economics and Statistics*, 29(3): 161-172.

Varian, H., 2014. "Big data: new tricks for econometrics." *Journal of Economic Perspectives*, 28(2): 3-28.

Lucas Jr, R.E., 1980. "Methods and problems in business cycle theory." *Journal of Money, Credit, and Banking*, 12(4): 696-715.

Lecture 2: General Equilibrium Environments – the language for specifying economies: Commodity Space, Commodity Sets, Endowments, Preferences, Production sets (also a preview of models used in upcoming lectures)

*NS Chapter 2 "Mathematics for Microeconomics"

*NS Chapter 3 "Preferences and Utility"

*Kreps 7.1-2 "Models of the Firm's Technological Capabilities" and "The Profit Function" (only up to and including "Analysis from Intermediate Micro")

*Kreps 5.1 "The Problem"

Townsend, R.M., 1988. "Models as economies." *The Economic Journal*, 98(390): 1-24.

Lecture 3: Village Economies, Rural/Urban Configurations, Cross U.S. State Comparisons, Settings for Theory/Data Validation: The Medieval Village Economy (historical records), Northern Thai Village Economies (field research methods); Townsend Thai project (data collection and long panels, from monthly micro to within-province variation), US States (trade and financial flows)

*Medville, Chapter 1 "Introduction"

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

Townsend R. 1995. "Financial Systems Northern Thai Villages." *Quarterly Journal of Economics*. Vol. 110, No. 4: 1011 -1046

Townsend R., Sombat Sakunthasathien, and Rob Jordan. 2013. *Chronicles from the Field: the Townsend Thai Project*. MIT Press.

Lectures 4-7, Pareto Optimality; Risk and Dynamics; Application to Village Economies, Social Networks, and the US

Lecture 4: Pareto Optimal Allocations and Model Prediction: concept defined, Pareto frontier, a programming problem for determination of optimal allocations, example in state space of the optimal allocation of risk

*Kreps 5.2-4 (up to and including "the production and allocation of private goods")

Lecture 5: Risk sharing Applications: 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 6: Risk Sharing Applications, continued: in Thai Village, Risk and Return in Production, using data on production and consumption; Social Network and sharing using measured links

*Samphantharak, K., and Townsend, R.M. 2018, "Risk and return in village economies." *American Economic Journal: Microeconomics* 10 (1): 1–40, 2018.

Kinnan, C., and Townsend, R.M., 2012. "Kinship and financial networks, formal financial access, and risk reduction." *The American Economic Review*, 102(3): 289-293.

Lecture 7: Dynamic Optimization--Storage, Seed and Starvation in Medieval Villages, household profiles with Life Cycle Maximization for financial planning in US and Thai Villages

*Varian 19.1-3 "Time"

*Medville Chapter 3 "Storage as Risk Reduction"

Lectures 8-9, Private Information, Contracts, Mechanism Design

Lecture 8: Contracts and Mechanism, Concepts and Methods: Motivation from rents and spatially scattered estates; Revelation Principle, Optimal Multi-period Contracts, Costly State Verification; Space of Lotteries

*Medville, Chapter 5 "Rentals with Unobserved Outputs"

Lecture 9: 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

*Karaivanov Alex, Anna L. Pauson, and Robert M. Townsend. 2006 "Distinguishing Limited Liability from Moral Hazard in a Model of Entrepreneurship." *Journal of Political Economy* 114 (1): 100-144.

Karaivanov, Alexander. 2001. "Computing Moral Hazard Programs with Lotteries Using Matlab." Mimeo.

Lectures 10-11, Quasi Natural Experiments, Prediction and Validation, Actual and Counterfactual Impact of Policy and Welfare

Lecture 10: Quasi Natural Experiments, Prediction and Model Validation, Counterfactual policy predictions and Welfare: Local, for Village Fund intervention, how to construct a model, understanding mechanism and pathways, costly state verification and village networks again here, corruption and room for better design

*Kaboski, Joseph and Robert M. Townsend. 2011. "A Structural Evaluation of a Large-Scale Quasi-Experimental Microfinance Initiative." *Econometrica* 79(5): 1357-1406.

Lecture 11: Quasi Natural Experiments continued: Regional and National Trade and Tariffs, actual and counterfactual regionalism and distortions in real and in financial flows, partial

equilibrium; measurement, from individual corporate financial accounts to village and state NIPA accounts; regional flow of funds in development and in the US

*Paweenawat, Archawa and Robert M. Townsend. 2018. "The Impact of Regional Isolationism: Disentangling Real and Financial Factors." Working paper.

