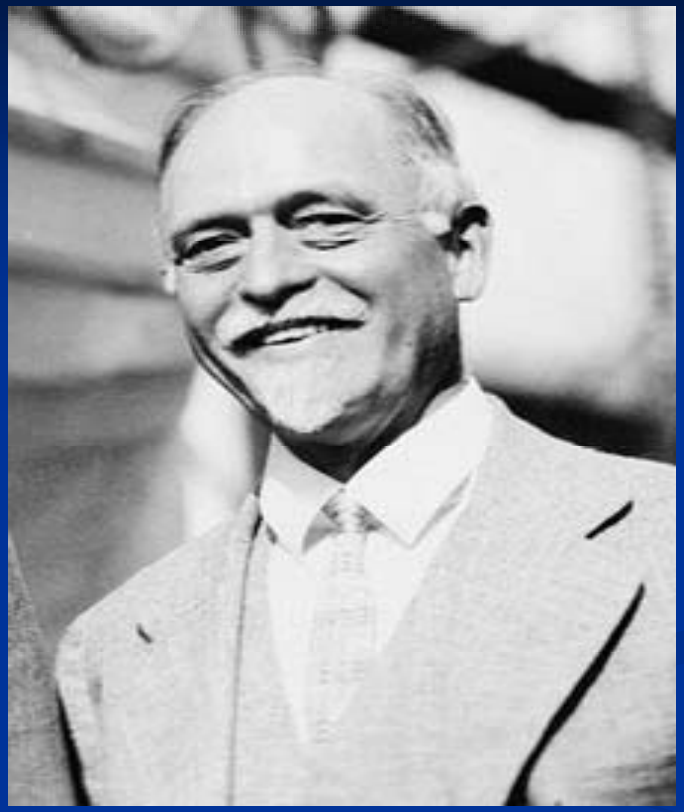


Irving Fisher
(1867-1947)
Presented by: Rendy Hadi

Background

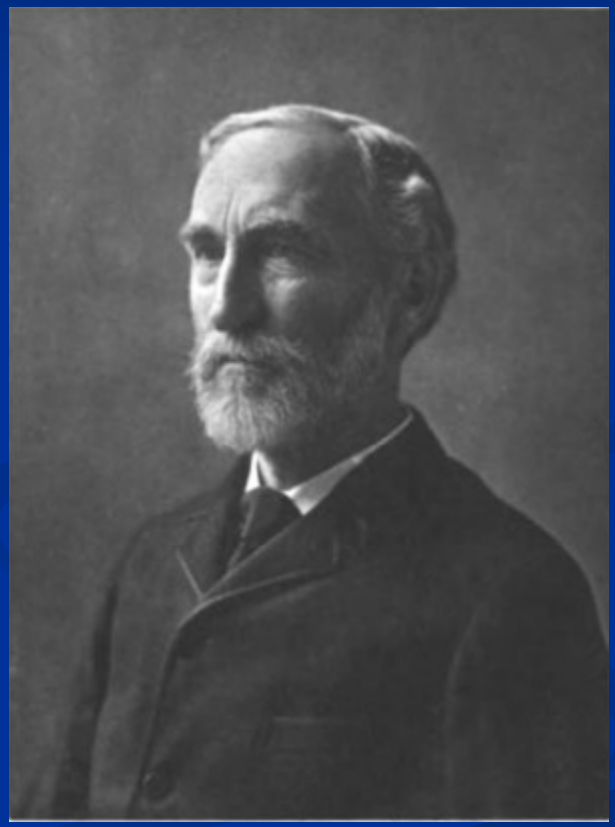
- Born Saugerties, New York 27 February, 1867
- Died New York City 29 April, 1947
- B.A in mathematics in 1888 Yale Univ.
- First being awarded Ph.D. in economics in 1891 Yale Univ.
- One of America's greatest mathematical economists and one of the clearest economics writers of all time

Background

- An inventor of card index file system (Rolodex)
- Prolific and gifted writer (2000 titles authored by him)
- Founded the Econometric Society in 1930 with Ragnar Frisch and Charles F. Ross
- President of American Economic Association in 1918

Influence

- Josiah Willard Gibbs,
  A mathematical physicist
  celebrated for his theory
  of thermodynamics

