

# 4.5 — Factor Markets II: Capital

ECON 306 · Microeconomic Analysis · Fall 2020

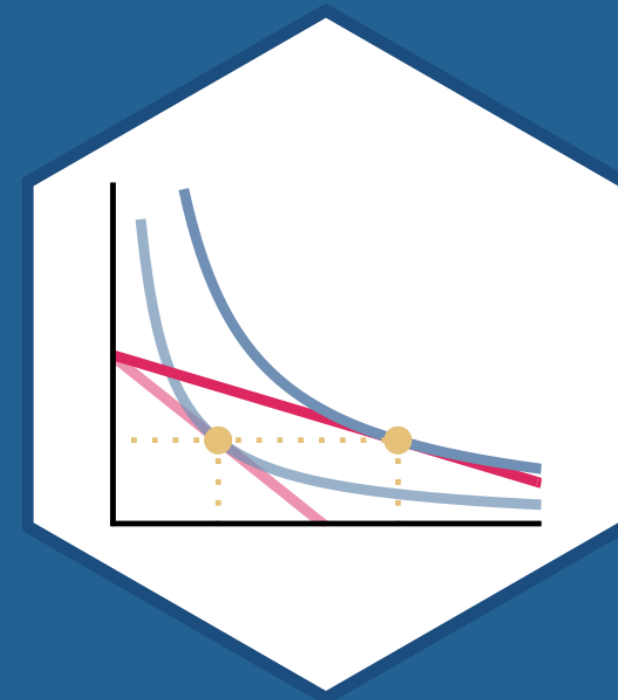
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[🐙 ryansafner/microF20](https://github.com/ryansafner/microF20)

[🌐 microF20.classes.ryansafner.com](https://microF20.classes.ryansafner.com)



# Outline



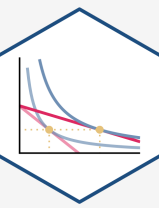
Labor Market for Competitive Firm

Labor Market for a Monopoly.

Monopsony Power

Monopoly Power in Labor Markets: Unions

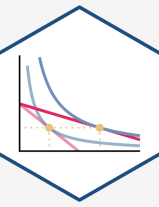
# What is Capital?



- A note on how we used capital  $(K)$  earlier this semester...
- Assumed capital (essentially machines) has a market price  $(r)$ , the “rental rate of capital”
  - Most firms purchase machines outright, rather than rent them per period (e.g. per hour)
  - But like any input, we consider the (opportunity) cost of using a marginal



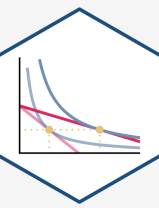
# What is Capital?



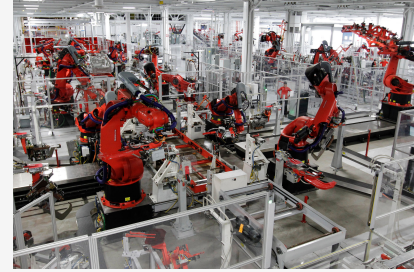
- Exact nature & definition remains controversial to economists to this day
- “Capital” is:
  - hard to define or (especially) aggregate
  - necessarily bound up with time and uncertainty



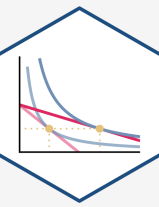
# What Is Capital?



- Economists (and others) often talk about different *types* of capital
  - **Physical capital:** tools, machines, specialized equipment, software, that makes labor more productive
  - **Human capital:** skills, training, education, experience embodied in a person that makes their labor more productive
  - **Financial capital:** access to immediate cash to finance investment for production
- Social scientists also talk about “political capital,” “social capital,” etc...



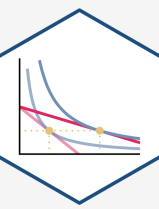
# What Is Capital?



- Some generally observed features of capital:
- **Capital is *not* an original factor**
  - It's land & labor combined in the past (i.e. someone had to make the shovel, the factory, etc. with land & labor)
- **Capital goods are not directly consumed**
  - Used in the production of other goods
- **Capital inherently consists of a time element**
  - Makes labor more productive
  - Capital as “stored labor time”



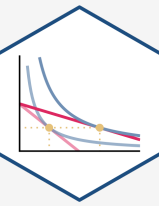
# What Is Capital?



