ECON 3133 Microeconomic Theory

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Course Overview

- Instructor: Yangguang Huang
  Teaching assistant: Dominic Pegler
- Syllabus
- See the note for online learning
- Textbook: Christopher Snyder and Water Nicholson, *Microeconomic Theory: Basic Principles and Extensions.*
  Optional textbook: Hal Varian, *Intermediate Microeconomics with Calculus*: *A Modern Approach.*
- Relationship to 3113
- L2 section taught by prof Qinggong Wu
- ECOF and MAEC

Course Overview

- Homework
  - Be serious about homework (no practice exam will be provided).
  - To cope with need of online teaching, homework will be done in a group of two students.
  - Homework may ask for things not covered in class. Learn from solutions.
  - Homework grading emphasizes participation. Correctness is secondary.
- Exams
  - midterm exam
  - final exam (cumulative)
- Attendance and participation

Course Overview

- Theme of this course
  - economic model with algebra and multivariate calculus
  - following the textbook
  - Discussion topics are mainly for fun.
- Study tips
  - Read relevant chapters of textbook before class.
  - Grasp the skill of handling economic model.
  - Use online resources come with the textbook.
  - Don't hesitate to seek help and advisory
  - Homework and what I write during lecture are important for exams.
  - Notes of lecture content will be provided.

Course Overview

- English is the official medium of instruction.

Course Information

Topic	Reading	No. of Lectures
Course Introduction and Math Review	Ch. 1 and 2	1
One Economic Agent: Profit-maximizing Firm		
Production Functions	Ch. 9	2
Cost Functions	Ch. 10	2
Profit Maximization	Ch. 11	2
Many Economic Agents: Competitive Market and Partial Equilibrium		
Partial Equilibrium Competitive Model	Ch. 12	3
Monopoly	Ch. 14	3
Midterm Exam		1
Multiple Strategic Economic Agents		
Game Theory	Ch. 8	5
Imperfect Competition	Ch. 15	4
Externalities and Public Goods	Ch. 19	3
Final Exam		

Economic Model

- In Economic models, humans (or other economic agents) are simple (rational/mechanical)
- Consumer (in intermediate Micro)

$$\max_{x,y} u(x,y) \text{ s.t. } p_x x + p_y y = w$$

Economic Model

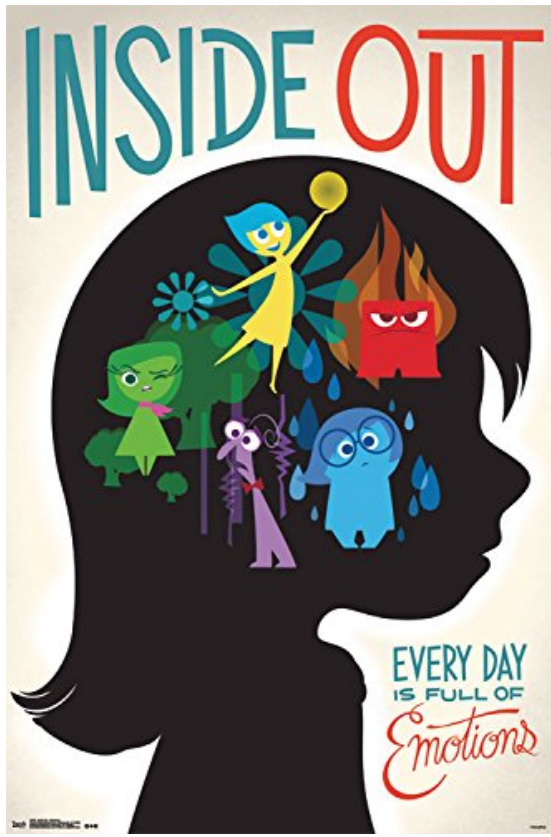
- Or, a more complicated version (in advanced Macro)

$$\begin{aligned} \max_{c,l} & \int_0^\infty U(c,l,g)e^{-\beta t}dt \\ \text{s.t. } & c+\dot{k}+\dot{b} = F(l,k)+rb-T \\ & c+\dot{k}+\dot{b} = wl+rk+rb-T \\ & \dot{b} = g+rb-T \\ & \dot{k} = F(k,l)-c-g \end{aligned}$$

- Economic agent, such as consumer, firm, and government, all make rational decision according to some *objective function* subject to some *constraints*.
  - In principle, it is still quite simple.