Samphantharak, K. and Townsend, R.M., 2009. *Households as corporate firms: an analysis of household finance using integrated household surveys and corporate financial accounting.* Econometric Society Monographs (Book 46). Cambridge University Press.

Moll, B. R. M., Townsend and V. Zhorin. 2017. "Economic development, flow of funds, and the equilibrium interaction of financial frictions." *Proceedings of the National Academy of Sciences* 114(24): 6176-6184.

Dawkins, C., T.N. Srinivasan and J Whalley, 2001. Chapter 58 - calibration. In Heckman, James J., and Edward E. Leamer (Eds) *Handbook of econometrics. Vol. 5.* Amsterdam: North Holland, pp. 3653-3703

Lectures 12-15, Prediction with Alternative Concepts; Welfare Theorems

Lecture 12: Prediction Continued: Walrasian Equilibrium, Core, Nash Bargaining; interrelationships, equivalence or lack thereof, finite and continuum agent economies

* Hildenbrand, W. and A.P. Kirman, *Introduction to Equilibrium Analysis: Variations on themes by Edgeworth and Walras*. Oxford: North Holland, 1976. Ch. 1, pp. 1-33.

*Kreps 6.1 "Pure Exchange and Price Equilibrium"

Lecture 13: Fundamental Welfare Theorems: Competitive equilibria are Pareto optimal; any Pareto Optimum supported as equilibrium with Transfers; Sufficient Assumption and proofs; finite dimensional Euclidean Space and Valuation Equilibria in more general spaces

*Kreps 6.3 "The Efficiency of a General Equilibrium"

Debreu, G., 1954. "Valuation equilibrium and Pareto optimum." *Proceedings of the National Academy of Sciences* 40 (7): 588-592.

Lecture 14: Welfare Theorems in "Hyperspace"—Applications: indivisible labor and overtime; incentive constrained contracts; the space of lotteries; welfare theorems extensions and qualifications

*Prescott, E., and R.M. Townsend. 1984. "General competitive analysis in an economy with private information." *International Economic Review* 25 (1): 1-20

Rogerson, R., 1988. "Indivisible labor, lotteries, and equilibrium." *Journal of Monetary Economics*, 21 (1): 3-16.

Hansen, G.D., 1985. "Indivisible labor and the business cycle." *Journal of Monetary Economics* 16: 309-327.

Lecture 15: Existence of Competitive Equilibria: Fixed Point Theorems, Computation and Scarf Algorithm, Recent Computer Science Contributions, Negishi Algorithm Using second welfare theorem, Nash equilibria in mixed strategies

*Kreps 6.4 "Existence and The Number of Equilibria"

Scarf, H.E., 1982. "The computation of equilibrium prices: an exposition." In Arrow, Kenneth J., and Michael D. Intriligator (Eds.) *Handbook of mathematical economics. Volume 2*. Amsterdam: North-Holland, pp. 1007-1061.

Negishi, T., 1960. "Welfare economics and existence of an equilibrium for a competitive economy." *Metroeconomica*, 12 (2-3): 92-97.

Jehle, Geoffrey A. and Philip J. Reny. 2011. *Advanced Microeconomic Theory*. Third Edition. New York : Financial Times/Prentice Hall. Chs. 7.1-7.2.2 "Strategic Decision Making", "Dominant Strategies", "Nash Equilibrium".

Lectures 16-19, Microeconomics and General Equilibrium Theory and Data; Identification and Falsification; Welfare

Lecture 16-17: Gorman Aggregation and Welfare, positive representative consumer for prediction, indirect utility and properties of the value function, Roys identity, Gorman Polar forms, Linear expansion paths and data, critical review of traditional and new foundations of macroeconomics, Normative representative consumer for welfare and Gorman Aggregation

*Daron Acemoglu. Introduction to Modern Economic Growth. Princeton: Princeton University Press. Chapter 5.2. "The Representative Household", 218-226

Lecture 18: Consumer Behavior, Elasticities, and another take on Welfare –the expenditure function, Hicksian and Marshallian demand, expenditures as a measure of welfare, welfare evaluation of price changes, Equivalent and Compensating Variation; Consumer Surplus, National Income as measures of welfare and Critiques

