

# Econ 110A: Lecture 1

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UCSD, Summer Session II

Welcome Econ 110A!

A little introduction about me and the course

# About me

I'm originally from Brazil...



- Education:

- Ph.D. Candidate (final year) & M.A., Economics  
- UCSD
- M.A., Dual Degree: Int'l Econ, Int'l Relations,  
Johns Hopkins

- Professional:

- Senior Economic Advisor, President of Brazil
- Consultant, World Bank
- Research Economist, World Trade Organization

- Misc:

- Econ Columnist, O Globo (Newspaper, Brazil)
- Twitter: @goescarlos
- Website: [www.carlosgoes.com](http://www.carlosgoes.com)

- Research: Macro & International Trade

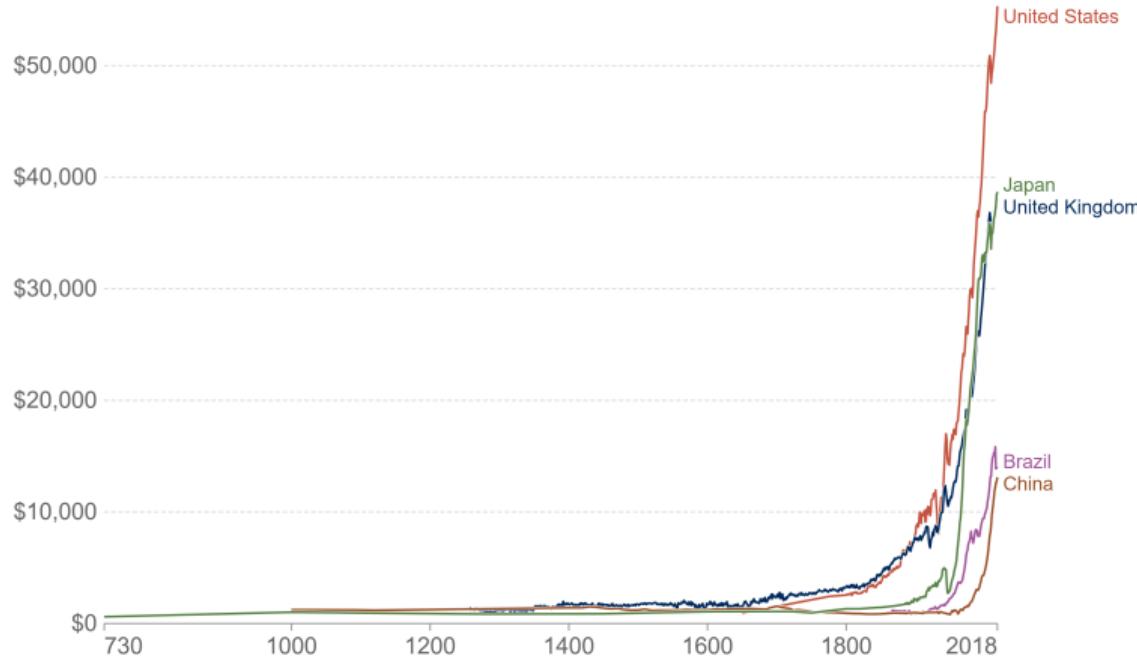
...now it is your turn:

- any questions?

# Why study macroeconomics? “The most important picture in economics”

## GDP per capita, 730 to 2018

This data is adjusted for inflation and for differences in the cost of living between countries.

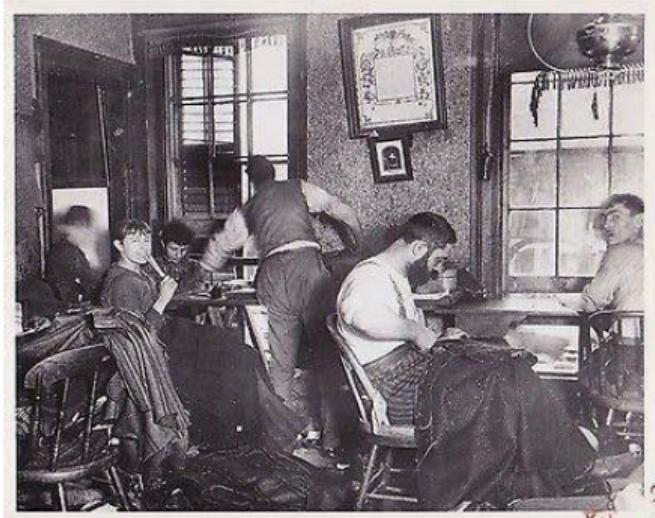


Source: Maddison Project Database 2020 (Bolt and van Zanden, 2020)

Note: This data is expressed in international-\$<sup>1</sup> at 2011 prices.