Economic Model

- Homo economicus (rational economic agent) vs. human being

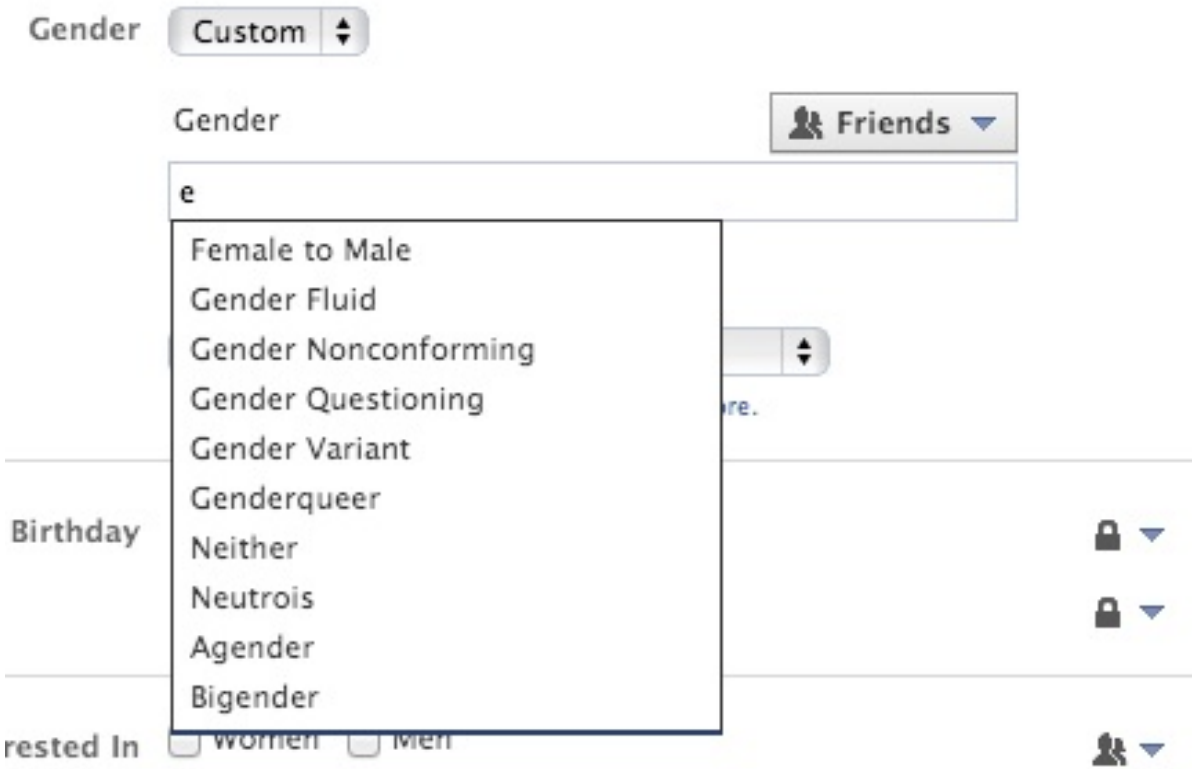


Economic Model

- Popular view of human being in psychology and other social sciences (In the picture: Joy, Sadness, Fear, Anger, and Disgust)

