

1.1 – The Tools of Microeconomics

ECON 306 • Microeconomic Analysis • Spring 2022

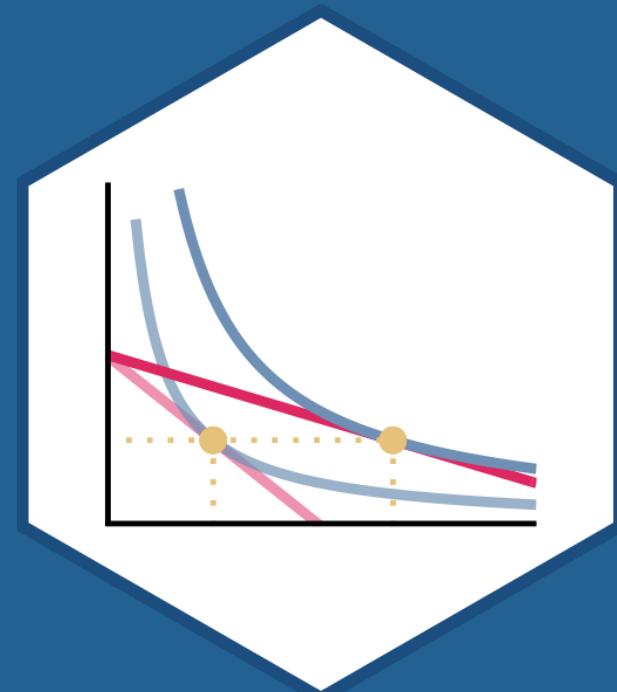
Ryan Safner

Assistant Professor of Economics

 safner@hood.edu

 [ryansafner/microS22](https://github.com/ryansafner/microS22)

 microS22.classes.ryansafner.com



Outline



The Tools of Microeconomics

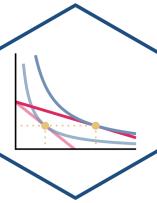
Incentives

Equilibrium

Real Talk: The Math

About This Course

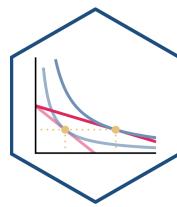
About Me



Edinburgh, 2019

- Ph.D (Economics) – George Mason University, 2015
- B.A. (Economics) – University of Connecticut, 2011
- 6th year teaching at Hood
- Specializations:
 - Law and Economics
 - Austrian Economics
- Research interests
 - modeling innovation & economic growth
 - political economy & economic history of intellectual property

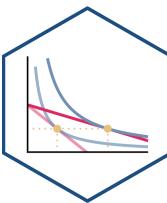
About Me



My face (without a mask), 2021

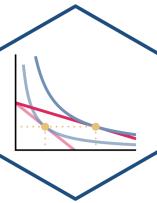
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The Reason I am Busy AF Behind the Scenes

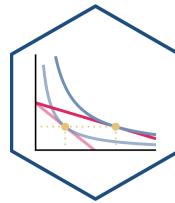


And why I wear a mask.

Micro-economics



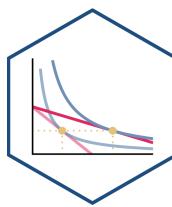
Micro- vs. Macro-economics



- What is “an economy?”
- Where do aggregates (“GDP”, “unemployment”, & “inflation”) come from?
- **Micro:** [modeling] **Choices** and **consequences**
- **Macro:** [modeling] **Systemic interaction** of choosers & **emergent behavior**

A word cloud centered around the term "MACROECONOMICS". Other prominent words include "GROWTH", "INFLATION", "GLOBAL", "FISCAL", "NATIONAL", "PERFORMANCE", "INDICATORS", "BEHAVIOR", and "STRUCTURE". The cloud is composed of various colors and includes many smaller, less frequent terms related to macroeconomics.

Where You Are Now

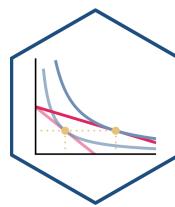


- **Basic concepts** of markets, individuals (consumers & firms), economies:
 - ECON 205: Principles of Macroeconomics
 - ECON 206: Principles of Microeconomics
- **Modeling** markets, individuals (consumers & firms), economies
 - ECON 306: Microeconomic Analysis
 - ECON 305: Macroeconomic Analysis[†]



[†] Required for ECON majors only. Calculus I required.

Economists Speak a Foreign Language...

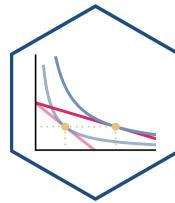


- Terms you “know” from ordinary life mean **very different things** to economists:

Cost, efficiency, welfare, competition, marginal, equilibrium, profit, public good, discrimination, elasticity
- Using these words’ “ordinary” meanings can lead to *wrong* economic conclusions!
- You will need to “**relearn**” the economic meanings of these words



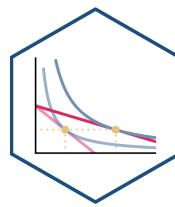
...But You Can Learn It



- You'll need to master a new vocabulary:
 - marginal rate of substitution,
 - marginal cost, consumer surplus,
 - allocative efficiency, externality
- Avoid excessive jargon, but these concepts are useful to explain reality!



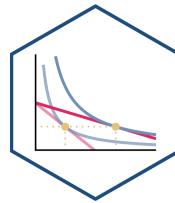
Don't Think You Know It Already!



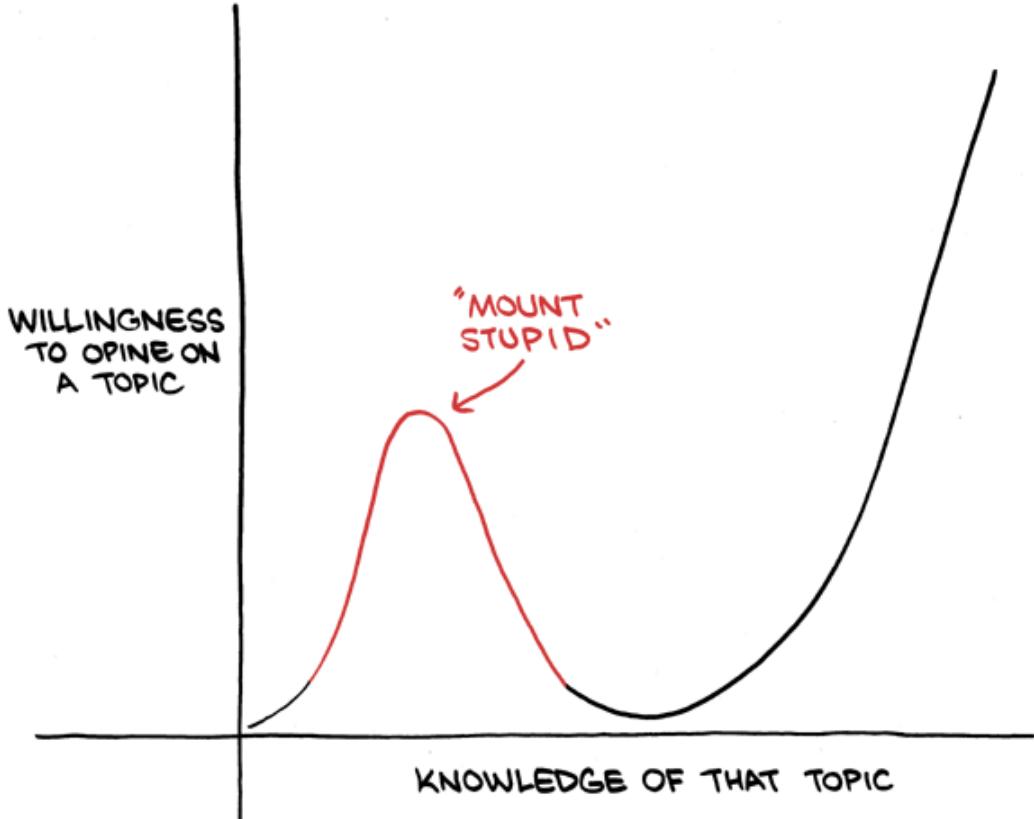
- Everyone thinks they are *already* an economist and can speak this foreign language
- Be humble!
- Economics is *often* common sense, but reached via deep analytical thinking



And Tread Cautiously

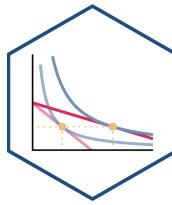


- But be careful, *a little bit of knowledge* is a dangerous thing!
- An application of the famous "Dunning-Kreuger effect" in social psychology



Source: [SMBC](#)

Economics ≠ Business or \$\$\$



Mike Simpson, M.D.

@DrMikeSimpson

Follow



The fact that every person with a PhD in economics is NOT a billionaire should tell you all you need to know about the worth of that particular field of study.