[OurWorldInData.org/economic-growth](https://OurWorldInData.org/economic-growth) • CC BY

# Macroeconomics studies economic growth



1880: \$5,000\*



2016: \$53,000\*

\*median income in 2011 dollars, source: Maddison Project Database

Macroeconomics studies **distribution** across groups and people

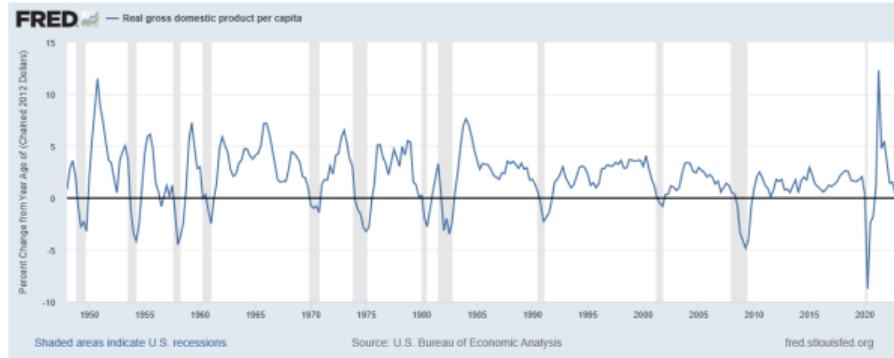


San Diego, 2023



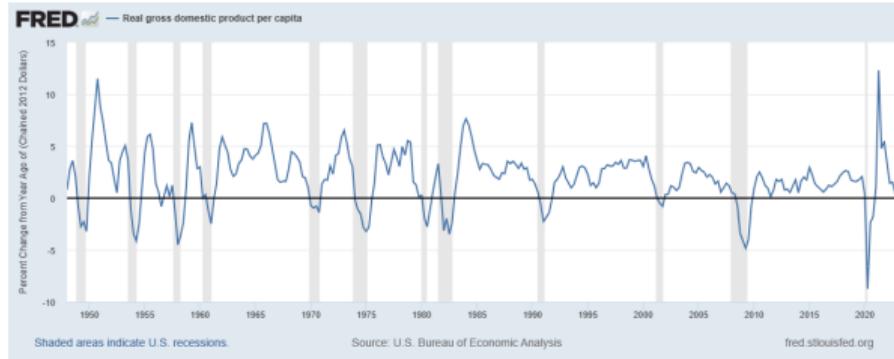
San Diego, 2023

# Macroeconomics studies the differences between **cycles** and long-run trends

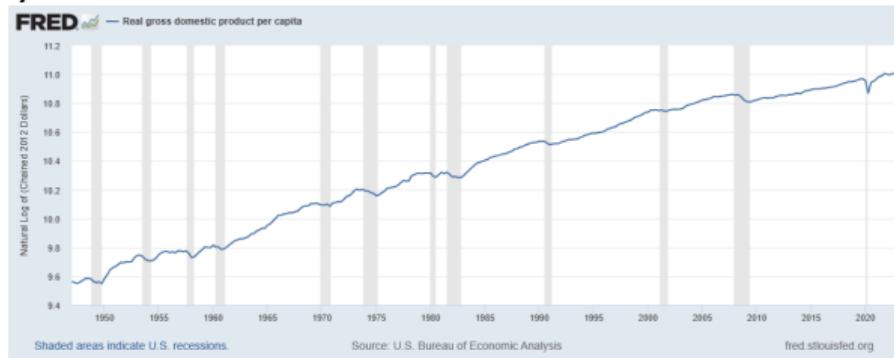


Can you spot the many recessions?

# Macroeconomics studies the differences between **cycles** and long-run trends



Can you spot the many recessions?



What about now?

## ...but what is the long run?

- definition based on time: any macro phenomenon that persists more than 20-25 years
- definition based on “adjustment:” any macro phenomenon that persists once prices and quantities have had the chance to adjust