- For our purposes today, let's not think of capital as *physical* capital, but as financial capital
  - All types of capital have the following financial aspect
- Capital is about **the diversion of present consumption towards future consumption**
  - Capital comes from savings, and is used for investments that firms (and households) use to increase their (production for) consumption
  - The return that owners of capital get for providing capital to firms is **interest**



# What Is Capital?

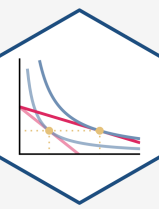


- Historically, the idea came from farmers
- During harvest time, can consume all produce today, or save some for next year
  - The more you save today, the less you can eat now, but the more you will have in the future
  - The more you consume today, the less you will have in the future



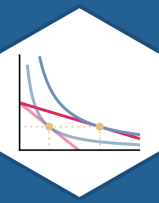


# Capital Markets



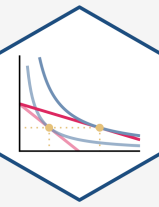
- Firms (and households) get money for investment today by participating in **capital markets**
- The funds in capital markets come from individual savings





# The Time Value of Money

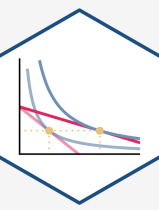
# Present vs. Future Goods



- In discussing capital, we are comparing **present goods** with **future goods**
- Futures: claims on goods to be delivered at a future date
  - corn futures, oil futures, etc.
- Financial assets: bonds, lottery winnings, loans
- Real goods: immature orchard of fruit trees; durable goods that yield output later



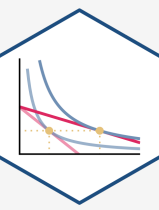
# Present vs. Future Goods



- **Interest rate is a price of future goods in terms of present goods**
  - How much individuals will pay to receive income now vs. later
- **Investment in capital:** present consumption can be saved to buy/build machinery that can increase future income flows



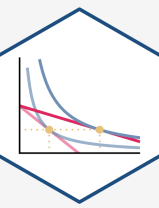
# Present vs. Future Goods



- Consider goods-bundles consumed now vs. consumed at later date
  - i.e. not apples vs. oranges, but apples and oranges **today** vs. apples and oranges **next year**
- **Agent's objective**: optimize time-profile of consumption, **maximize net present value**



# Present vs. Future Goods



- **Time Value of Money:** same nominal amount of money<sup>†</sup> is worth different amounts over time

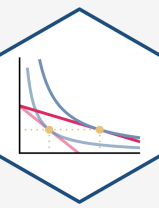
$$\begin{aligned} PV &= \frac{FV}{(1+r)^n} \\ FV &= PV(1+r)^n \end{aligned}$$

- $(PV)$ : present value
- $(FV)$ : future value
- $(r)$ : interest rate
- $(n)$ : number of time periods

<sup>†</sup> Or income, or consumption...