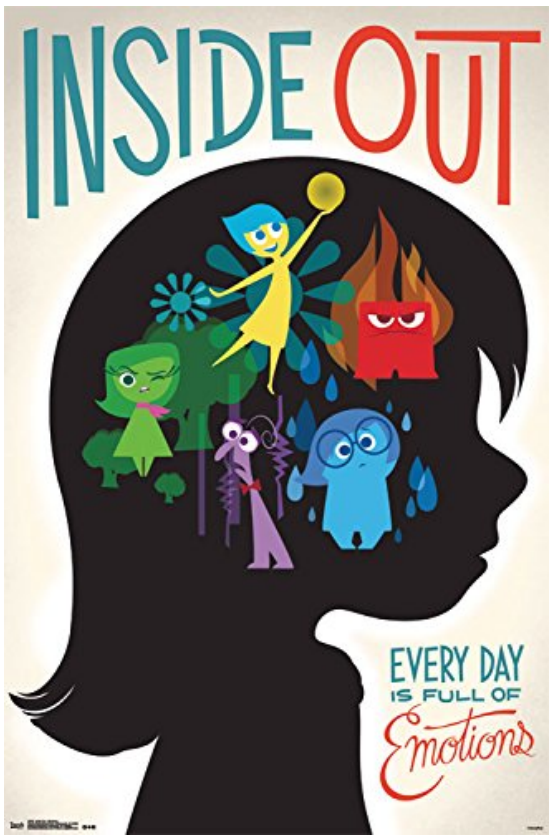
Economic Model

- Human beings are complicated
  (e.g. Facebook's 71 gender options)