2:25 PM - 2 Jun 2018

213 Retweets 1,035 Likes



236

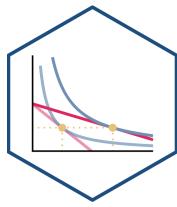
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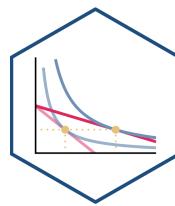
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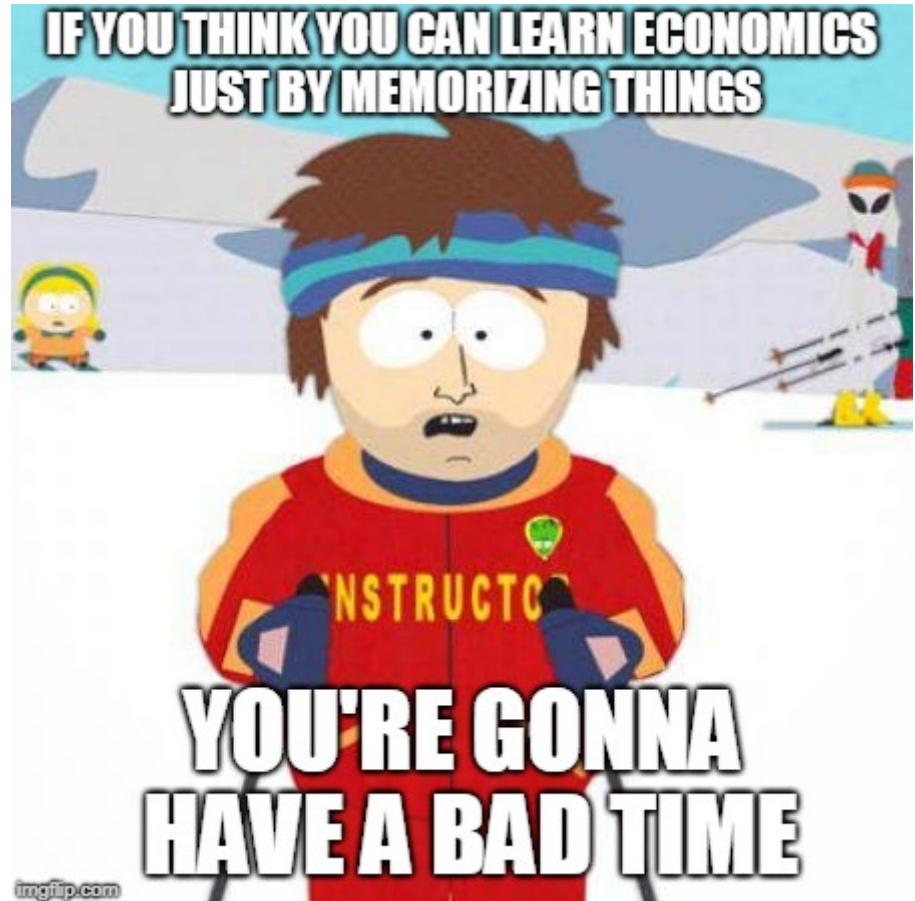
Economics \neq Business or \$\$\$



Economics Can Be Difficult

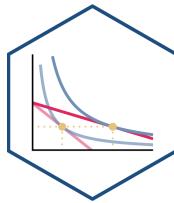


- Economics is hard!
- We are literally retraining and rewiring your brain to see the world in a new way
- If you “don't get it” you can't just try to memorize a bunch of facts



imgflip.com

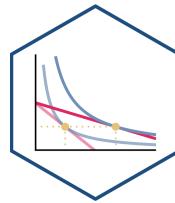
Economics Can Be Difficult



- Not trying to scare you! (I'd rather say this now than after the Exam)
 - **Grades don't reflect your worth as a person!**
- **Comparative advantage:** nobody can be good at everything!
 - I'm awful at accounting, chemistry, etc.



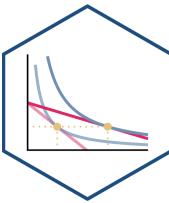
The Uses of Economics



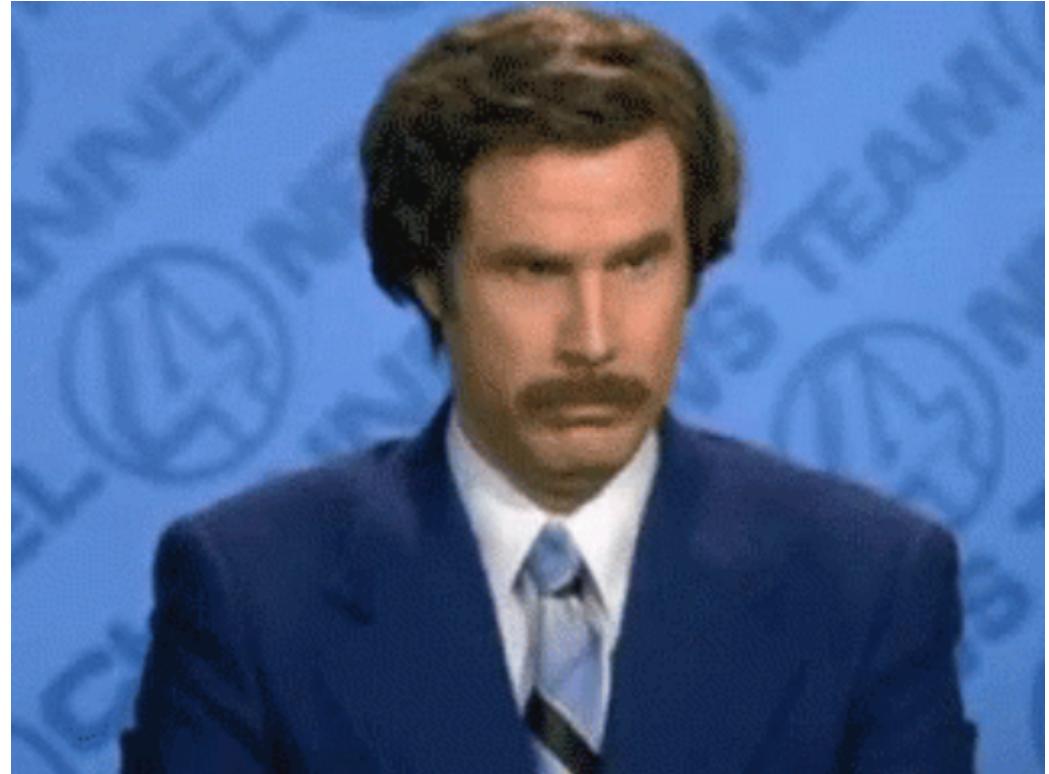
- Most of you will not become professional economists – that's OK
 - Economics is a **liberal art**, useful to you even if it's not your career
- Understand “**how the world works**”

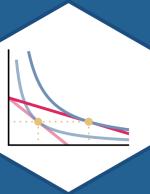


The Uses of Economics



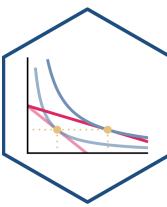
- A great **bullshit-detector**, especially about self-interested, squishy, or political statements
- People love to forget that we have to make tradeoffs
 - “Economics puts parameters on people's utopias”





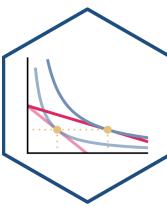
The Tools of Microeconomics

Economics as a *Way of Thinking*



- Economics is a **way of thinking** based on a few core ideas:

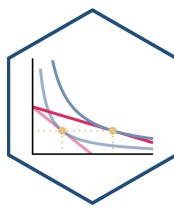
Economics as a *Way of Thinking*



- Economics is a **way of thinking** based on a few core ideas:
- **People respond to incentives**
 - Money, punishment, taxes and subsidies, risk of injury, reputation, profits, sex, effort, morals

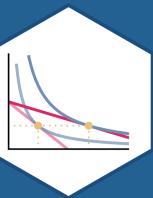


Economics as a *Way of Thinking*



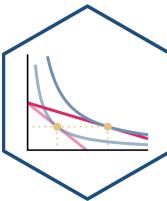
- Economics is a **way of thinking** based on a few core ideas:
- **People respond to incentives**
 - Money, punishment, taxes and subsidies, risk of injury, reputation, profits, sex, effort, morals
- **Environments adjust until they are in equilibrium**
 - People adjust their choices until optimal, given others' actions





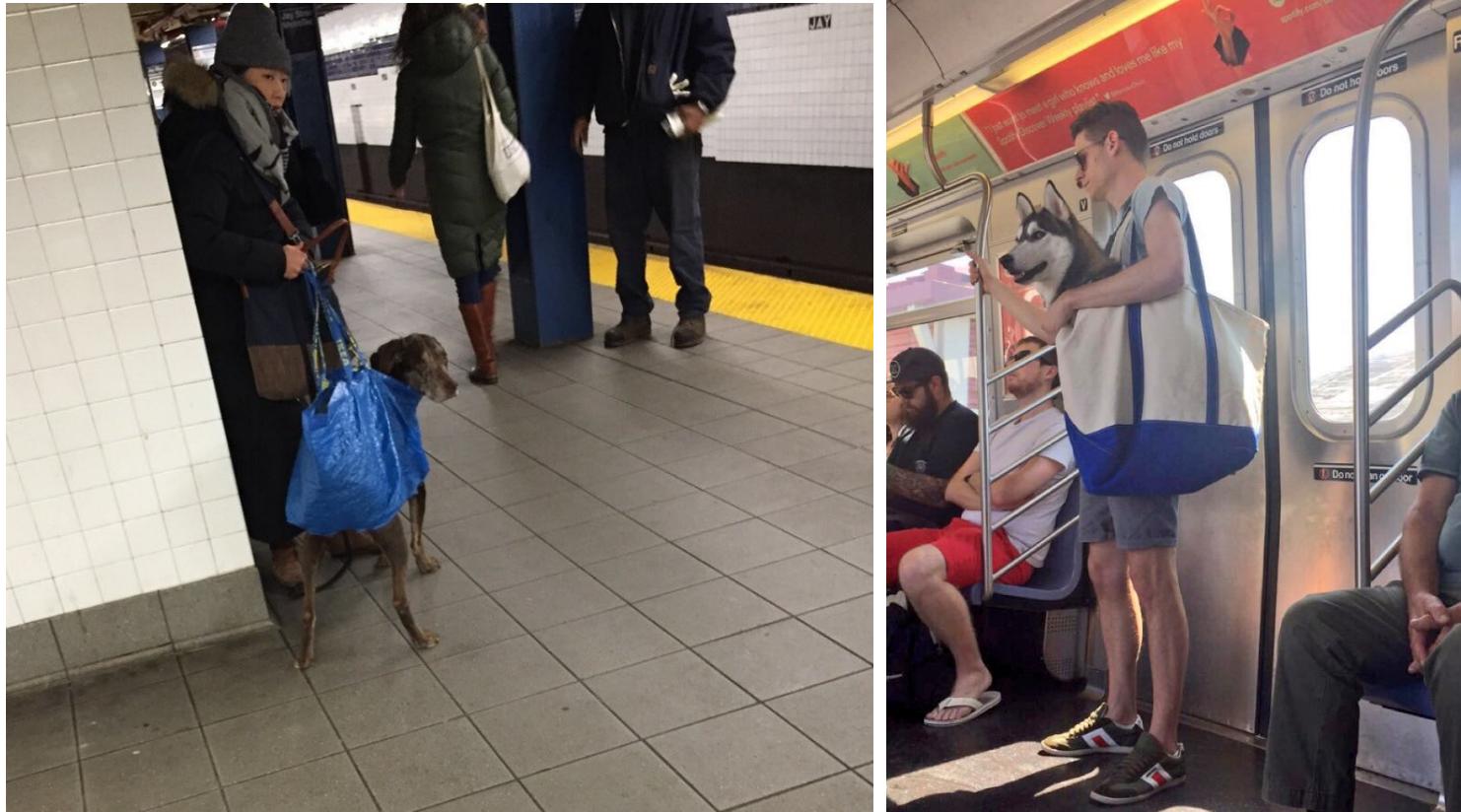
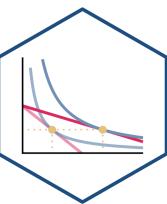
Incentives

Incentives Example: Subway I



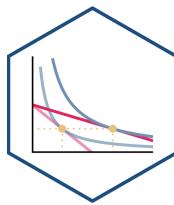
The NYC Subway bans dogs unless they can be "enclosed in a container"

Incentives Example: Subway II



Pictures [Source](#)

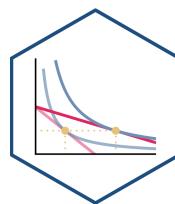
Incentives Example: Rat Bounty



Some governments pay bounties to reduce pest populations such as rats.