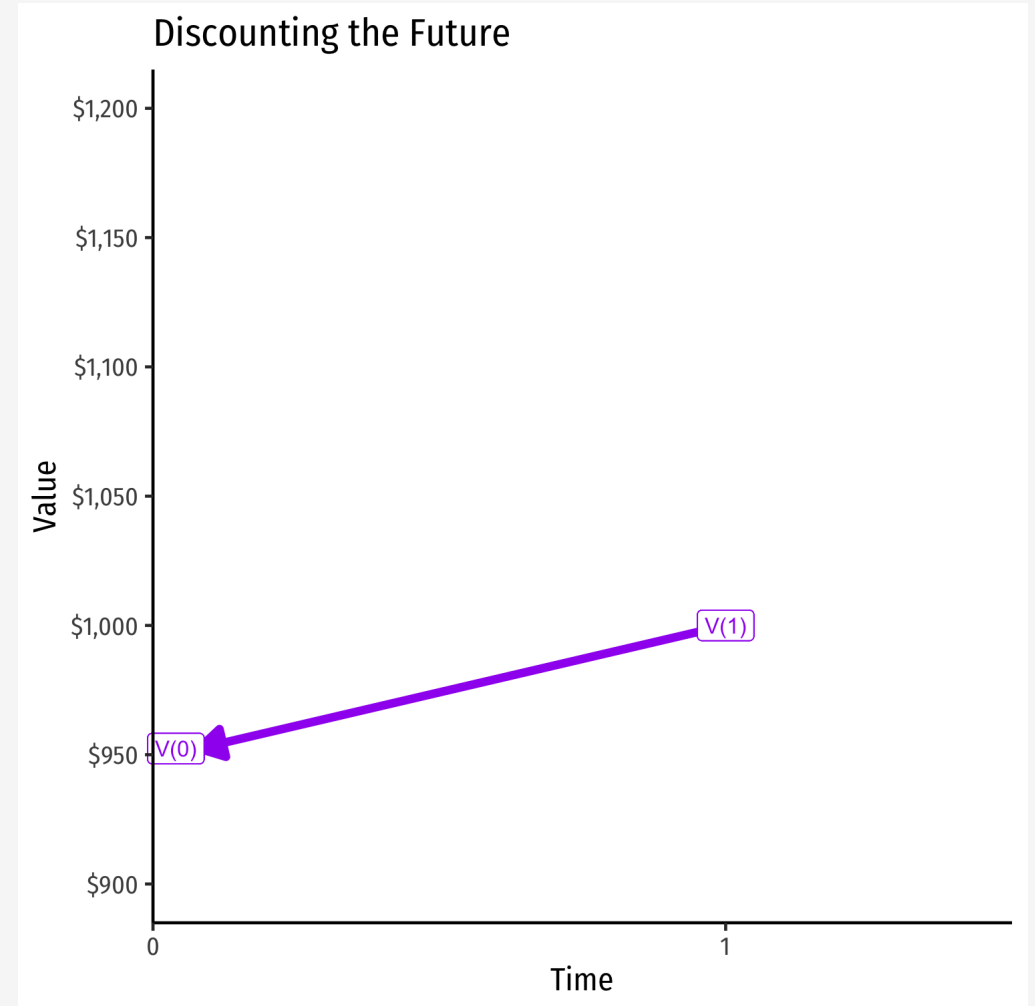


# Present vs. Future Goods

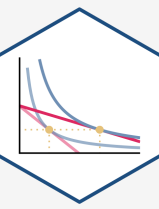


- **Example:** what is the present value of getting \$1,000 one year from now at 5% interest?

$$\begin{aligned} PV &= \frac{FV}{(1+r)^n} \\ PV &= \frac{1000}{(1+0.05)^1} \\ PV &= \frac{1000}{1.05} \\ PV &= \$952.38 \end{aligned}$$