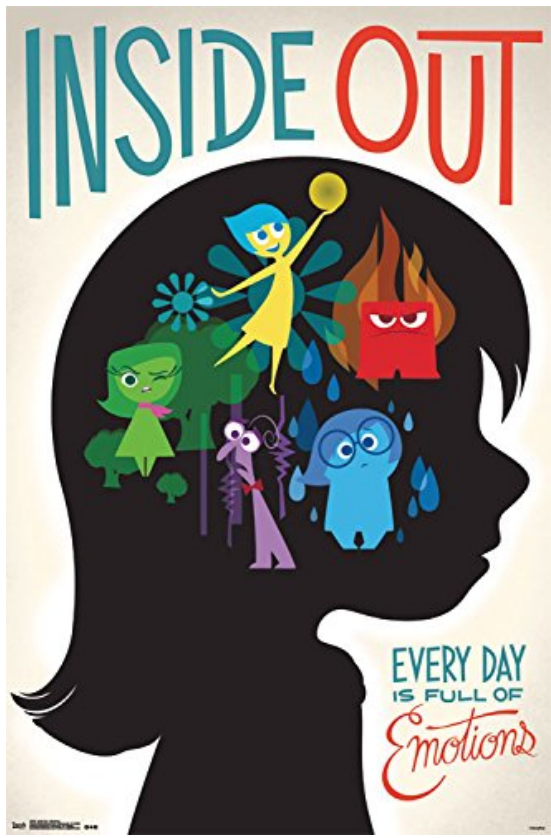


Economic Model

- Nearly impossible to study interaction of complicated agents



versus



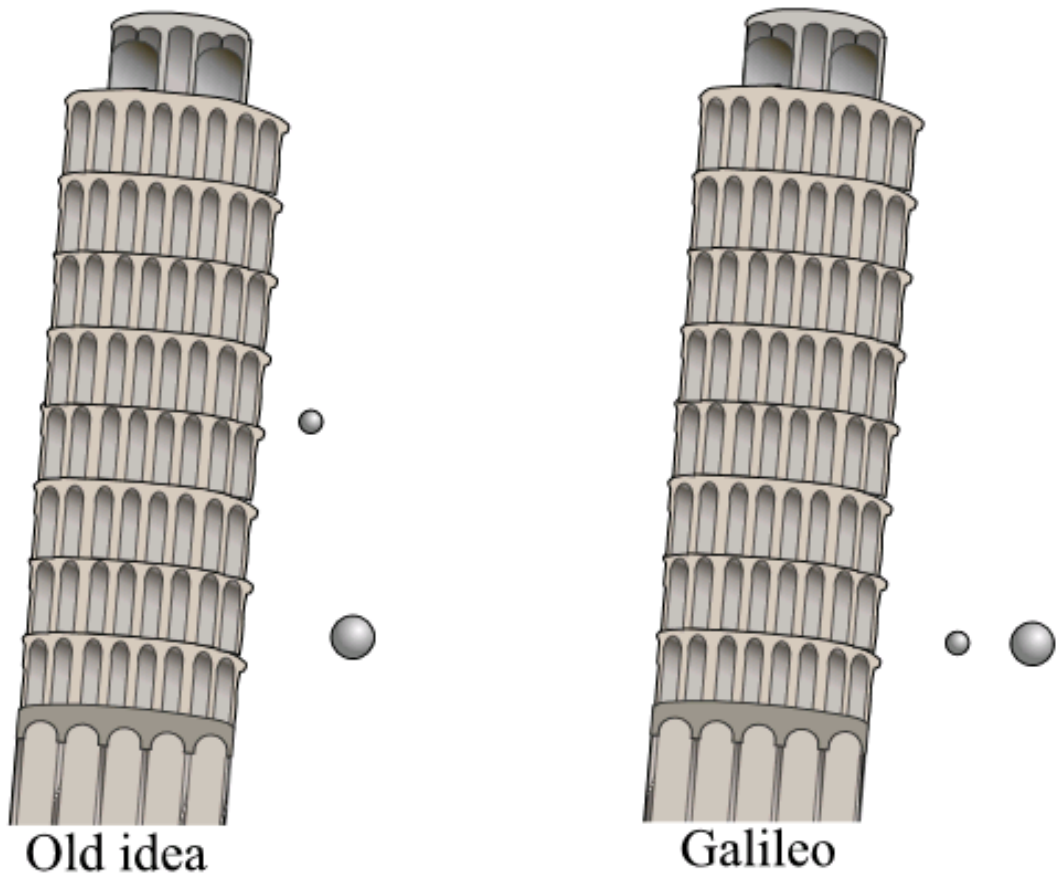
Economic Model

- In Economics, we keep agents relatively simple, so we can study
  - how agent response to incentives
  - equilibrium with many agents
  - strategic interaction (game theory) among many agents

versus

Economic Model

- Most economic model are based on rational agents
  - Understanding the rational paradigm is very valuable
  - We can allow bounded rational agents but their behavior bias must be tractable.
  - "*All models are wrong, but some are useful.*"