*NS Chapter 4 "Utility maximization and Choice"

*NS Chapter 5 "Income and Substitution Effects"

Lecture 19: Identification and Falsification with Data, as applied to Consumer Optimization and General Equilibrium theory, A Unified Approach—Infinite Data and the Slutsky Matrix,

Finite data and Reveled preference Axioms, Afriat's Theorem and testability of Consumer rationality, Convexity not testable, computational considerations, Afriat and Testing GE theory with Finite Data. Falsifiability, income data alone is not enough to test

*Varian 8.1-3 on Slutsky matrix

*Varian 8.5 "Integrability"

*Varian 8.7 "Revealed Preference"

Lectures 20-21, Failures of the Welfare Theorems and Some Market Structure Remedies

Lecture 20: Failure of the Welfare Theorems: First Welfare Theorem, Satiation and Indivisibilities; Failure of the Second Welfare Theorem, non-convexity, pollution. Fixed with cap and trade and more generally, markets in rights

*Arrow, K.J., 1969. "The organization of economic activity: Issues pertinent to the choice of market versus nonmarket allocation." In *The analysis and evaluation of public expenditure: the PPB-system*. Washington DC: Joint Economic Committee, 91st Cong., 1st sess 1, pp. 59-73.

Lecture 21: Internalizing Externalities with Market Design, Platform and Payment externalities, Fire sale Pecuniary Externalities

*Jain, Anil and Robert M. Townsend. 2018. "The economics of platforms in a Walrasian setting." Working paper.

Kilenthong, W., and R.M. Townsend 2016. "A market based solution to resales and other pecuniary externalities." NBER Working Paper 22056.

Lectures 22-25, Bitcoin, Blockchain, and Distributed Ledgers

Lecture 22: Distributed Ledgers, Currency, Bitcoin, E-Payments

*Alvarez, Fernando, Anan Pawasutipaisit and Robert M. Townsend. 2018. "Cash Management in Village Thailand: Positive and Normative Implications." Working Paper.

Jack, William, Tavneet Suri, and Robert Townsend. 2010. "Monetary Theory and Electronic Money: Reflections on the Kenyan Experience." *Economic Quarterly* 96 (1): 83–122

Samphantharak, Krislert, Scott Schuh, and Robert M. Townsend. 2018. "Integrated Household Surveys: An Assessment of U.S. Methods and an Innovation," *Economic Inquiry* 56 (1): 50-80.

Lecture 23: Smart Contracts on Ledgers and Mechanism Design

*Karaivanov, Alexander and Robert M. Townsend. 2014. "Dynamic Financial Constraints: Distinguishing Mechanism Design from Exogenously Incomplete Regimes." *Econometrica* 82 (3) 2014: 887–959.

Townsend, Robert M. 1988. "Information Constrained Insurance: the Revelation Principle Extended." *Journal of Monetary Economics* 21 (2-3): 411-50.

Lecture 24: Distributed Ledgers, Tokens, Bubbles, and Monetary Theory

*Townsend, Robert and Neil Wallace. 1987. "Circulating Private Debt: An Example with a Coordination Problem." In *Contractual Arrangements for Intertemporal Trade*, edited by Edward C. Prescott and Neil Wallace. Minneapolis: University of Minnesota Press, pp 105-20.

*Townsend, Robert M. 1980. "Models of Money with Spatially Separated Agents." In *Models of Monetary Economies*, edited by John Kareken and Neil Wallace. Minneapolis: Federal Reserve Bank of Minneapolis, pp. 265-303

Townsend, Robert M. 1987. "Economic Organization with Limited Communication." *American Economic Review* 77 (5): 954-70.

Ostroy, Joseph M. and Ross M Starr. 1974. "Money and the Decentralization of Exchange." *Econometrica* 42 (6):1093-1113

Abel, Andrew B., N. Gregory Mankiw, Lawrence H. Summers, and Richard J. Zeckhauser. 1989. "Assessing Dynamic Efficiency: Theory and Evidence." *Review of Economic Studies* 56 (1): 1-19

Tirole, Jean. 1985. "Asset Bubbles and Overlapping Generations." *Econometrica* 53 (6): 1499-1528

Manuelli, Rodolfo, and Thomas J. Sargent. 2010. "Alternative Monetary Policies in a Turnpike Economy." *Macroeconomic Dynamics* 14 (5): 727-762