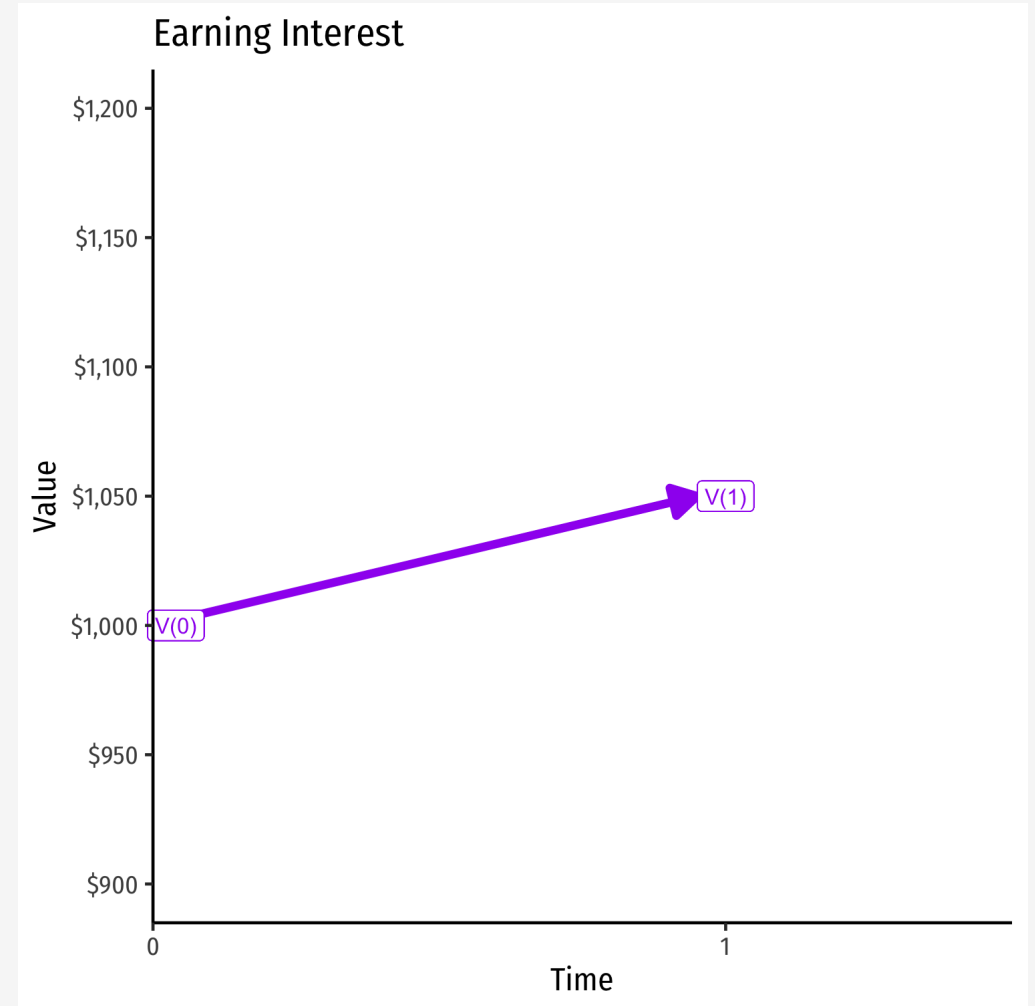


# Present vs. Future Goods



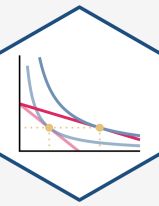
- **Example:** what is the *future* value of \$1,000 lent for one year at 5% interest?

$$\begin{aligned} FV &= PV(1+r)^n \\ FV &= 1000(1+0.05)^1 \\ FV &= 1000(1.05) \\ FV &= \$1050 \end{aligned}$$





# Rule of 72



- A good rule of thumb: number of years for your principal to double:

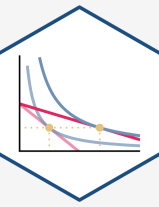
$$\frac{72}{r}$$

- This is known as the **rule of 72**<sup>1</sup>



<sup>1</sup> Different people use other numbers, like 70. The point is more to make mental calculations easily rather than accurately.

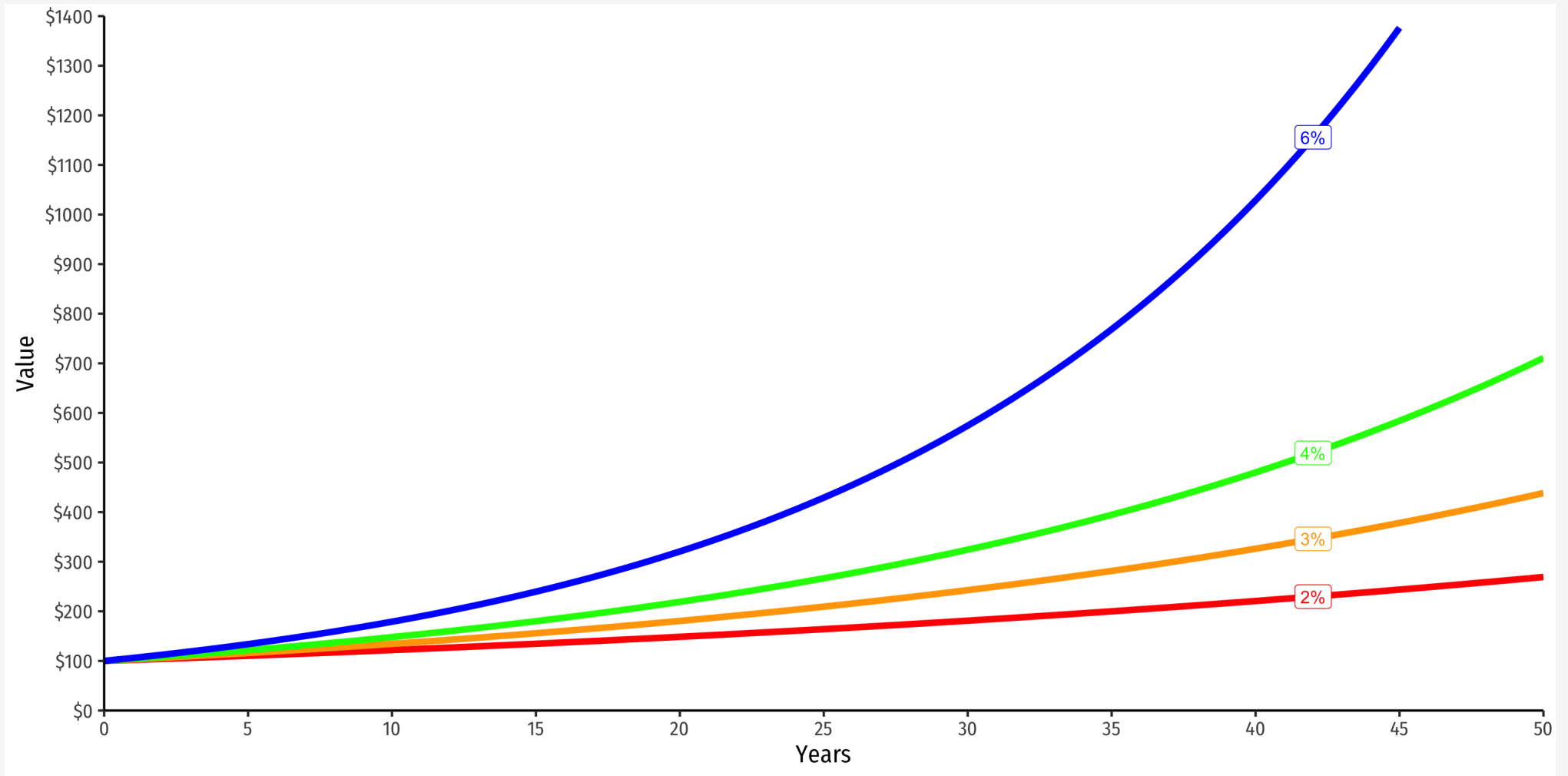
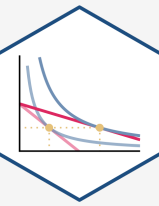
# Rule of 72