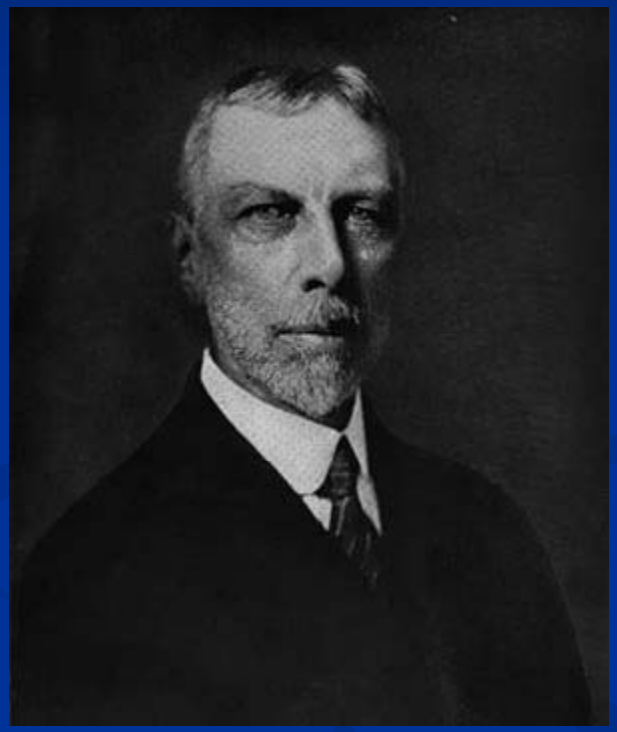


Influence

- William Graham Sumner, lead Fisher into mathematical economics. In Fisher's 3rd year graduate study Fisher won a worldwide recognition in economic theory on his dissertation.

Influence

- Arthur Twining Hadley, a political economist at Yale, specializing in what is now known as Industrial Organization

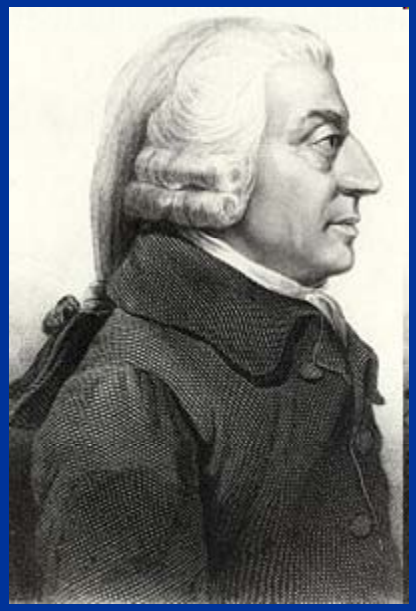


Influence

Adam Smith

David Ricardo

John Stuart Mill



Contribution

1. Quantity Theory of Money
2. Real vs. Nominal interest rate
3. Intretemporal Choice Model (Saving theory)

Quantity Theory of Money

- This theory explain how the quantity of money that households want to hold is determined
- In this theory, households want to hold money in proportion to dollar value of goods produced in the economy
- Let Y_t be the real GDP at time t and let P_t be the price level. The nominal GDP is P_tY_t. M^D_t is the demand for money and k_t is the propensity to hold money. The demand for money according to this theory is given by

$$M_t^D = k_t \cdot P_t Y_t$$

Quantity Theory of money

- In 2005 kt = 0.11, which means that in 2005 households held money at the amount of 11% of the GDP. In other words, each dollar circulated 9 times during 2005 (1/0.11 = 9)

- We define the velocity of money as the average number of times a piece of money circulates during the year.

Quantity Theory of money

- The velocity is denoted by V_t and defined as

$$V_t = \frac{P_t Y_t}{M_t^D}.$$

- Now we know the equation as "quantity equation"

$$M_t V_t = P_t Y_t$$

Quantity Theory of money

- The quantity theory is silent about what determines the velocity V_t and real GDP Y_t, but nevertheless this equation is useful for relating money, inflation and real GDP
- Divide "quantity equation" at time t + 1 by the same equation at time t

$$\frac{M_{t+1}V_{t+1}}{M_tV_t} = \frac{P_{t+1}Y_{t+1}}{P_tY_t}$$

$$\left(1+\hat{M}\right)\left(1+\hat{V}\right) = \left(1+\hat{P}\right)\left(1+\hat{Y}\right)$$