Example: Suppose the government were to pay \$250 for every rat tail turned in.

Incentives: Even Dolphins Understand I



Animal behaviour

Why dolphins are deep thinkers

The more we study dolphins, the brighter they turn out to be, writes **Anuschka de Rohan**

Anuschka de Rohan

Wed 2 Jul '03 21.25 EDT

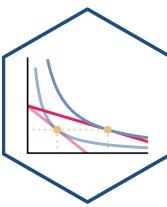


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i The brain of an adult bottlenose dolphin is about 25% heavier than the average human adult's brain.
Photograph: Stephen Frink/Getty Images

Incentives: Even Dolphins Understand II

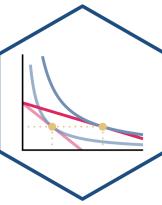


At the Institute for Marine Mammal Studies in Mississippi, Kelly the dolphin has built up quite a reputation. All the dolphins at the institute are trained to hold onto any litter that falls into their pools until they see a trainer, when they can trade the litter for fish. In this way, the dolphins help to keep their pools clean.

Kelly has taken this task one step further. When people drop paper into the water she hides it under a rock at the bottom of the pool. The next time a trainer passes, she goes down to the rock and tears off a piece of paper to give to the trainer. After a fish reward, she goes back down, tears off another piece of paper, gets another fish, and so on. This behaviour is interesting because it shows that Kelly has a sense of the future and delays gratification. She has realised that a big piece of paper gets the same reward as a small piece and so delivers only small pieces to keep the extra food coming. She has, in effect, trained the humans.

July 2 2003, ["Why Dolphins are Deep Thinkers"](#), *The Guardian*

Incentives: Monkeys Too



These Monkeys Understand Economics and Intentionally Steal High-Ticket Items to Barter for Better Food, Study Finds



Jody Serrano
1/17/21 8:43PM

54

1



A Balinese long-tailed monkeys, *Macaca fascicularis*, eats an apple in the Sacred Monkey Forest in Ubud, Bali, Indonesia, on November 16, 2018.

Photo: Gabriel Bouys / AFP (Getty Images)

Some of you all may be familiar with the [crime ring of long-tailed macaque monkeys](#) that reside around the Uluwatu Temple in Bali, Indonesia, who were

Recent Video



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Caitlin McGarry | 12

In Fact a Lot of the Natural World Behaves Economically



PNAS
Proceedings of the
National Academy of Sciences
of the United States of America

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RESEARCH ARTICLE

Walrasian equilibrium behavior in nature

Ted Loch-Temzelides

+ See all authors and affiliations

PNAS July 6, 2021 118 (27) e2020961118; <https://doi.org/10.1073/pnas.2020961118>

Edited by Stephen Polasky, University of Minnesota, St. Paul, MN, and approved April 16, 2021 (received for review October 12, 2020)

Article

Figures & SI

Info & Metrics

PDF

Significance

Mutualisms are commonly observed ecological interactions, often involving the exchange of resources across species. Such exchanges can be thought of as biological markets. Biologists modeling these markets often employ an informal mix of economics and game-theoretic concepts. A fundamental question is whether exchange in biological markets is consistent with general economic equilibrium theory (GET), the main paradigm used to study exchange in economics. This paper uses data from biological experiments to demonstrate that the trading behavior of mycorrhizal fungi is consistent with the predictions of GET. The large volume of knowledge in GET might result in new insights about biological exchange. In turn, experimental findings in biology can lead to a new field of application for GET.



bioRxiv
THE PREPRINT SERVER FOR BIOLOGY

bioRxiv posts many COVID19-related papers. A reminder: they have not been formally peer-reviewed and should not guide health-related behavior or be reported in the press as conclusive.

New Results

The nematode worm *C. elegans* chooses between bacterial foods exactly as if maximizing economic utility

Abraham Katzen, Hui-Kuan Chung, William T. Harbaugh, Christina Della Iacono, Nicholas Jackson, Stephanie K. Yu, Steven W. Flavell, Paul W. Glimcher, Shawn R. Lockery

doi: <https://doi.org/10.1101/2021.04.25.441352>

This article is a preprint and has not been certified by peer review [what does this mean?].



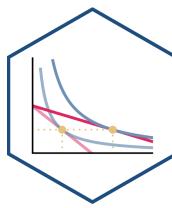
Abstract Full Text Info/History Metrics Preview PDF

Abstract

In value-based decision making, options are selected according to subjective values assigned by the individual to available goods and actions. Despite the importance of this faculty of the mind, the neural mechanisms of value assignments, and how choices are directed by them, remain obscure. To investigate this problem, we used a classic measure of utility maximization, the Generalized Axiom of Revealed Preference, to quantify internal consistency of food preferences in *Caenorhabditis elegans*, a nematode worm with a nervous system of only 302 neurons. Using a novel combination of microfluidics and electro-physiology, we found that *C. elegans* food choices fulfill the necessary and sufficient conditions for utility maximization, indicating that nematodes behave exactly as if they maintain, and attempt to maximize, an underlying representation of subjective value. Food choices are well-fit by a utility function widely used to model human consumers. Moreover, as in many

Loch-Temzelides, Ted, 2021, "Walrasian equilibrium behavior in nature", PNAS 118(27)

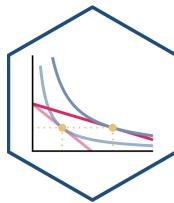
Takeaways About Incentives I



- People respond to (changes in) incentives
- People have goals they seek to attain
- Making one alternative more costly ≠ people *stop* pursuing their goals
- People will seek (less preferred) *alternative* methods to attain goals
- **Unintended consequences!**



Takeaways About Incentives II



Peter Fortune AM

@PeterTFortune

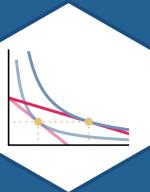


Whenever I am working on policy decisions I think of this image...



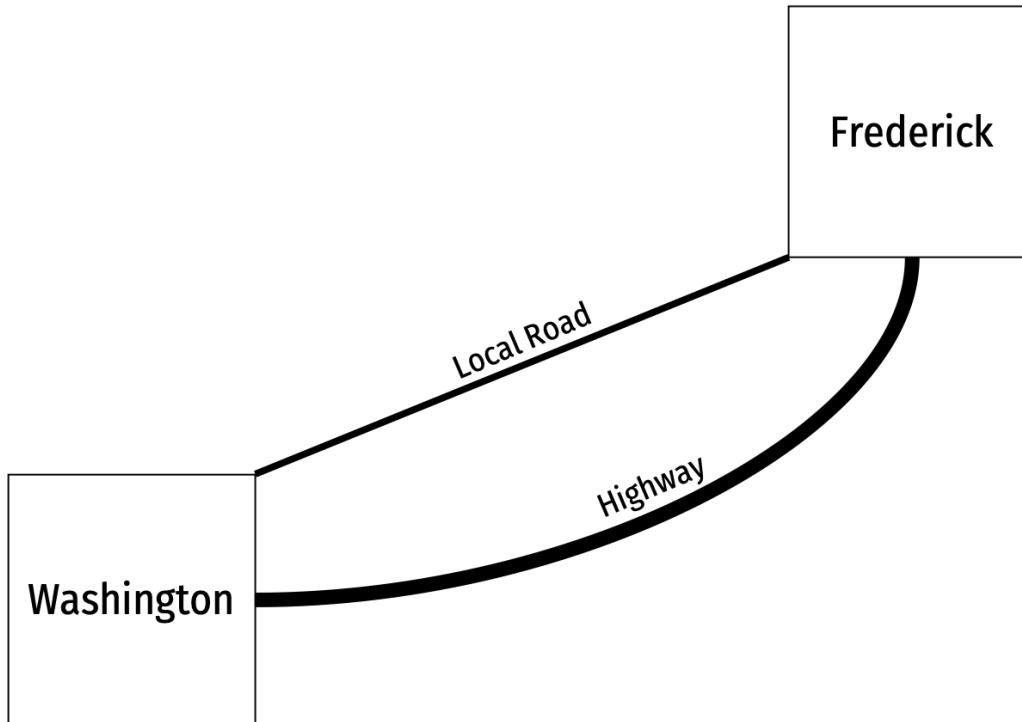
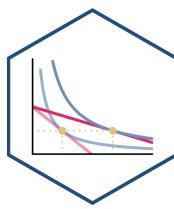
2:54 PM · Aug 7, 2019