## What are our Learning Objectives in Econ 110A?

- **measure**
- **model**
- **understand/predict**

## What is different from Macro Principles (Econ 3)?

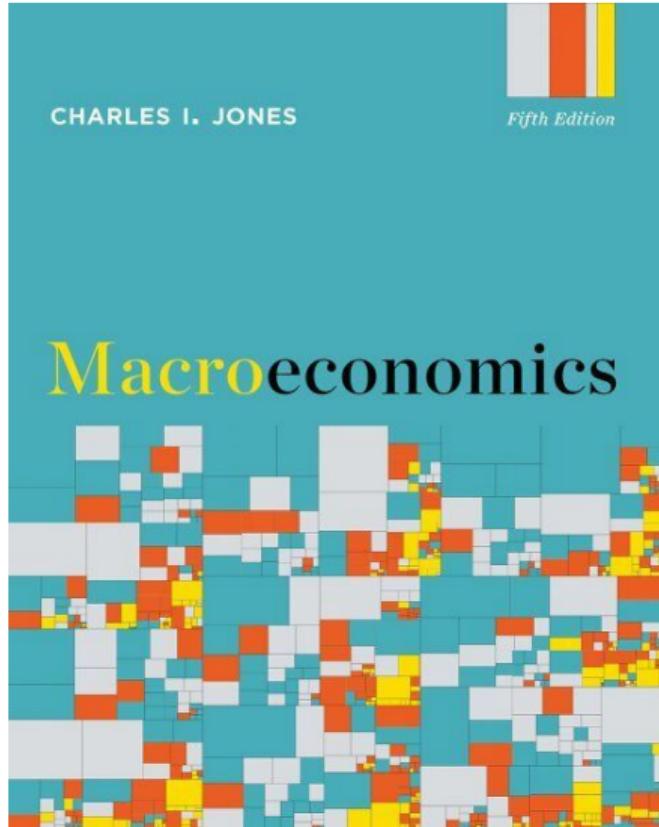
- **measure:** advanced understanding of critical issues with measurement of macroeconomic variables
- **model:** advanced practice of how to build and analyze macroeconomic models
- **understand/predict:**
  - quantitative predictions due to mathematical structure
  - sophisticated and nuanced analysis of economic mechanisms
  - advanced critical
  - understanding of power and limits of macroeconomic analysis

# Housekeeping

## Lectures, Recordings, and Material

- in person, Mondays and Wednesdays, CSB 04 2:00p-4:50p
- Attendance is very much encouraged but **not** mandatory.
- Audio recordings will be available through podcasts. Hopefully, video recordings will also be available.
- Slides are available on Canvas and on my website ([www.carlosgoes.com](http://www.carlosgoes.com)).
- Grades are based on midterm + final + weekly problem sets.

## Textbook



- Title: Macroeconomics
- Author: Charles I. Jones
- Edition: 5th
- Canvas: Redshelf (opt-out system)

## TAs and Discussion Sessions

- TAs:
  - Junyuan Chen (juc212@ucsd.edu)
  - Renata Abbott-Navarrete (rabbottnavarrete@ucsd.edu)
- Discussions: Tuesdays (11-12:50pm), on Zoom, starting week two
- Review important material
- Work on problems from old exams + PSETs
- Live + recorded and posted on Canvas
- This week: review of math needed for Econ 110A (asynchronous, posted on Canvas)

## Important dates

All exams will take place in person. Please mark your calendar as follows:

- Midterm, Monday, August 21<sup>st</sup>, 2:00 pm to 3:30 pm;
- Final, Friday, Sep 8<sup>th</sup>, 3:00 pm to 6:00 pm;

## Problem Sets

- There are weekly problem sets, 5 in total
- These are long but graded only on completion
- If you submit every problem set you are very likely to get a good grade in this class
- They are meant to be an incentive for you to learn the material and also a hedge against high stakes exams
- Each problem set is worth 20 points but you can only get a maximum 100 points
- This means that if you fail to submit one of the problem sets you will have suffer not consequences

## Grade system

There are 550 points up for grab in this course. Your final grade will be determined according to the following points