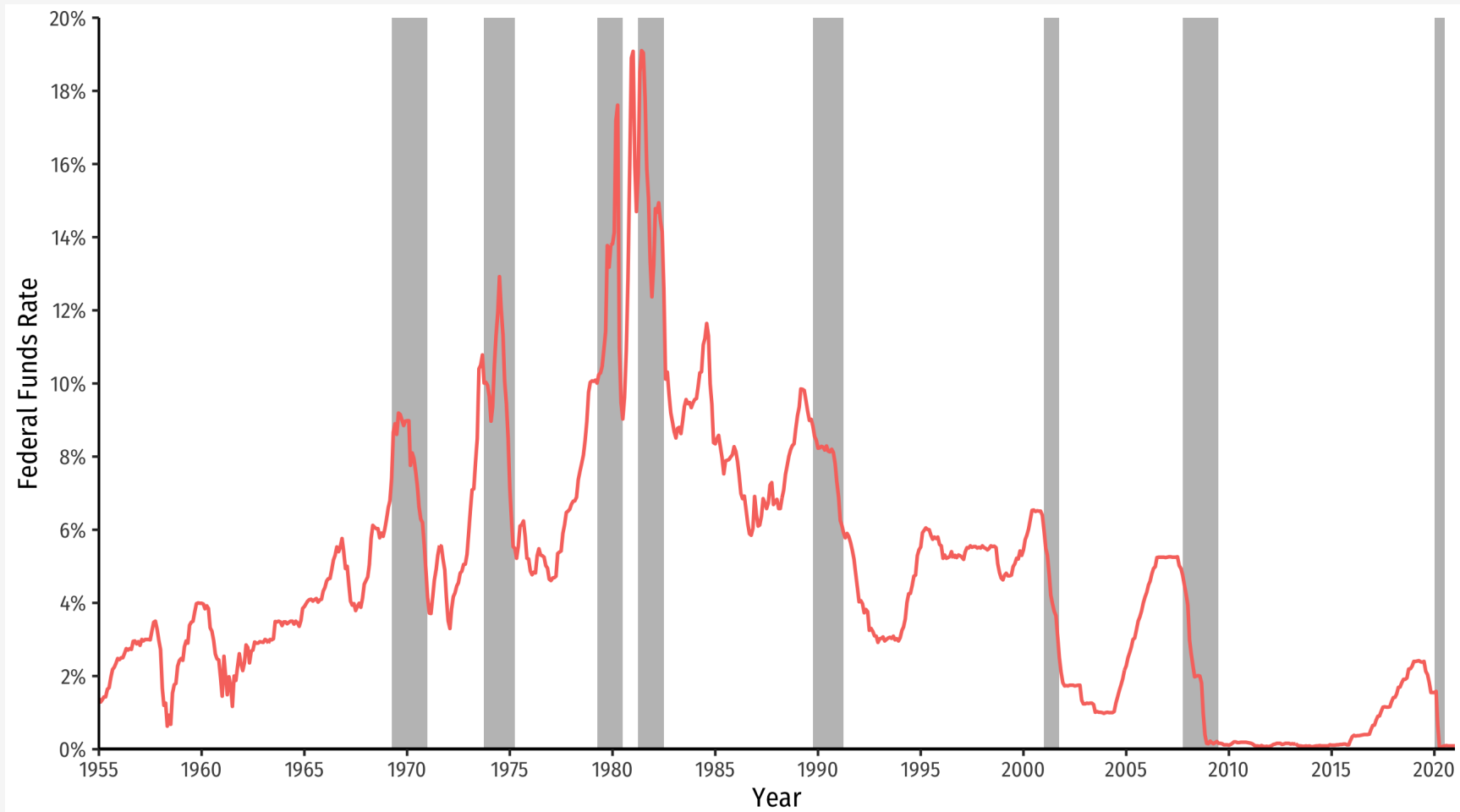
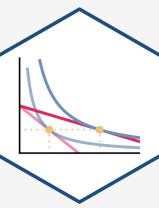
## Example:

- If interest rate is 2%, your money doubles in  $(\frac{72}{2}=36)$  years
- If interest rate is 3%, your money doubles in  $(\frac{72}{3}=24)$  years
- If interest rate is 4%, your money doubles in  $(\frac{72}{4}=18)$  years
- If interest rate is 6%, your money doubles in  $(\frac{72}{6}=12)$  years
- Interest rate is very important price! Makes all the difference whether it is 1% vs. 2%!

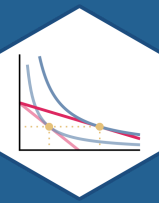
# Compounding Interest



# Historical Interest Rates

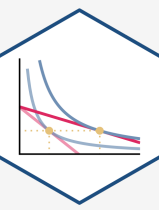


Data Source: FRED; Recessions Shaded in Gray



# Individual Savings Decisions

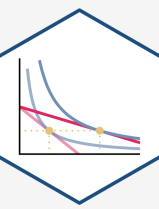
# Individual Savings Decisions



- The **Supply of Capital** comes from **individual decisions to save**
- Saving is considered a **disutility** (a **bad**)
  - **Opportunity cost** of saving is **consumption**
  - But, saving (and lending) can earn **interest**
- Tradeoff: if you save more, you consume less today, but can consume more in the future (with interest income)



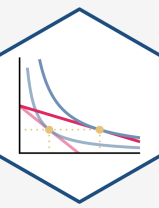
# Individual Savings Decisions



- Apply our consumer choice model to **“intertemporal” choice** to consume:  
 $u(c_1, c_2)$ 
  - $(c_1)$ : consumption today (period 1)
  - $(c_2)$ : consumption tomorrow (period 2)
- Define amount of saving as:  $s = M - c_1$ 
  - where  $(M_0)$  is today's income



# Individual Savings Decisions



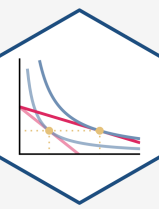
$u(c_1, c_2)$

- Individuals have a “**time preference**” between present consumption and future consumption
  - In general, everyone prefers consumption today over consumption in the future
  - We place a **premium** on present consumption and **discount** future consumption
  - This is where the idea of **interest** and the **time value of money** come from (more on those later)
- A measure of how **impatient** you are