Quantity Theory of money

$$\ln\left(1+\hat{M}\right)+\ln\left(1+\hat{V}\right)=\ln\left(1+\hat{P}\right)+\ln\left(1+\hat{Y}\right)$$

- For small growth rates the above is approximately

$$\hat{M}+\hat{V}=\hat{P}+\hat{Y}$$

- Holding velocity constant we have

$$\hat{M}=\hat{P}+\hat{Y}$$

Example of Quantity Theory of money

- Suppose the money supply increase by 4% and the growth rate of real GDP was 1.5%, we can find the inflation rate using

$$\hat{M} = \hat{P} + \hat{Y}$$

- Since the growth rate of price level is also known as inflation
- We would have 2.5% of inflation rate

Nominal Vs. Real Interest Rate

- Fisher was the first one to explain the difference between nominal and real interest rate

- Nominal interest rate= the **extra dollars** that one gets in the future when he gives up one dollar today (what you would get when opening a saving account)

Nominal Vs. Real Interest Rate

- If the annual nominal interest rate is 10%, this means that when you deposit $1 today, you will receive your $1 back, plus $0.1 interest

Nominal Vs. Real Interest Rate

- Real interest rate= the **extra amount of consumption** that one gets in the future when he gives up one unit of current consumption
- Real interest rate is what people really care about.

Nominal Vs. Real Interest Rate

- Suppose the nominal interest rate is 10%, and there is a consumption good of burger that cost $1
- What you really care is how many extra burgers will you get next year when you give up one burger this year
- Suppose the inflation rate is 5%, so the price of burger next year is $1.05

Nominal Vs. Real Interest Rate

- When you give up one burger today and save the $1 in the saving account, you will receive $1.1 in the next year
- You can buy 1.1/1.05 ≈ 1.048 burgers
- By giving up 1 burger today you would be able to get an extra 0.048 burgers in the future
- The real interest rate is going to be 0.048 or 4.8%

Nominal Vs. Real Interest Rate

- Fisher derived the relationship between nominal interest rate and real interest behavior as what is called "fisher equation":

$$\frac{1+i}{1+\pi} = 1+r$$

r = real interest rate

i = nominal interest rate

π = inflation rate (predicted/expected)

Nominal Vs. Real Interest Rate

$$\ln(1+i) - \ln(1+\pi) = \ln(1+r)$$

If i, r, π are small, the above equation can be rewritten

$$r = i - \pi$$

The real interest rate is approximately equal to the nominal interest rate minus the inflation rate

Nominal Vs. Real Interest Rate

- In the burger example the nominal interest rate was 10% and the inflation rate was 5% using the equation

$$r \approx 10\% - 5\%$$

$$r \approx 5\%$$

- In the example the exact real interest rate was 4.8%

Intertemporal Choice Model (Saving Theory)

- Model which consumers make explicit decision about consumption and saving
- There are two periods in this model, period 1 (current) and period 2 (future)
- Consumers decide how much to consume in both period and how much to save in current period
- In both period consumers also receive income as well as pay tax to the government

Intertemporal Choice Model

- Budget Constraints for both period:

$$BC_1: \quad c_1 + s = y_1 - t_1$$
$$BC_2: \quad c_2 = y_2 - t_2 + (1+r)s$$

c= consumption

s= savings

y= income

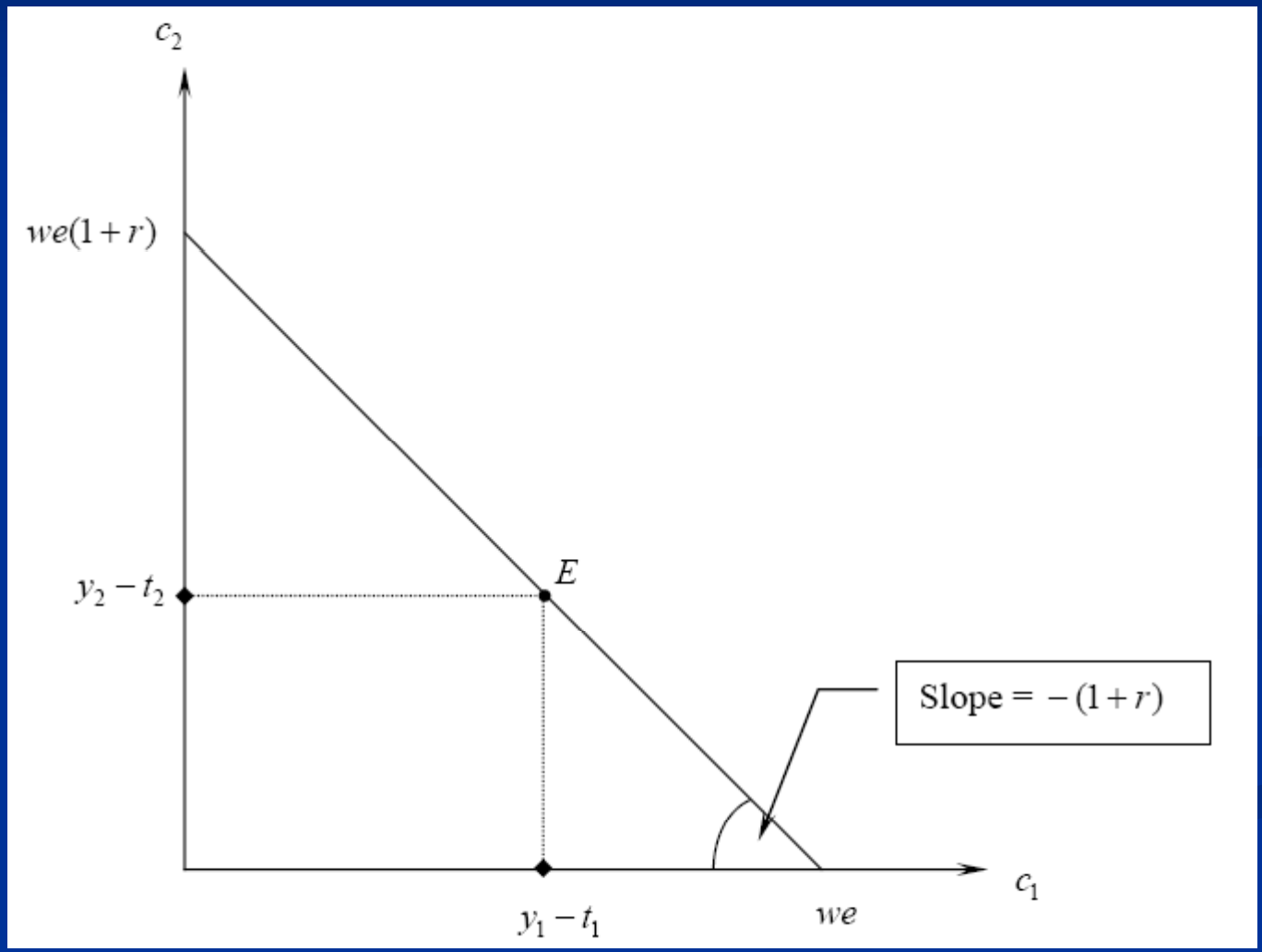
t= lump sum tax

Intertemporal Choice Model

- Lifetime budget constraint

$$\underbrace{c_1 + \frac{c_2}{1+r}}_{PV\ of\ lifetime\ \ consumption} = \underbrace{y_1 - t_1 + \frac{y_2 - t_2}{1+r}}_{we=lifetime\ wealth}$$