Problem Sets 100 pts

Midterm 200 pts

Final Exam 250 pts

## Office hours

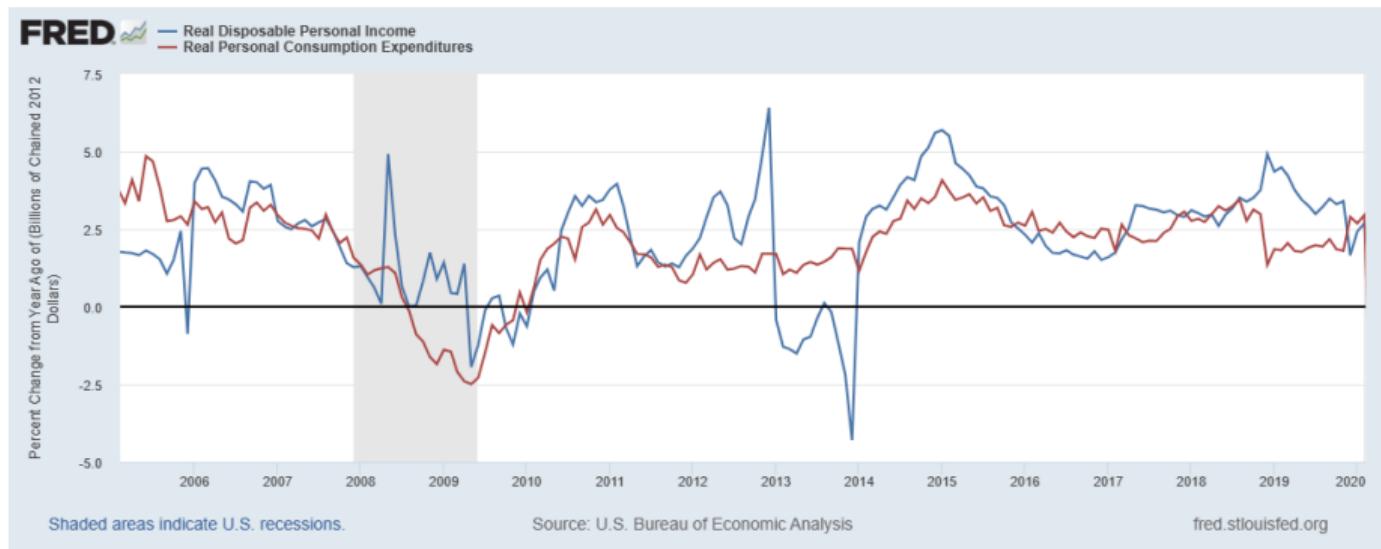
- Mine:
  - Tuesdays: 2-3pm, through Zoom: <https://ucsd.zoom.us/my/goescarlos>
- TAs:
  - TBD, check canvas

## How to think like a macroeconomist (or like most scientists)?

- Document the facts
- Develop a simplified a model
- Compare the predictions of the model with the original facts (i.e., test the model)
- Use the model to make other predictions that may eventually be tested (i.e., run counterfactual experiments with the model).

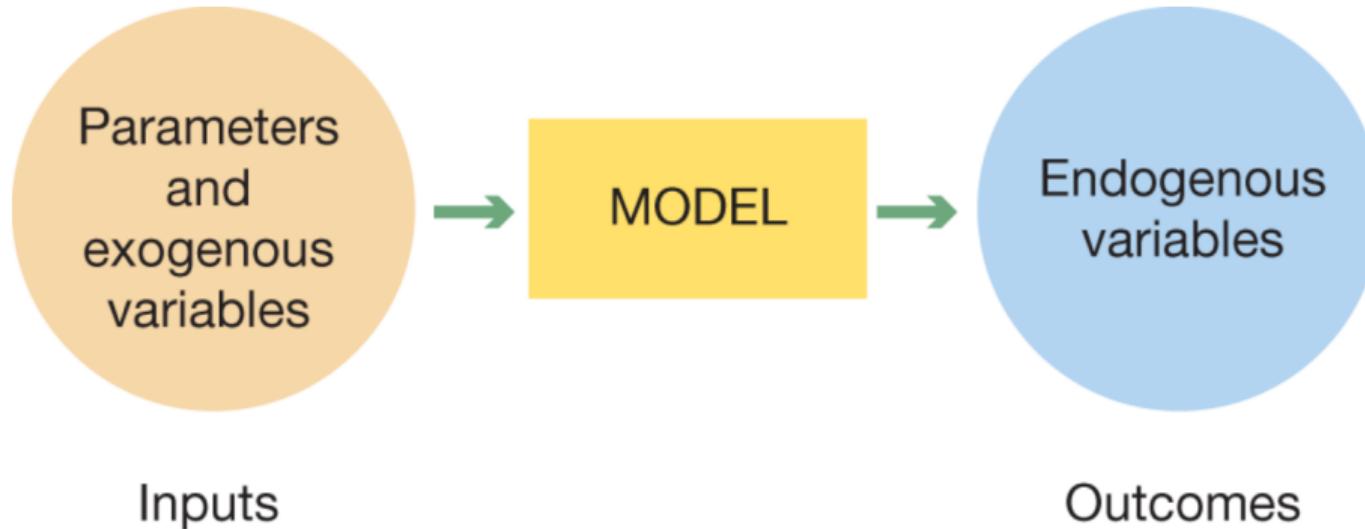
# Document the facts

Consumption is much less volatile than income...