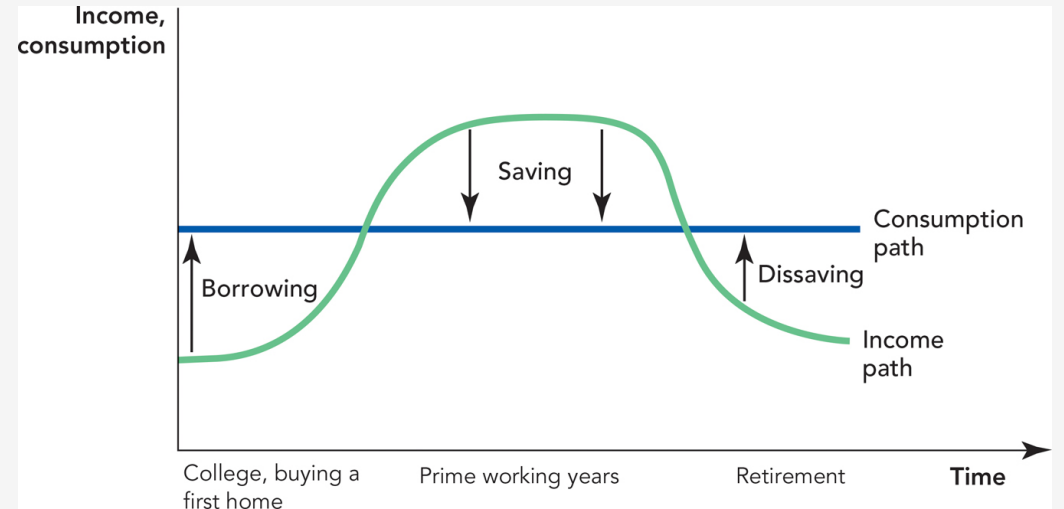




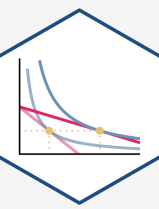
# Individual Savings Decisions



- Most people follow a consistent “life cycle” of saving decisions
- People like to “smooth” their consumption over time, rather than experience sudden, discontinuous jumps in consumption level
  - When actual income  $\lt$  preferred consumption: **borrow** money
  - When actual income  $\gt$  preferred consumption: **save** (and **lend**) money