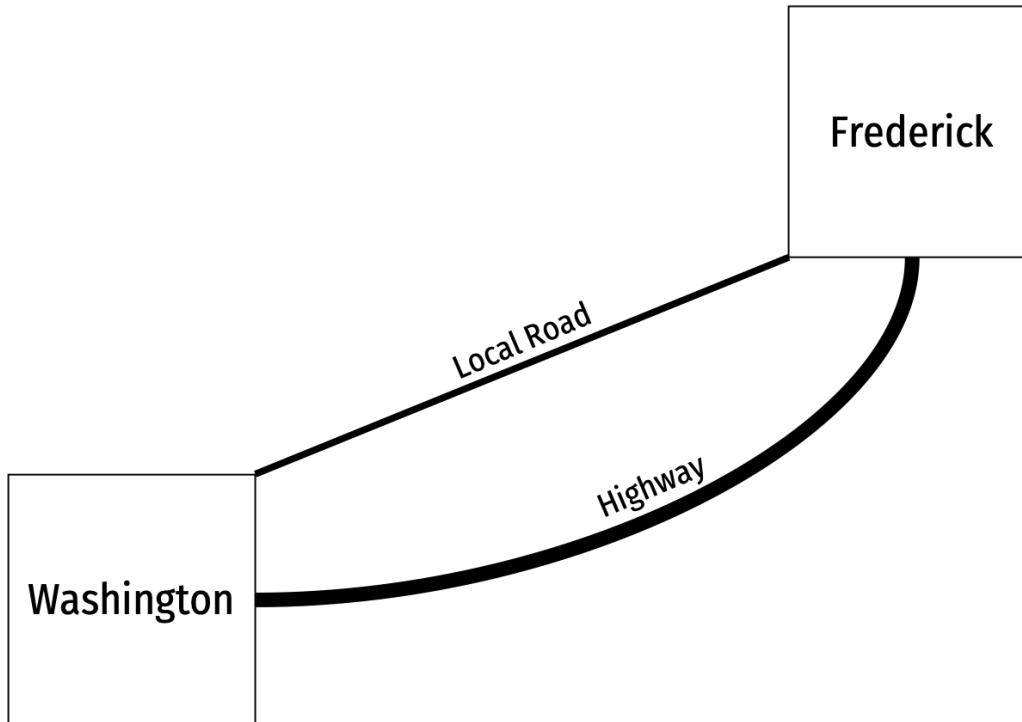
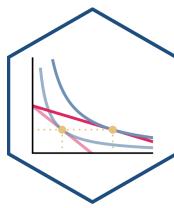
Equilibrium

Equilibrium Example I



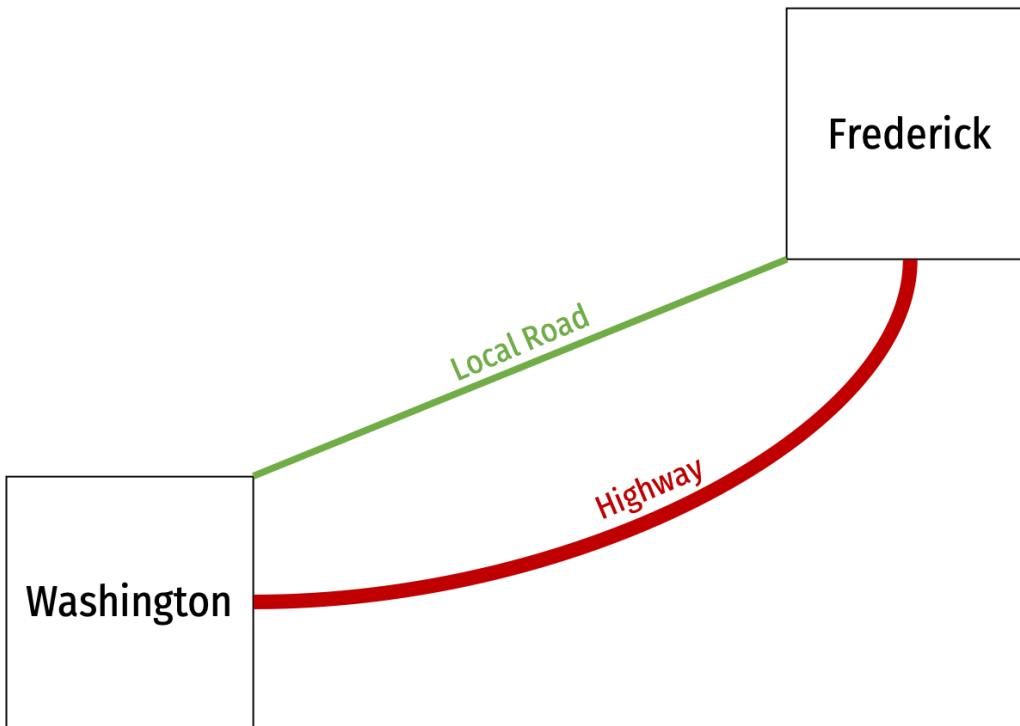
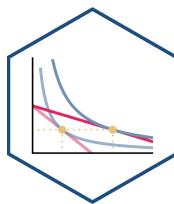
- Suppose 2 roads connect Frederick and Washington
- 100 cars commute
- Local road travel time: $30 \text{ min} + 1 \text{ min/car}$
- Highway travel time: 1 hour (always)

Equilibrium Example I



- Suppose 2 roads connect Frederick and Washington
- 100 cars commute
- Local road travel time: $30 \text{ min} + 1 \text{ min/car}$
- Highway travel time: 1 hour (always)
- Assume people **optimize**: choose road to **minimize travel time** between cities

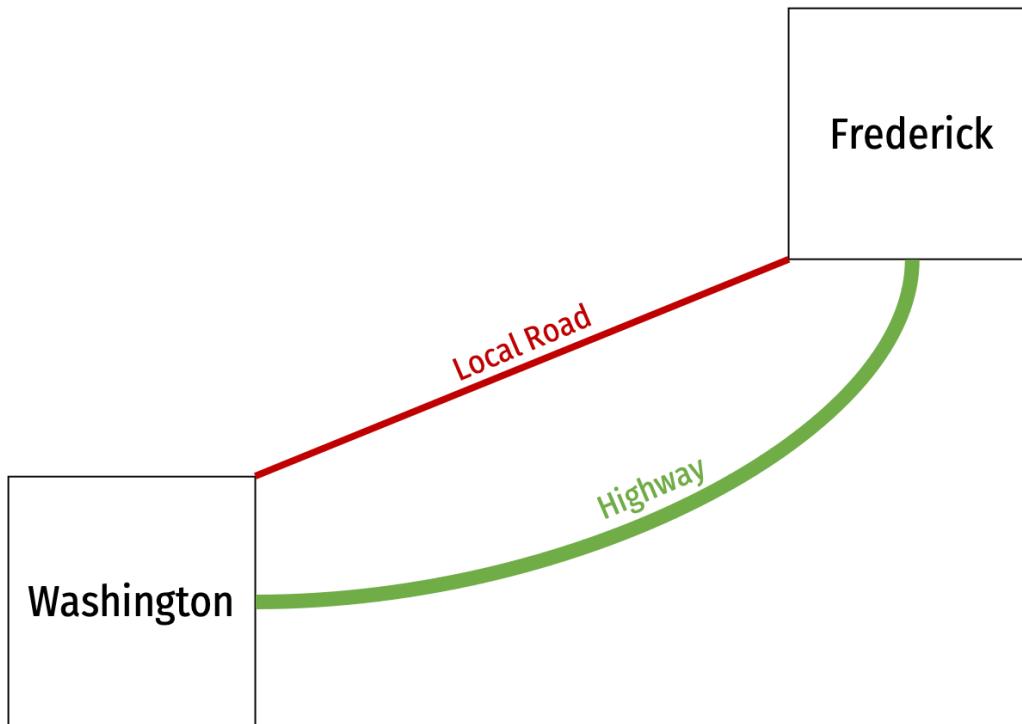
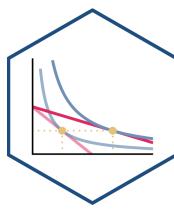
Equilibrium Example II



- Suppose 2 roads connect Frederick and Washington
- 100 cars commute
- Local road travel time: $30 \text{ min} + 1 \text{ min/car}$
- Highway travel time: 1 hour (always)

Scenario I: There are **less than 30 cars** on the local road

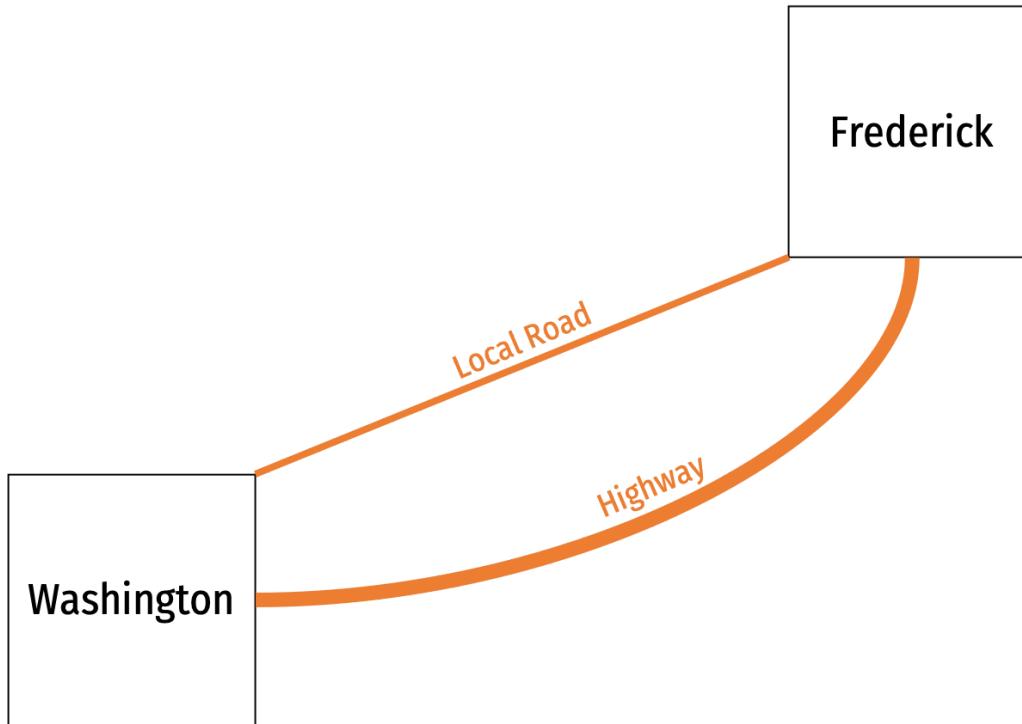
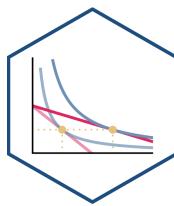
Equilibrium Example III



- Suppose 2 roads connect Frederick and Washington
- 100 cars commute
- Local road travel time: $30 \text{ min} + 1 \text{ min/car}$
- Highway travel time: 1 hour (always)