# Develop a model

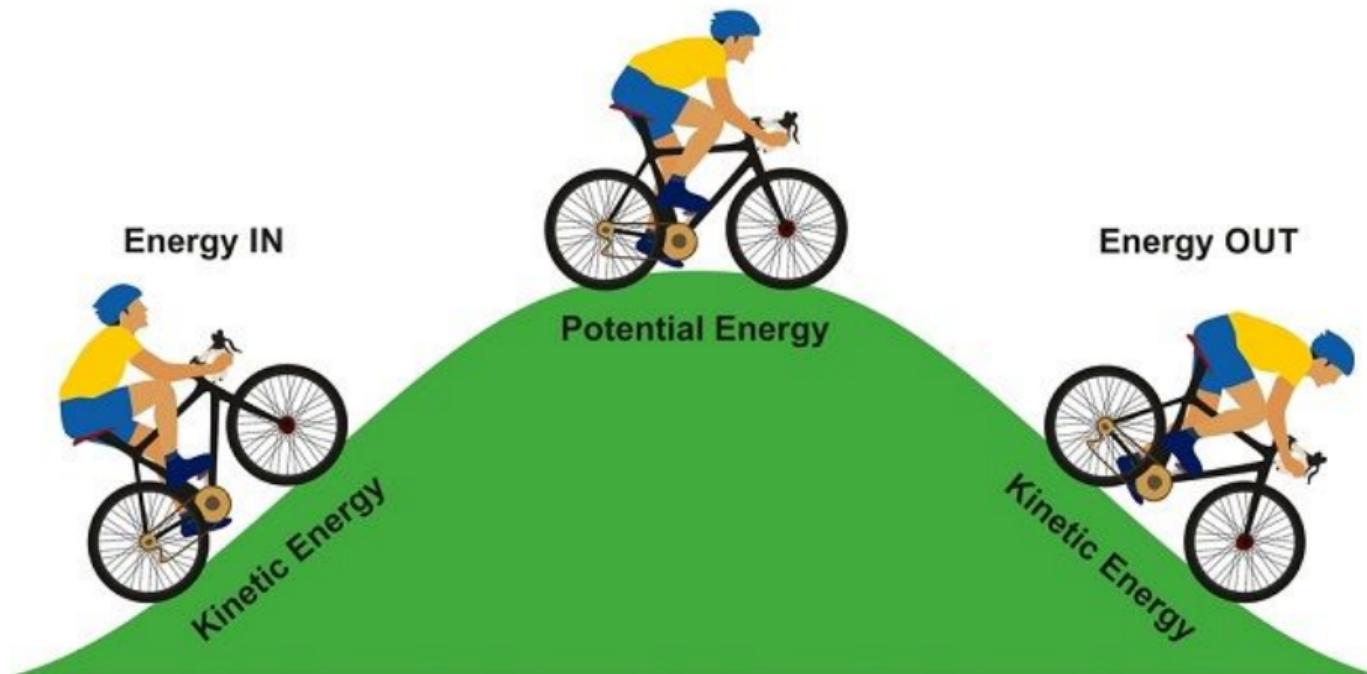
The Structure of Economic Models



# A model in HS physics

## The True Value of Energy

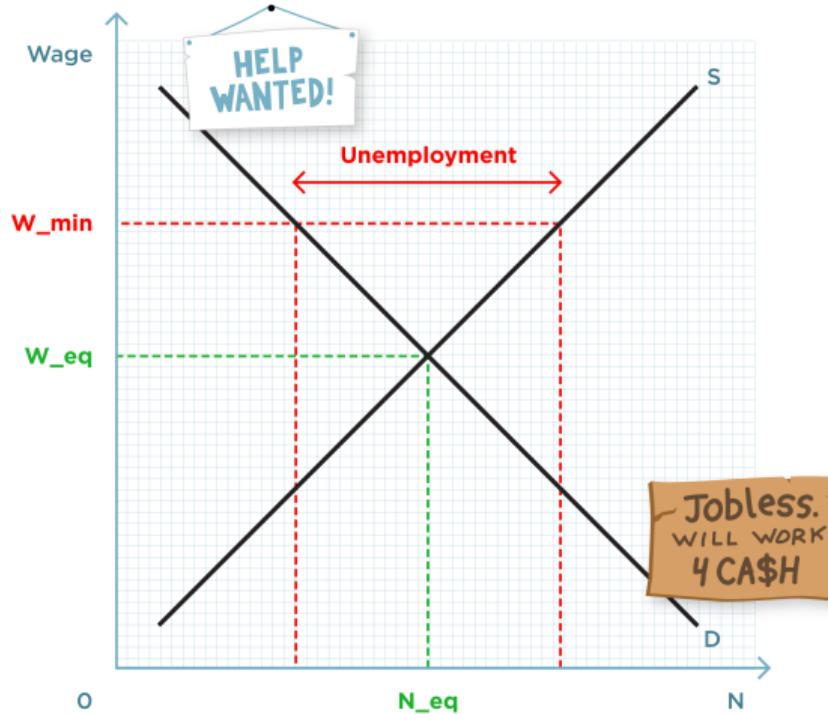
Kinetic Energy In - Potential Energy - Kinetic Energy Out