Economic Model

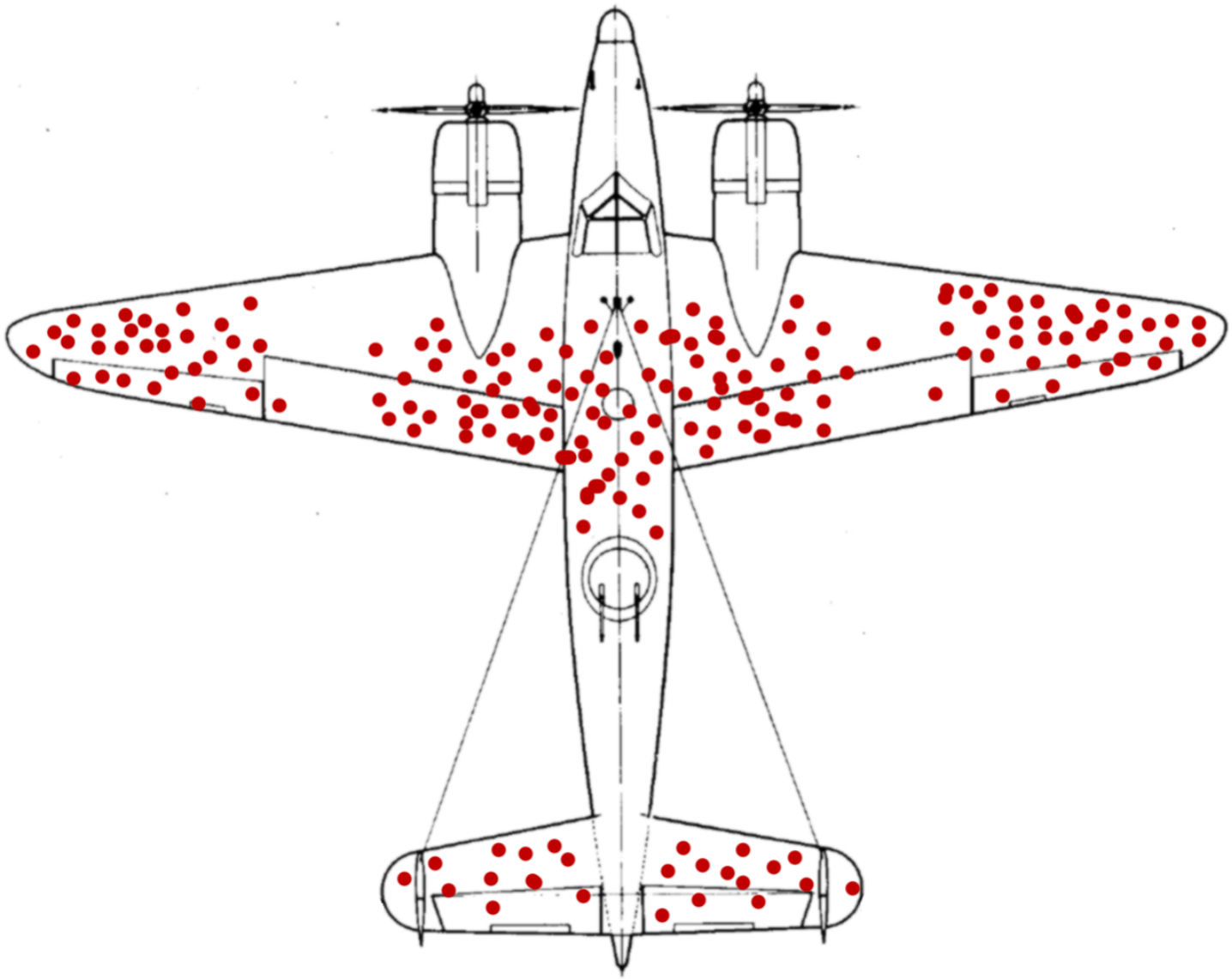
- Economic model
  - people response to incentive
  - understand how each economic agent affect the equilibrium of the system
  - prediction (comparative statics, counterfactuals)
  - policy implication

- **Assumption** + Data = Conclusion
  - Be serious about the assumptions when interpreting the data
    e.g. survivorship bias, hospital mortality rate
  - It is important to know how the data are generated.
  - Incentive in data generating and sample selection process.

- ECON4274: Programming Econometrics with R

Economic Model

- Survivorship bias



Math Review

- Maximize a single variable function

$$\max_x f(x)$$

  - e.g., Firm chooses price to maximize profit.
  - e.g., Individual chooses hours of working
  - e.g., Government chooses tax rate.

- Solution

$$x^* = \arg\max_x f(x)$$

- First-order approach
  - replace max problem by first-order condition (FOC) $f'(x^*) = 0$
  - continuity and differentiability
  - be careful of boundary and second-order condition (SOC)

Math Review

- Derivatives
  - Basis derivatives

$$\frac{dx^n}{dx} = nx^{n-1}, \quad \frac{d\ln x}{dx} = \frac{1}{x}, \quad \frac{de^x}{dx} = e^x$$

  - Product rule

$$\frac{d\left(f(x)g(x)\right)}{dx} = f(x)\frac{dg}{dx} + g(x)\frac{df}{dx}$$

  - Quotient rule

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{\frac{df}{dx}g(x) - \frac{dg}{dx}f(x)}{[g(x)]^2}$$