Scenario II: There are **more than 30 cars** on the local road

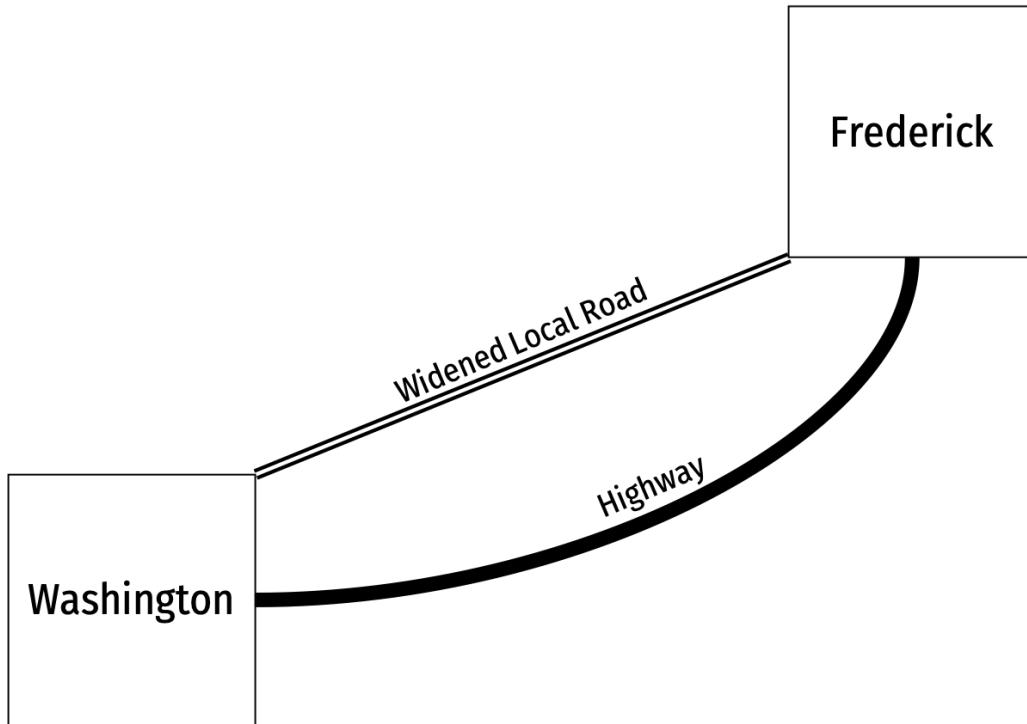
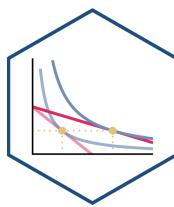
Equilibrium Example IV



- Suppose 2 roads connect Frederick and Washington
- 100 cars commute
- Local road travel time: $30 \text{ min} + 1 \text{ min/car}$
- Highway travel time: 1 hour (always)

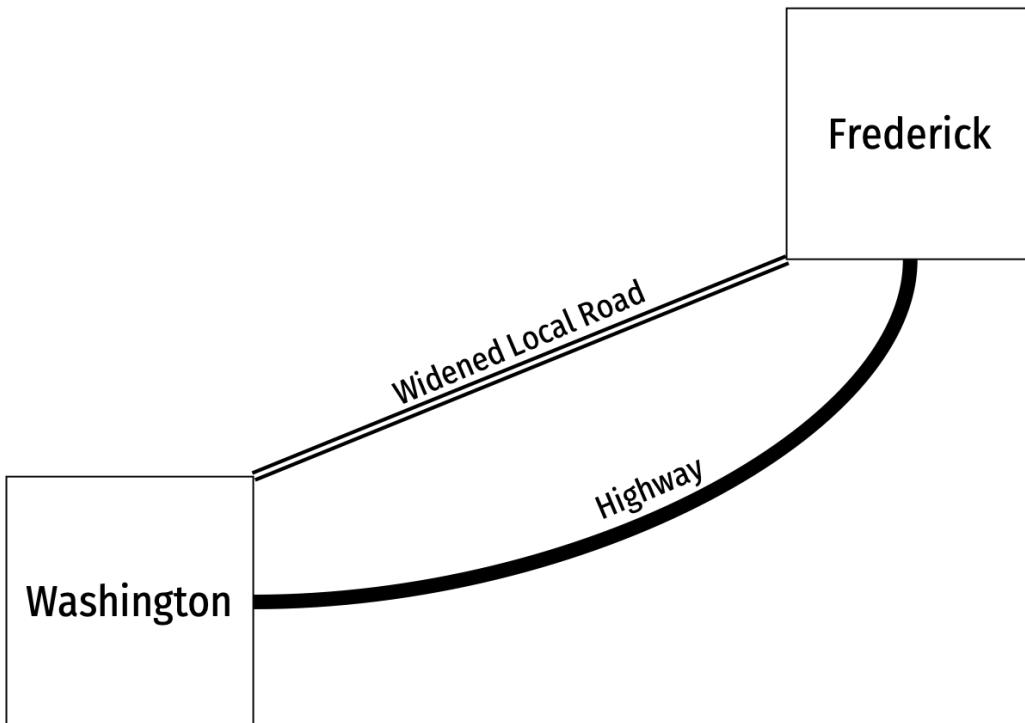
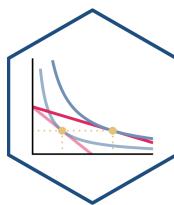
Equilibrium: How many cars are on each road? (Why?)

Equilibrium Example V



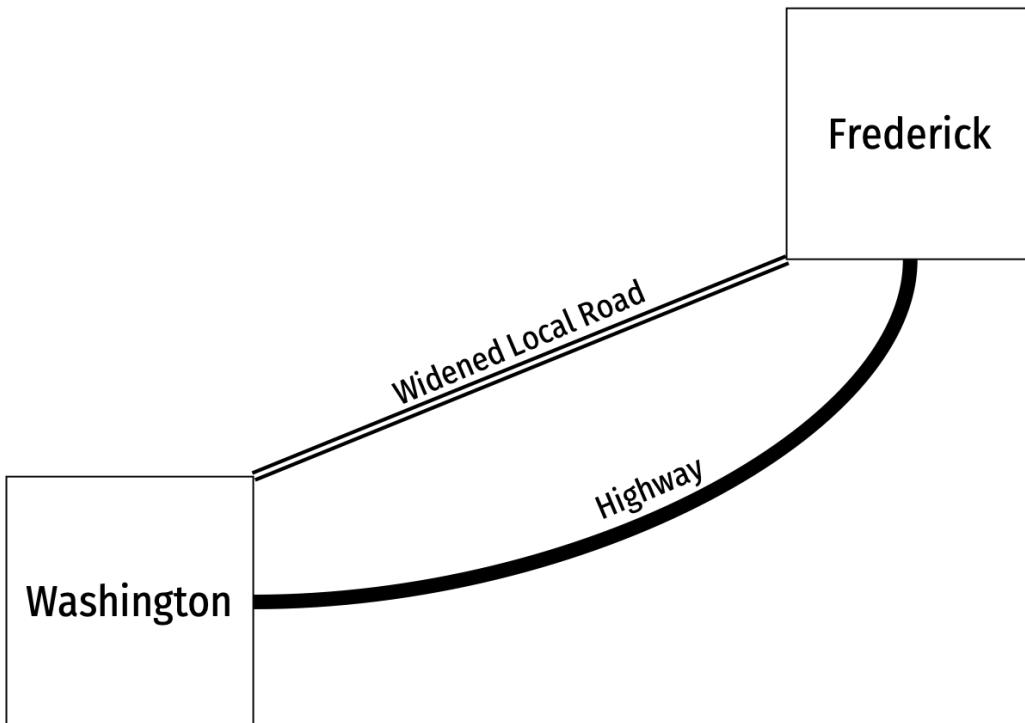
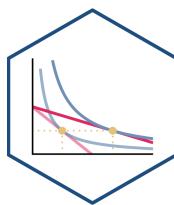
- Suppose the State *doubles the capacity of the local road*
- Local road travel time: **30 min + 0.5 min/car**
- Highway travel time: 1 hour (always)

Equilibrium Example V



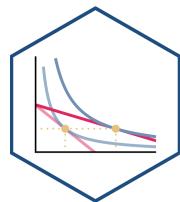
- Suppose the State **doubles the capacity of the local road**
- Local road travel time: **30 min + 0.5 min/car**
- Highway travel time: 1 hour (always)
- **Will this reduce travel time?**
- Yes! says the State:
 - 30 cars use the local road, takes 1 hour
 - With wider road it takes 45 min!

Equilibrium Example V



- Suppose the State *doubles the capacity of the local road*
- Local road travel time: **30 min + 0.5 min/car**
- Highway travel time: 1 hour (always)
- **Will this reduce travel time?**
- Yes! says the State:
 - 30 cars use the local road, takes 1 hour
 - With wider road it takes 45 min!
- **Is this an equilibrium?**

In the Long Run...(& Repeating the Same Mistake)



21st Century City
@urbanthoughts11

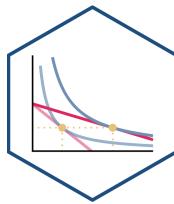


1970: One more lane will fix it.
1980: One more lane will fix it.
1990: One more lane will fix it.
2000: One more lane will fix it.
2010: One more lane will fix it.
2020: ?

via [@avelezig](#)

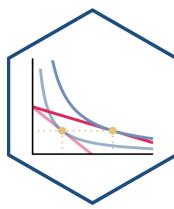


Comparative Statics

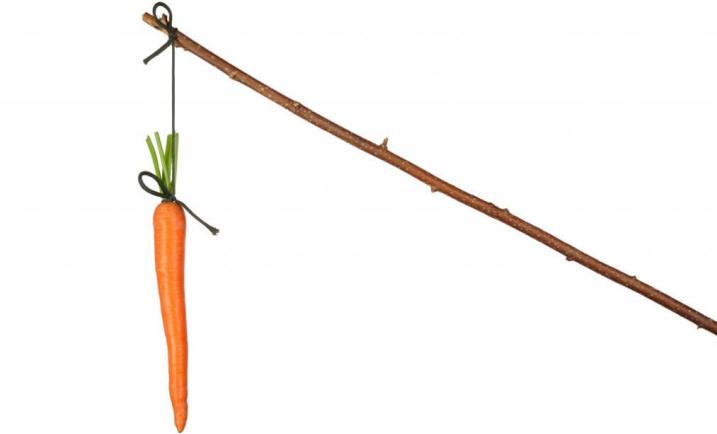


- **Comparative statics:** examining changes in equilibria cased by an external change (in incentives, constraints, etc.)