# A model in Econ 1

## Employment Equilibrium

FEE



## Can the model explain reality?

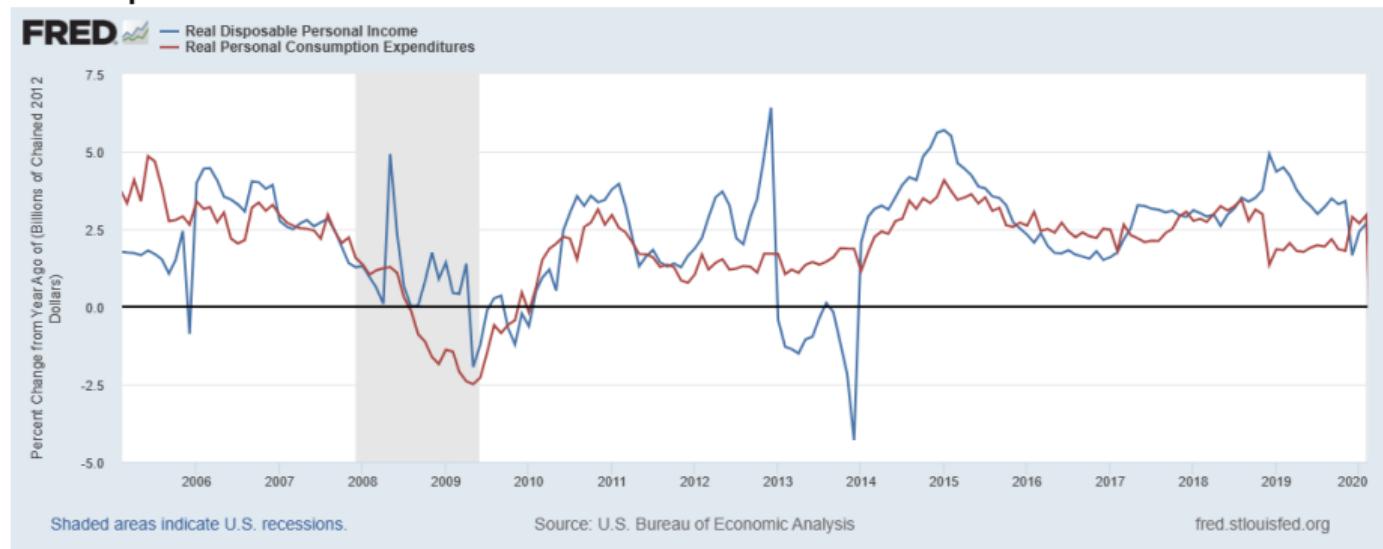
- If so, in what circumstances?
- If not why?
- In the real world, neither model fully generalizes.
- It depends on the particular context: friction, air resistance, temperature; pressure... economic frictions, competition, etc...
- But they both can explain the world *under certain assumptions...*

## Counterfactual experiment

- What happens if we change a parameter in the model?
- Gravity, temperature, altitude...?
- Taxes, government expenditure, inflation, elasticities, etc...?
- How would our predictions change? How does that align with reality? Which of these parameters can we observe? Which of them do we have to calibrate indirectly?

# Let's go back to our fact...

## Why is consumption smoother than income?



## Two-Period Neoclassical Growth Model

- The economy consists of a representative consumer who only lives for two periods: today (period 1), and the future (period 2).
- The consumer earns income in both periods; can save (or borrow) and receives (or pays) some interest.
- $Y_1$ : income in period 1,  $Y_2$ : income in period 2
- $C_1$ : consumption in period 1,  $C_2$ : consumption in period 2
- $S > 0$ : savings;  $S < 0$ : borrowing
- $1 + R$  gross interest rate

## Two-Period Neoclassical Growth Model

- Period 1:

$$Y_1 = C_1 + S \quad (1)$$

- Period 2:

$$Y_2 = S(1 + R) = C_2 \quad (2)$$

## Two-Period Neoclassical Growth Model

- Period 1:

$$Y_1 = C_1 + S \quad (1)$$

- Period 2:

$$Y_2 = S(1 + R) = C_2 \quad (2)$$

- Solve for  $S$  in (2):

$$S = \frac{C_2 - Y_2}{1 + R}$$

## Two-Period Neoclassical Growth Model

- Period 1:

$$Y_1 = C_1 + S \quad (1)$$

- Period 2:

$$Y_2 = S(1 + R) = C_2 \quad (2)$$

- Solve for  $S$  in (2):

$$S = \frac{C_2 - Y_2}{1 + R}$$

- Replace in (1):

$$\underbrace{Y_1 + \frac{Y_2}{1 + R}}_{\text{lifetime value income of income today}} = \underbrace{C_1 + \frac{C_2}{1 + R}}_{\text{lifetime value income of consumption today}} \quad (3)$$