  - Partial derivative

$$\frac{\partial}{\partial x}\left(f(x)g(y)\right) = \frac{df}{dx}g(y)$$

  - Chain rule

$$\frac{df(g(x))}{dx} = \frac{df}{dg} \times \frac{dg}{dx}$$

  - Direct effect and indirect effect

$$\frac{d}{db}\left(f(b, x^*(b)\right) = \frac{\partial f}{\partial b} + \frac{\partial f}{\partial x}\frac{dx^*}{db}$$

Math Review

- Maximize a multivariate function

$$\max_{x,y} f(x, y)$$

- First-order approach
  - replace max problem by $\frac{\partial f}{\partial x} = 0$, $\frac{\partial f}{\partial y} = 0$
- Second-order condition
  - global concavity
  - local concavity

Math Review

- Constraint maximization problem

$$\max_{x} f(x), \quad \text{s.t.} g(x) = b$$

$$\max_{x,y} f(x,y), \quad \text{s.t.} g(x,y) = b$$

  - Utility maximization problem: choose a bundle given a budget constraint.
  - Cost minimization problem: choose an input combination given a output level.
  - b is **exogenous variable**: not controlled by the agent / determined outside of the model
  - x is **endogenous variable**: chosen by the agent / solved from the model
  - $f\left(x^*(b)\right)$ is the **value function.**

Math Review

- Solving an economic model

$$x^*(b) = \arg \max_{x \in \{g(x)=b\}} f(x)$$

  - Find endogenous variables as functions of exogenous variables
  - Comparative statics: How change of parameter affects the solution of maximization. $\frac{dx^*(b)}{db} > 0$ or < 0?
  - e.g. effort as a function of wage $e(w)$.

- Lagrangian for interior solution

$$\mathcal{L} = f(x, y) + \lambda(g(x, y) - b)$$

- Envelop theorem

$$\frac{\partial \mathcal{L}}{\partial b} = \frac{\partial f\left(x^*(b)\right)}{\partial b}$$

Math Review

- Game theoretical problem

$$\max_x f(x, y)$$

$$\max_y g(x, y)$$

- Best-response and equilibrium

$$x^*(y) = \arg\max_x f(x, y)$$

$$y^*(x) = \arg\max_y g(x, y)$$

$$\begin{cases} x^*(y^e) = x^e \\ y^*(x^e) = y^e \end{cases} \Rightarrow (x^e, y^e)$$

Math Review

- Game theoretical problem

$$\max_x f(x, y, b)$$

$$\max_y g(x, y, b)$$

- Best-response and equilibrium

$$x^*(y, b) = \arg\max_x f(x, y, b)$$

$$y^*(x, b) = \arg\max_y g(x, y, b)$$

$$\begin{cases} x^*(y^e, b) = x^e \\ y^*(x^e, b) = y^e \end{cases} \Rightarrow (x^*(b), y^*(b))$$

Economic Model

- Agent always benefit from more choices?
- Mathematically

$$v_A = \max_{x \in A} u(x), \quad v_B = \max_{x \in B} u(x)$$

  If $A \subset B$, then $v_A \leq v_B$.
- Yes, this is true for rational homo economicus.

Economic Model

- The more choice the better: it is true for two human beings?
- No. Strategic interaction changes things.
  e.g. chicken game

		2	
		Swerve	Straight
1	Swerve	3, 3	2, 7
	Straight	7, 2	0, 0

		2	
		Swerve	Straight
1			
	Straight	7, 2	0, 0

Economic Model

- The more choice the better: it is true for for human being?
- Scenario A:

$$v_A = \max_{x \in \{\text{spent all, save some money}\}} u(x)$$

- Scenario B:

$$v_B = \max_{x \in \{\text{save some money}\}} u(x)$$

Economic Model

- Economic theory provides tools for us to understand bounded rational agents.
  - self-control
  - time inconsistency / present bias
  - information overload / inattention / unawareness
  - reference-dependent preferences
- Theory built upon homo economicus serves as important benchmark.