Intertemporal Choice Model



Intertemporal Choice Model

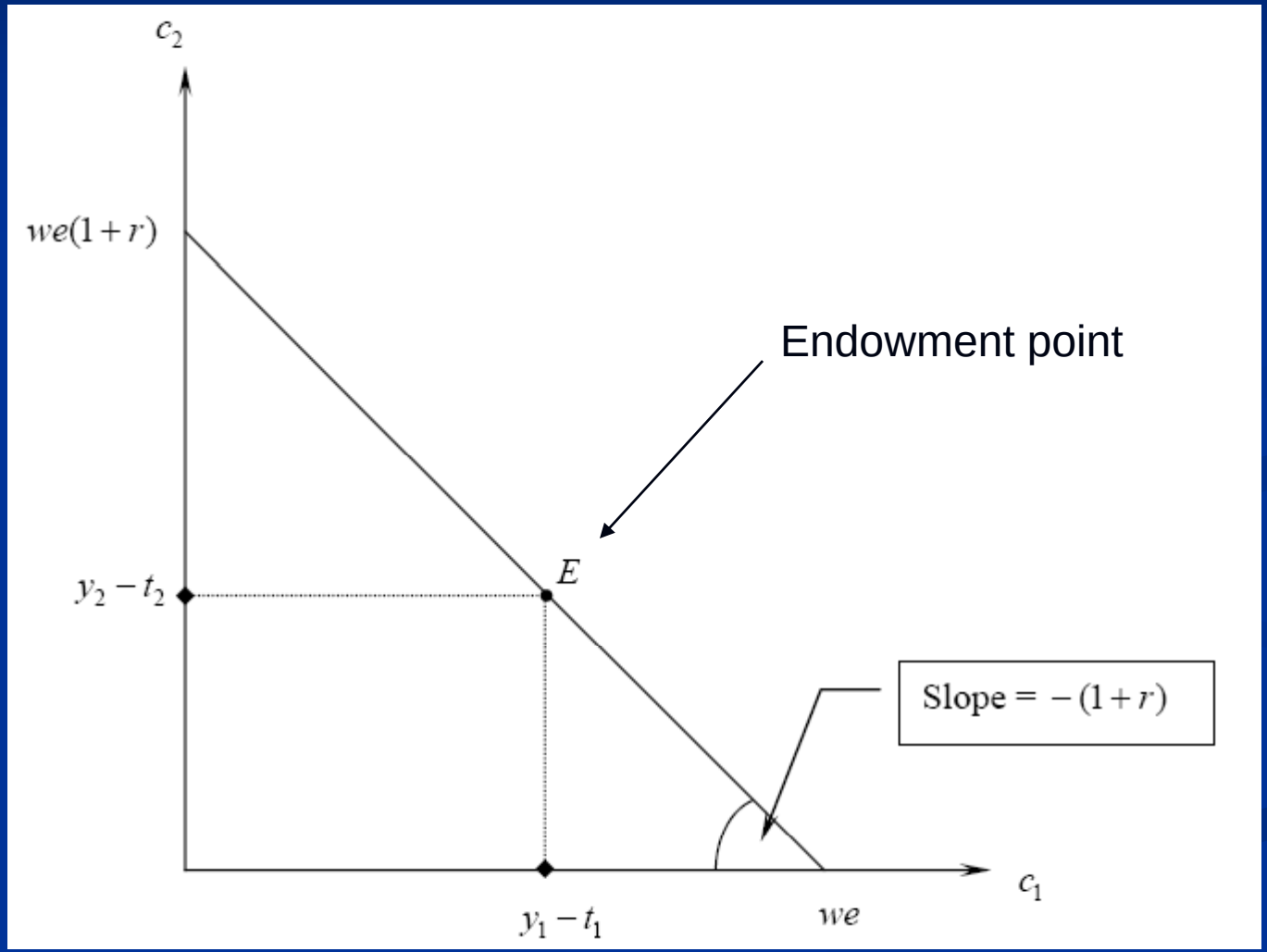
- With free borrowing and lending, it is feasible for this consumer to consume all his wealth in the first period and nothing in the second: (c_1=we, c_2=0)
- It is also feasible for this consumer not to consume anything in the first period and consume all his wealth in the second period: (c_1=0, c_2=we(1+r))

Intertemporal Choice Model

- Also notice that it is feasible for the consumer to consume in each period the income (net of taxes) received in that period: ($c_1=y_1-t_1$, $c_2=y_2-t_2$)

- That point where consumers consume its income at each period is the endowment point