# Two-Period Neoclassical Growth Model

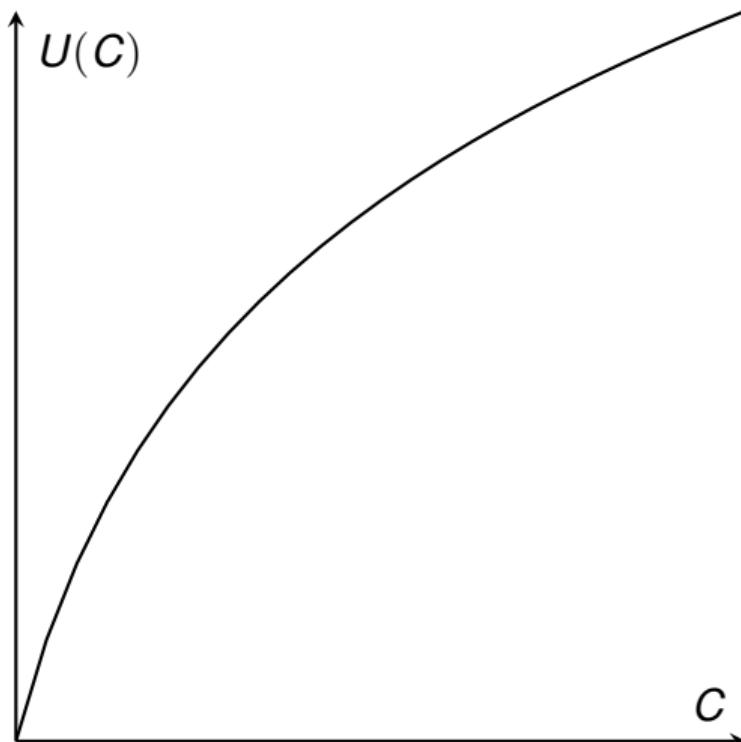
## Intertemporal Budget Constraint (IBC)

$$\underbrace{Y_1 + \frac{Y_2}{1+R}}_{\text{lifetime value income of income today}} = \underbrace{C_1 + \frac{C_2}{1+R}}_{\text{lifetime value income of consumption today}}$$

- So  $\frac{1}{1+R}$  is the price of consumption in the future in terms of price of consumption today.
- Why?
- If deposit \$1 in the bank today, how much will you get tomorrow?
- Are \$1 today and \$1 tomorrow worth the same amount?

## Two-Period Neoclassical Growth Model

- In each period, consumer receives utility from consumption measured by the utility function  $U(C)$ , which displays diminishing marginal utility.



## Two-Period Neoclassical Growth Model

Total lifetime utility is the weighted sum of flow utility in both periods

$$U(C_1) + \beta U(C_2)$$

- e.g.,  $C_1$ : gelato today,  $C_2$ : gelato tomorrow
- $\beta$ : degree of impatience
  - $\beta \rightarrow 0$ : very impatient
  - $\beta \rightarrow 1$ : very patient

## Two-Period Neoclassical Growth Model

The consumer maximizes lifetime utility subject to the intertemporal budget constraint

$$\begin{aligned} \max_{\{C_1, C_2\}} \quad & U(C_1) + \beta U(C_2) \\ \text{s.t.} \quad & Y_1 + \frac{Y_2}{1+R} = C_1 + \frac{C_2}{1+R} \end{aligned}$$

Solution, using Lagrangian :

$$\mathcal{L} = U(C_1) + \beta U(C_2) + \lambda \left[ Y_1 + \frac{Y_2}{1+R} - C_1 - \frac{C_2}{1+R} \right]$$

Take first order conditions, combine (will do in discussion section) into the Euler Equation (EE):

$$U'(C_1) = \beta(1+R)U'(C_2) \tag{4}$$

## Two-Period Neoclassical Growth Model

The Euler Equation (EE) packs a lot of economic intuition. First, note:

$$\underbrace{U'(C_1)}_{\text{marginal utility of consumption today}} = \underbrace{\beta(1+R)U'(C_2)}_{\substack{\text{marginal discounted utility} \\ \text{of saving one unit} \\ \text{of consumption today} \\ \text{and consumption earnings tomorrow}}}$$

why must it hold with equality at the optimal? Suppose not? Then what?