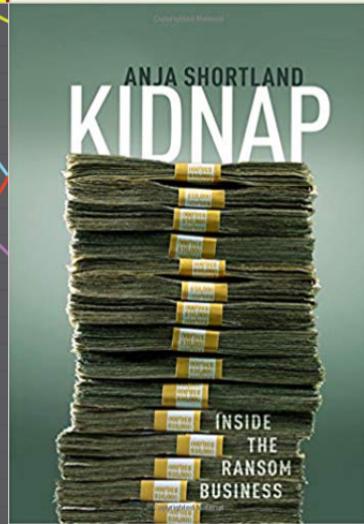
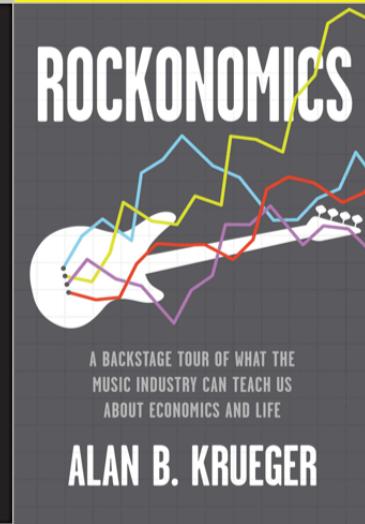
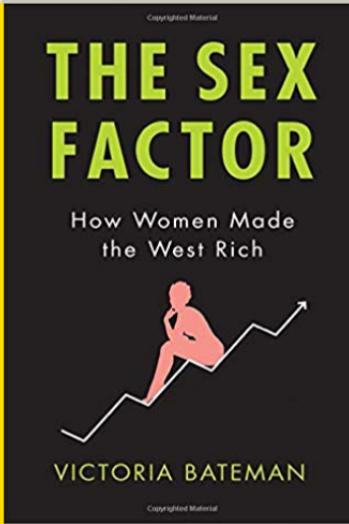
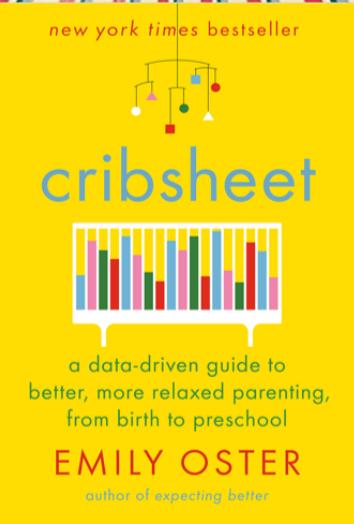
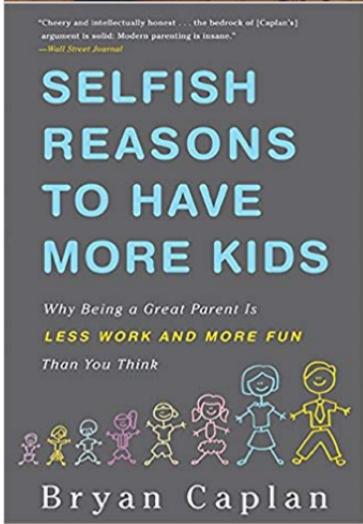
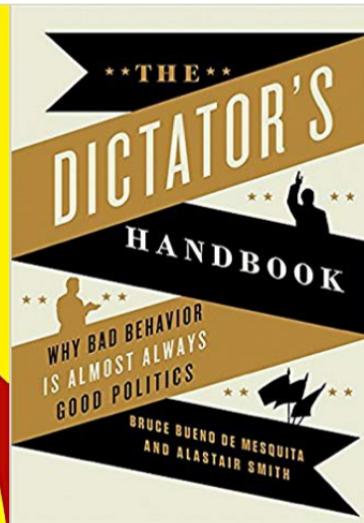
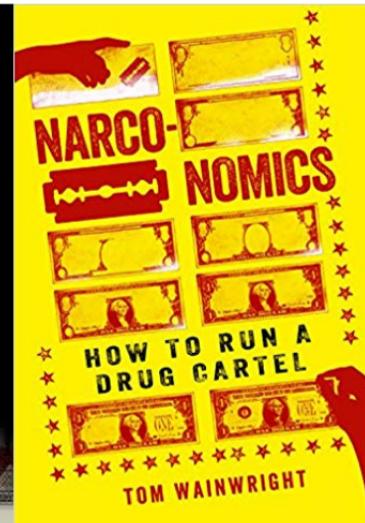
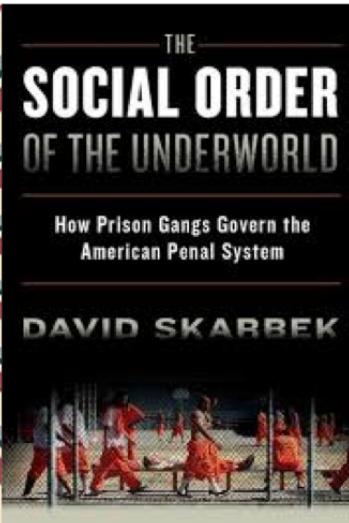
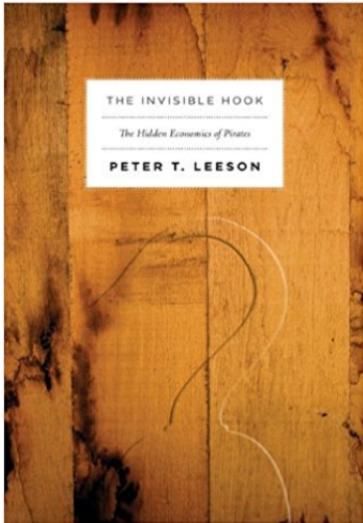
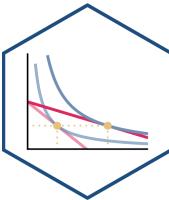
Optimization and Equilibrium

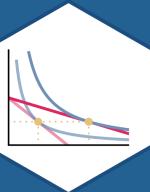


- If people can **learn** and **change** their behavior, they will tend to **switch** to a higher-valued option
- If there are no alternatives that are better, a person is at an **optimum**
- Everyone is at an optimum \iff the system is in **equilibrium**



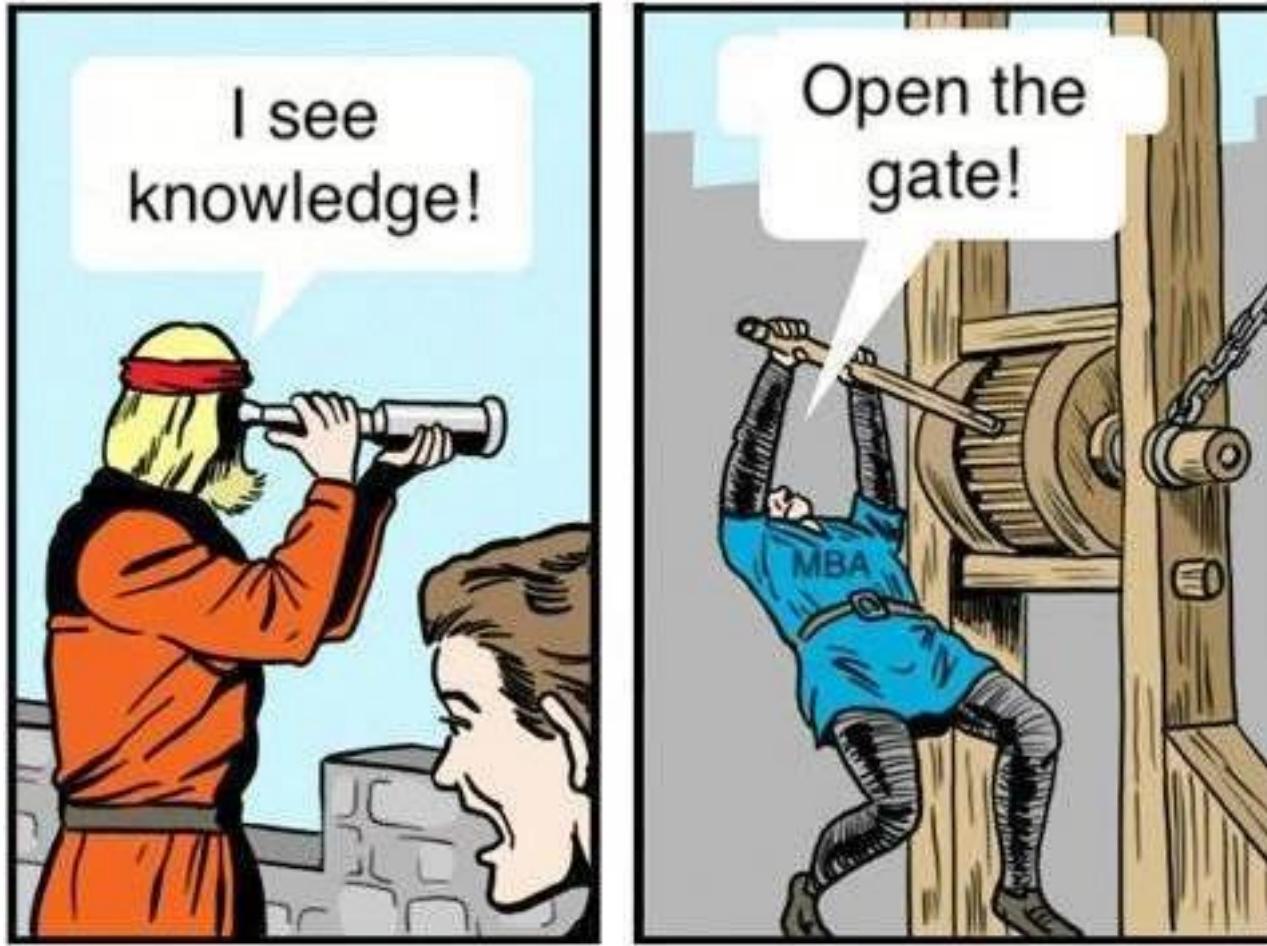
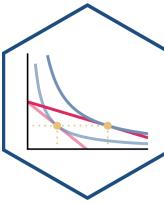
Economics Is Broader Than You Think