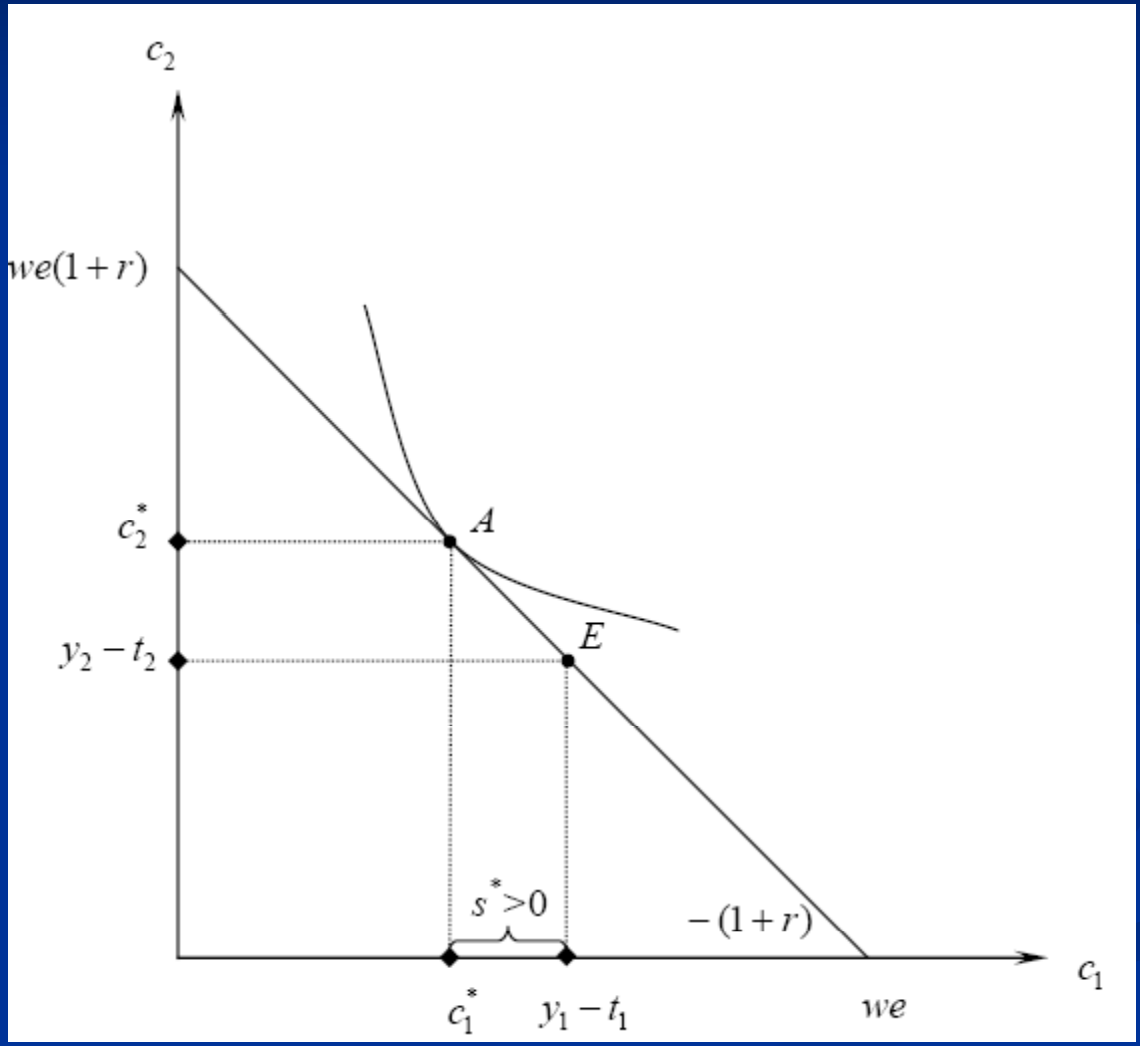
Intertemporal Choice Model



Intertemporal Choice Model

- When consumer choose a bundle above the endowment point that means that the consumer is a lender
- Above the endowment point consumer consume less than their income in the first period in order to consume more in the second period