Now realize that the price of consumption at period 1 is equal to 1, the price of consumption at period 2 is equal to  $\frac{1}{1+R}$ . Then:

$$\underbrace{\frac{U'(C_1)}{\beta U'(C_2)}}_{\text{marginal rate of substitution}} = \underbrace{(1+R)}_{\substack{\text{marginal rate of transformation:} \\ \text{(price of } C_1)/(\text{price of } C_2)}}$$

## Two-Period Neoclassical Growth Model

Example **log utility**:  $U(C) = \ln(C)$ ,  $U'(C) = 1/C$ . **EE** becomes:

$$\frac{1}{C_1} = \beta(1 + R) \frac{1}{C_2} \implies \frac{C_2}{C_1} = \beta(1 + R)$$

Let  $\mathbb{W} = \left[ Y_1 + \frac{Y_2}{1+R} \right]$ : lifetime income. One can show:

- $C_1 = \frac{1}{1+\beta} \cdot \mathbb{W}$
- $C_2 = \frac{\beta}{1+\beta} \cdot (1 + R) \cdot \mathbb{W}$

## Two-Period Neoclassical Growth Model

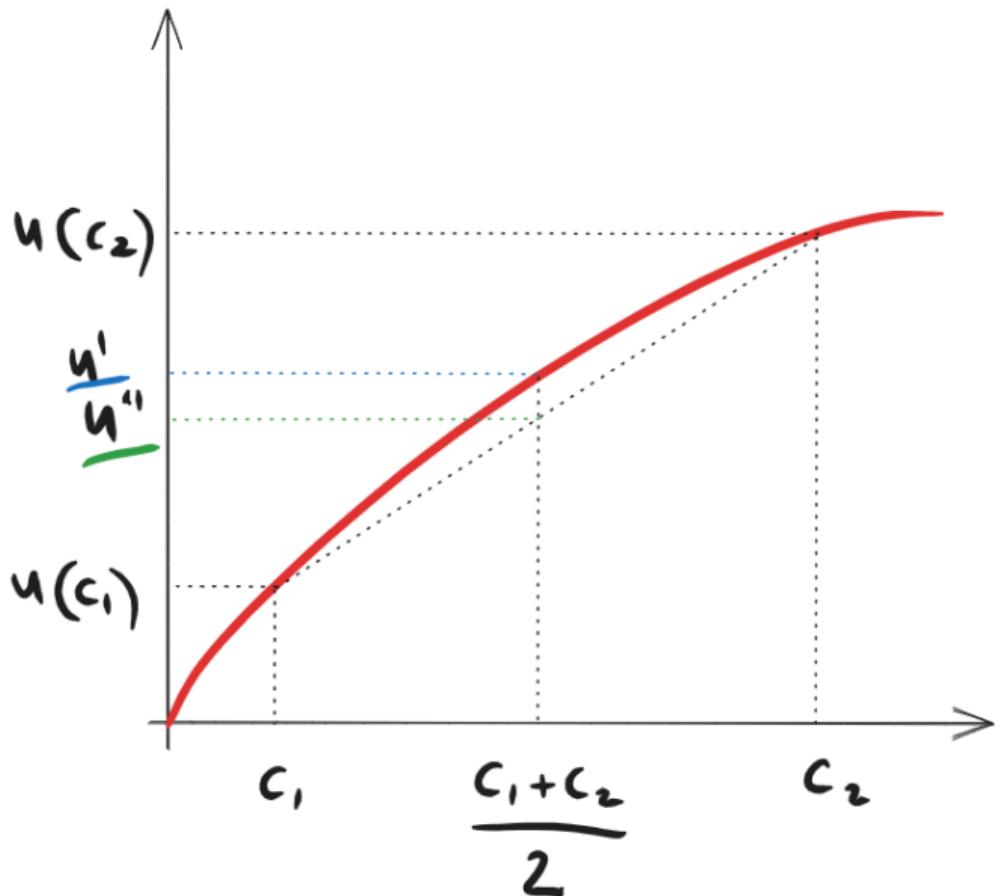
Numerical example with **log utility**.

- $\beta = 1, R = 5\%, Y_1 = \$30,000, Y_2 = \$50,000$
- $C_1 = \frac{1}{1+\beta} \cdot W = \frac{1}{2} \cdot \left[ \$30,000 + \frac{\$50,000}{1.05} \right] = \$38,809.5$
- $C_2 = \frac{\beta}{1+\beta} \cdot (1 + R) \cdot W = \frac{1}{2} \cdot [\$30,000(1.05) + \$50,000] = \$40,750$
- Is it smoother?



- why?

## Two-Period Neoclassical Growth Model



$$\begin{aligned} u' &= u\left(\frac{c_1+c_2}{2}\right) > \\ &\frac{1}{2} \left( u(c_1) + u(c_2) \right) \\ &= u'' \end{aligned}$$