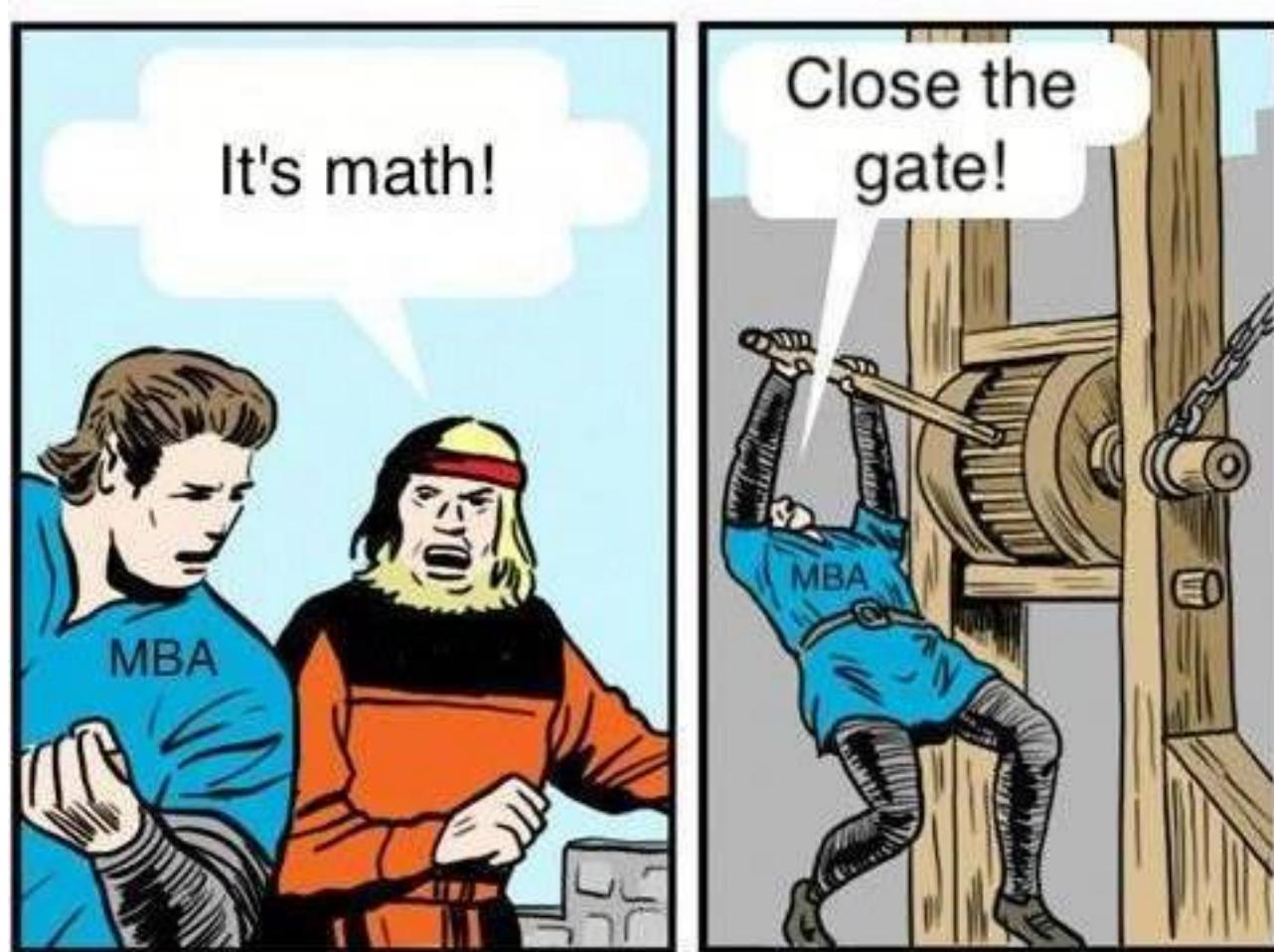
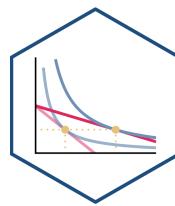


Real Talk: The Math

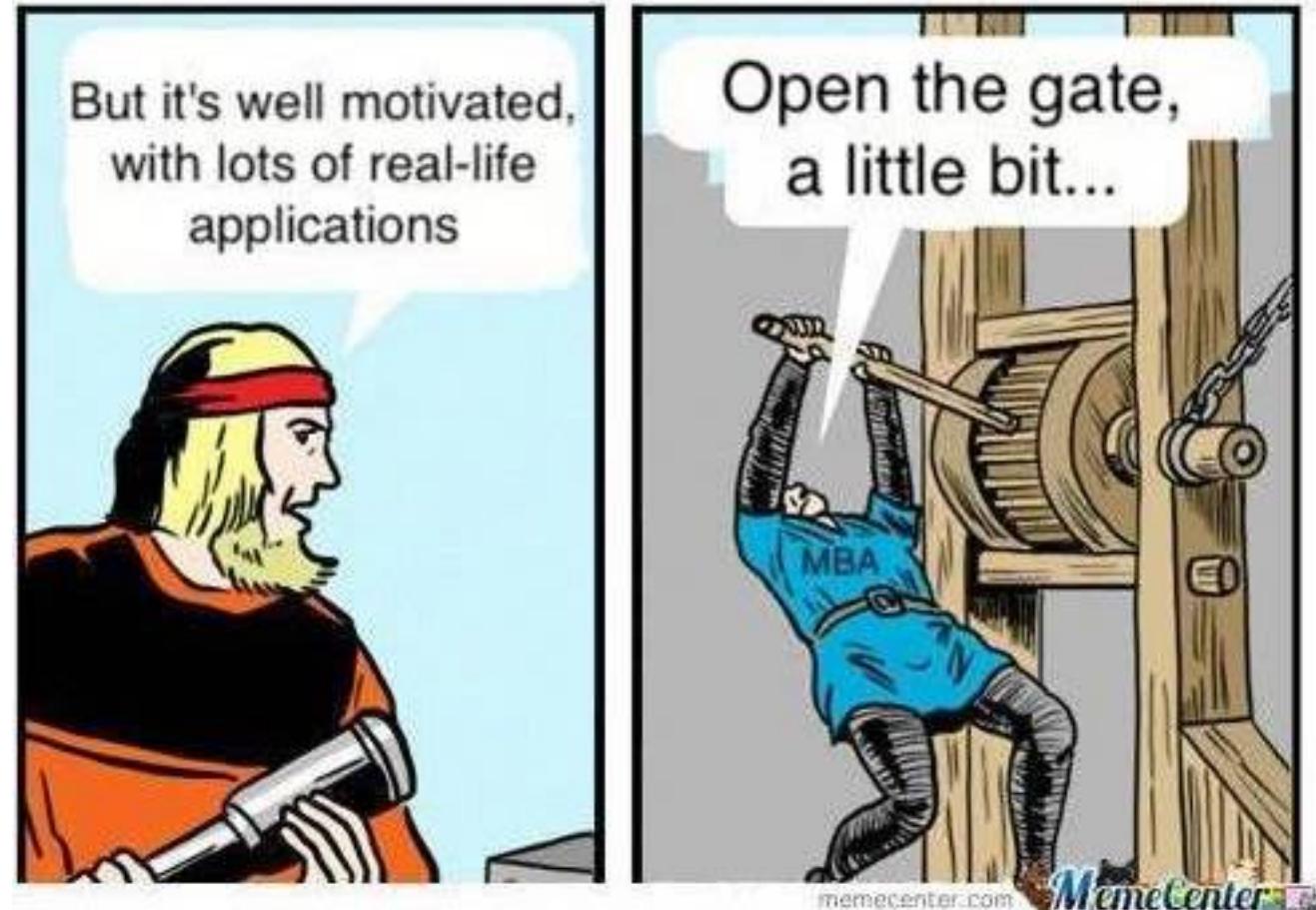
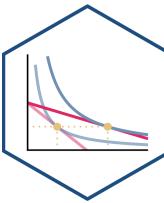
Real Talk



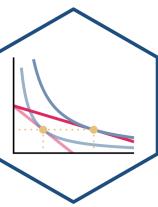
Real Talk



Real Talk



Real Talk



Screenshot of a web browser showing the ECON 306 - Microeconomic Analysis course page. The main content is a survey titled "Preliminary Survey on Math Background".

Preliminary Survey on Math Background

Please submit by 11:59 PM Sunday January 30, 2021

This is an *ungraded* and *anonymous* survey for me to evaluate the distribution of your math and statistics backgrounds. Please complete all problems to the best of your ability. Your responses will help me craft the course to see which material we need to focus on at greater length, especially review material.

Please submit your answers in [this Google Form](#). Feel free to download the PDF and work out the problems on paper first.

[Download PDF](#)

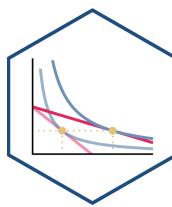
Question 1

Draw a graph of the following linear equation, $R = 4 - \frac{1}{2}W$. Plot W on the vertical axis and R on the horizontal axis.

Question 2

- Complete the [preliminary math survey](#).
- Help me help you with the math!