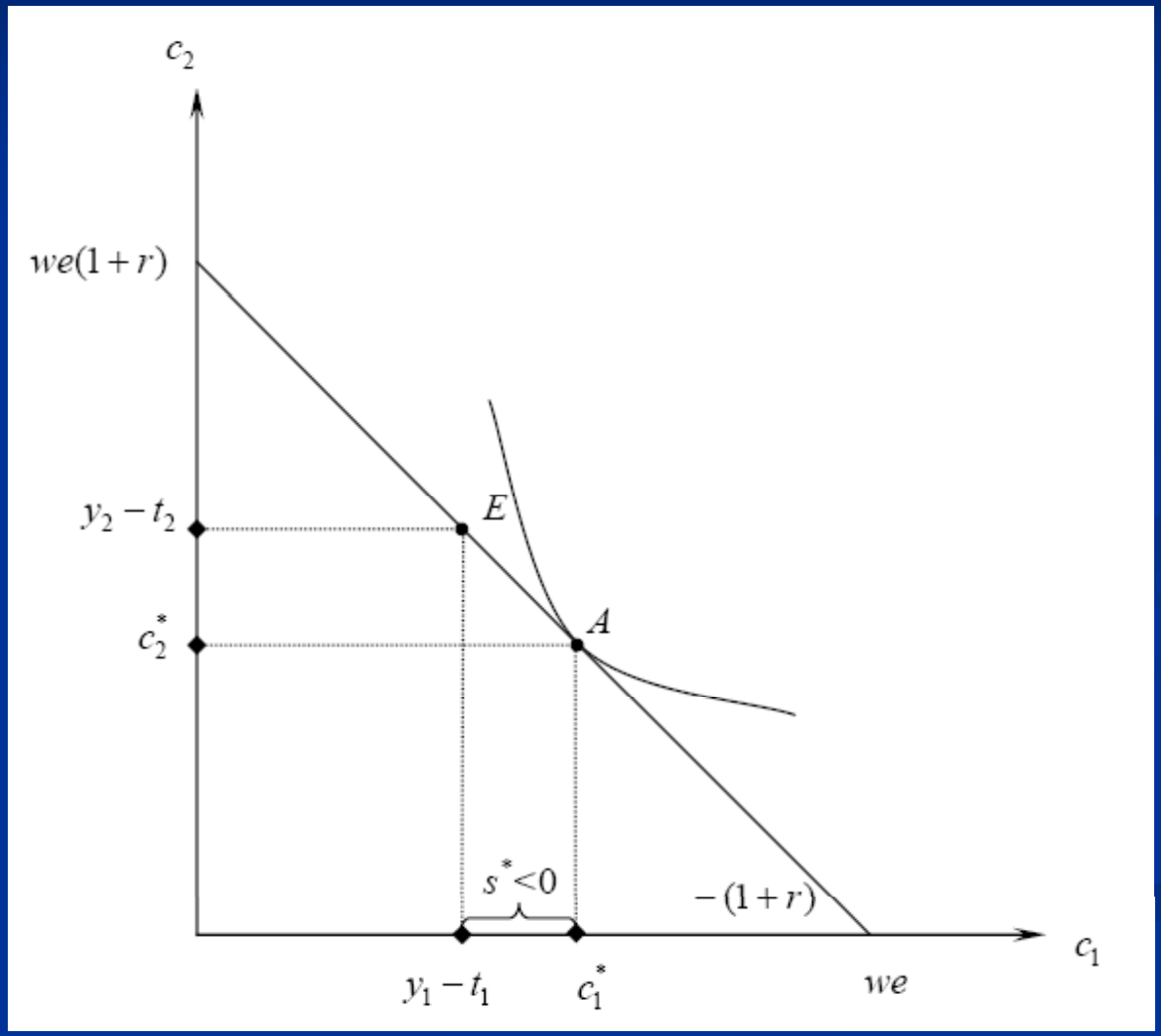
Intertemporal Choice Model (lender)



Intertemporal Choice Model

- Consumer who choose to borrow in the first period in order to consume more, will have a consumption bundle point that is below the endowment point
- By consuming more in the first period this means that the consumer will give up some of their future consumption

Intertemporal Choice Model (borrower)



Impact

- The quantity theory of money is the rule of thumb of monetary policy of the FED
- Introduced what is now known as distributed lag in time series model (used in econometrics)
- Index number to measure average prices of goods and services during certain time period
- We can see his theories in many economics classes

Questions

- Would you be happier with 2% cut in nominal income or have an increase of 2% in nominal income where there is 5% inflation?
  - **The first option has higher real income**
- What is the difference between nominal and real interest rate?
  - **Nominal interest is interest without taking into account the inflation rate**
  - **Real interest rate is interest adjusted to inflation**
- What are the factors that effects people's decisions to save?
  - **Real interest rate, current and future income, preferences**
- Does the FED directly affect **real interest rate?**
  - **FED only effects the nominal interest rate**