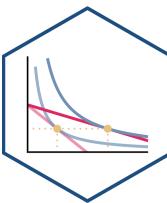
Why We Model I



- Economists often “speak” in models that explain and predict human behavior
- The pure language of models is mathematics
 - things that are universally true, deducible from axioms, can easily spot errors
 - often equations and graphs
 - this is what scares students most about economics

$$\begin{aligned} \zeta(s) &= \sum_{m=1}^{\infty} (m^{-s}) \quad |a \cos(\theta a) = b/c| \\ \psi(x) &= \frac{d}{dx} \ln(\Gamma(x)) \quad \sqrt{1+\sqrt{1+\sqrt{1}}} \quad \frac{x}{3x} \\ &\quad \langle a, b \rangle \cdot \langle c, d \rangle = ac + bd \\ &\quad y = 2\sin 5x \quad \sum_n \int_a^b y dx \\ A &= 2; P = \frac{2\pi}{3} \quad y = 2\cos 2t \\ &\quad y = 2\cos 5x \\ U(t) &= 1 - \frac{i\lambda}{n} \int_{t_0}^t \quad A = 2; P = \pi \\ &\quad \text{triangle area} = \frac{1}{2} \times \text{base} \times \text{height} \quad m+n \\ &\quad M = \sqrt{1 - \frac{v^2}{c^2}} \quad \Delta = 1^2 - 1^2 = 0 \end{aligned}$$

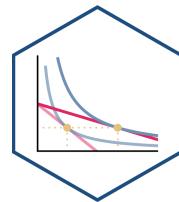
Why We Model II



- Economists use conceptual models: fictional constructions to logically examine consequences
- Very different from other sciences
 - No social experiments
 - Purposive, strategic human beings
 - Introspective understanding



The Two Major Models of Economics as a “Science”



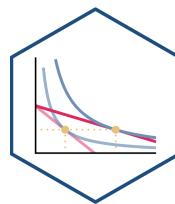
Optimization

- Agents have **objectives** they value
- Agents face **constraints**
- Make **tradeoffs** to maximize objectives within constraints

Equilibrium

- Agents **compete** with others over **scarce** resources
- Agents **adjust** behaviors based on prices
- **Stable outcomes** when adjustments stop

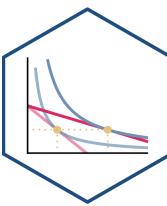
A Hint That Will *Almost* Never Fail You



- **The answer to 95% of questions in this course: where marginal benefit equals marginal cost**
 - What's the benefit? What's the cost?
 - Interpretation from math → English
- In practice: **where slopes (rates of change) of two things are equal**



Remember: All Models are Wrong!



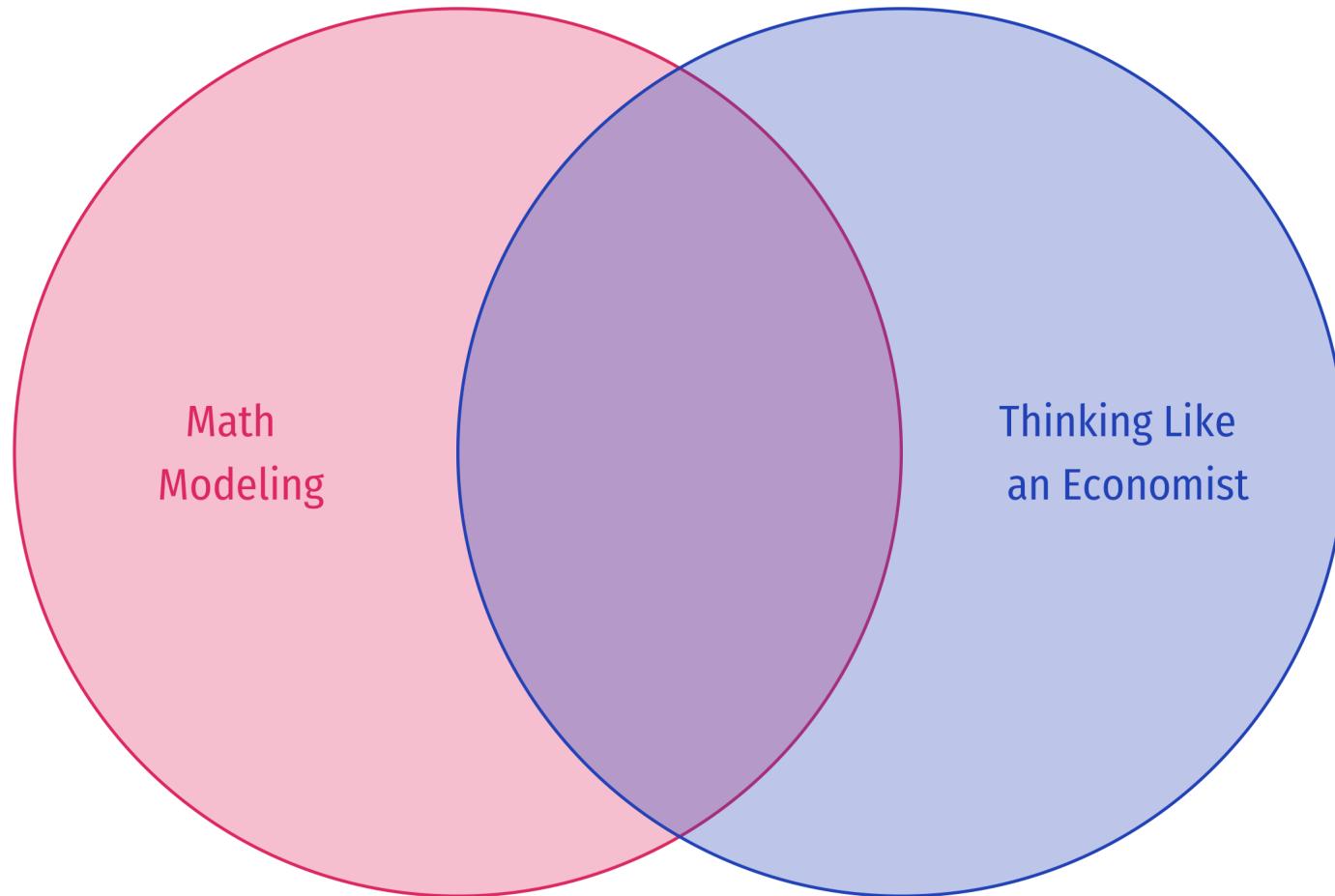
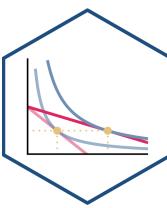
Caution: Don't conflate models with reality!

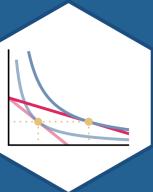
- Models **are not** reality. They help us **understand** reality.

“All models lie. The art is telling useful lies.” - George Box



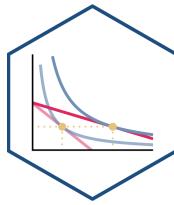
Economics Uses, but Is Not Limited to, Math





About This Course

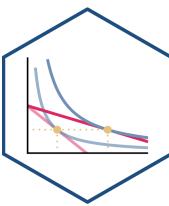
Learning Goals



By the end of this course, you will:

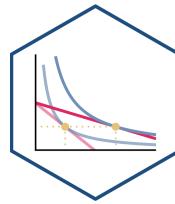
1. apply the models of microeconomics (constrained optimization and equilibrium) towards explaining real world behavior of individuals, firms, and governments
2. explore the effects of economic and political processes on market performance (competition, market prices, profits and losses, property rights, entrepreneurship, market power, market failures, public policy, government failures)
3. apply the economic way of thinking to real world issues in writing

Assignments



Assignment	Percent
1 Opinion-Editorial	20%
n Homeworks (Average)	20%
3 Exams	20% each

Your “Textbook”

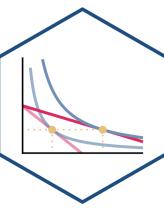


MICROECONOMICS

GOOLSBEE LEVITT SYVERSON



Course Website



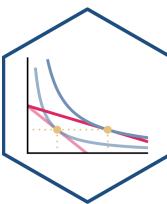
The screenshot shows the homepage of the ECON 306 course website. The title "ECON 306 – Microeconomic Analysis" is at the top left. To its right are navigation links: Syllabus, Schedule, Content, Assignments, Resources, and a user icon. Below the title, the course name "Microeconomic Analysis" is displayed in large white text, followed by "ECON 306 • Spring 2022 • Hood College". A descriptive text block states: "Learn the common tools and techniques that economists use to model the world around you." Below this, a section titled "By the end of this course, you will:" lists three objectives:

1. apply the models of microeconomics (constrained optimization and equilibrium) towards explaining real world behavior of individuals, firms, & governments
2. explore the effects of economic and political processes on market performance (competition, market prices, profits and losses, property rights, entrepreneurship, market power, market failures, public policy, government failures)
3. apply the economic way of thinking to real world issues in writing

At the bottom of the page are two buttons: "Schedule" and "Syllabus".

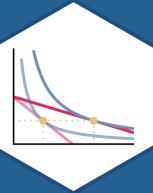
microF21.classes.ryansafner.com

Logistics



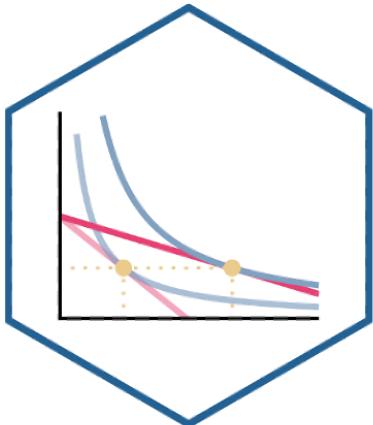
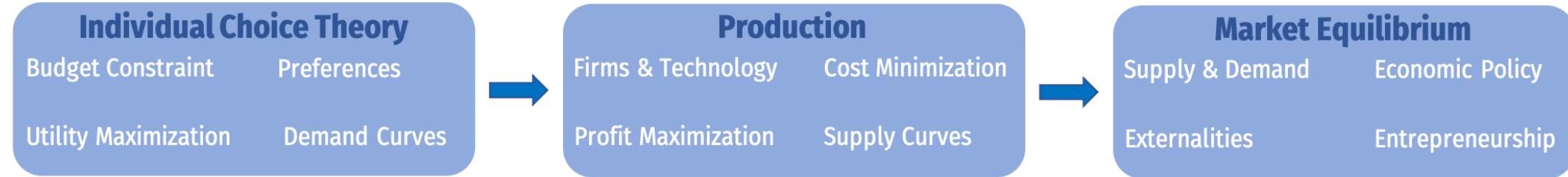
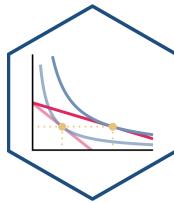
- Office hours: TBD & by appt
 - Office: 110 Rosenstock
-  Slack channel [#c-econ-306-micro](#)
- Covid/Zoom policy, attendance
- **Possible Room Change**
- Teaching Assistant(s): TBD
 - grade HWs & hold office hours
- See the [resources page](#) for tips for success and more helpful resources





You Can Do This
And I Am Here To Help You

Roadmap for the Semester



Microeconomic Analysis