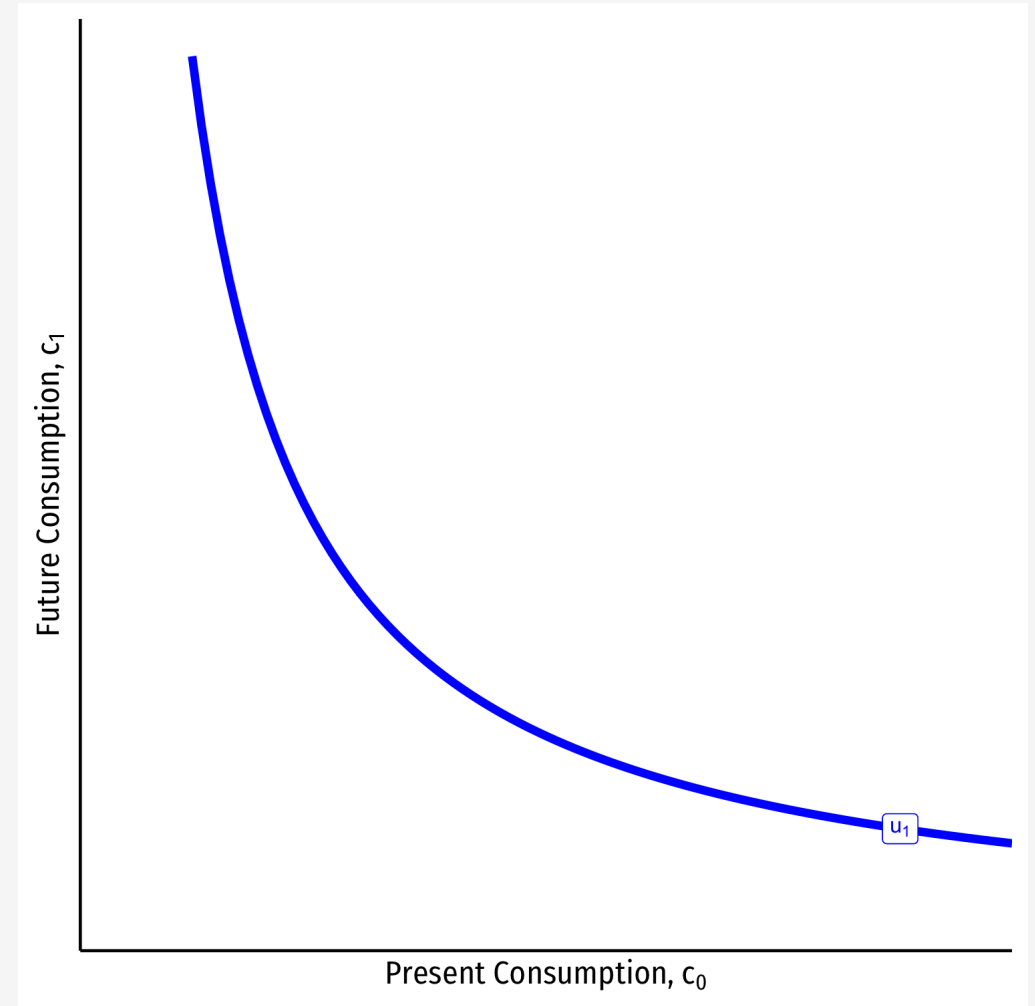


# Individual Savings Decisions

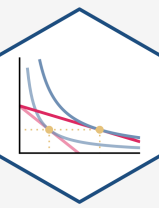


$u(c_1, c_2)$

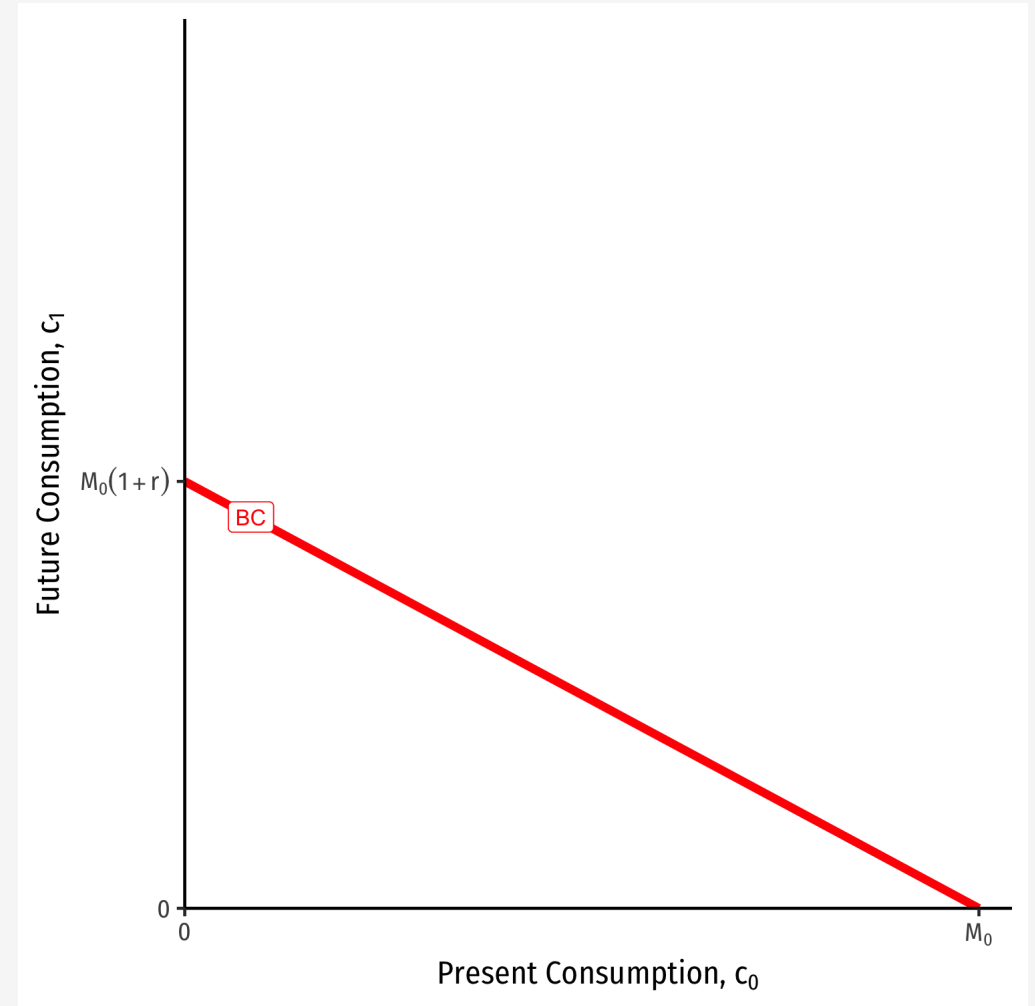
- **Marginal rate of (intertemporal) substitution:** rate at which person gives up future consumption  $((c_1))$  to obtain more present consumption  $((c_0))$ 
  - The slope of the indifference curve!



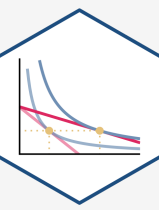
# Individual Savings Decisions



- Suppose individual starts with an income today  $(M_0)$ 
  - Must choose how much of it to consume today  $(c_0)$  versus save to consume more in future  $(c_1)$
- Let individual have opportunities to exchange in **capital markets**
  - Exchange present goods  $(c_0)$  for claims on future goods  $(c_1)$  repaid with interest at rate  $(r)$

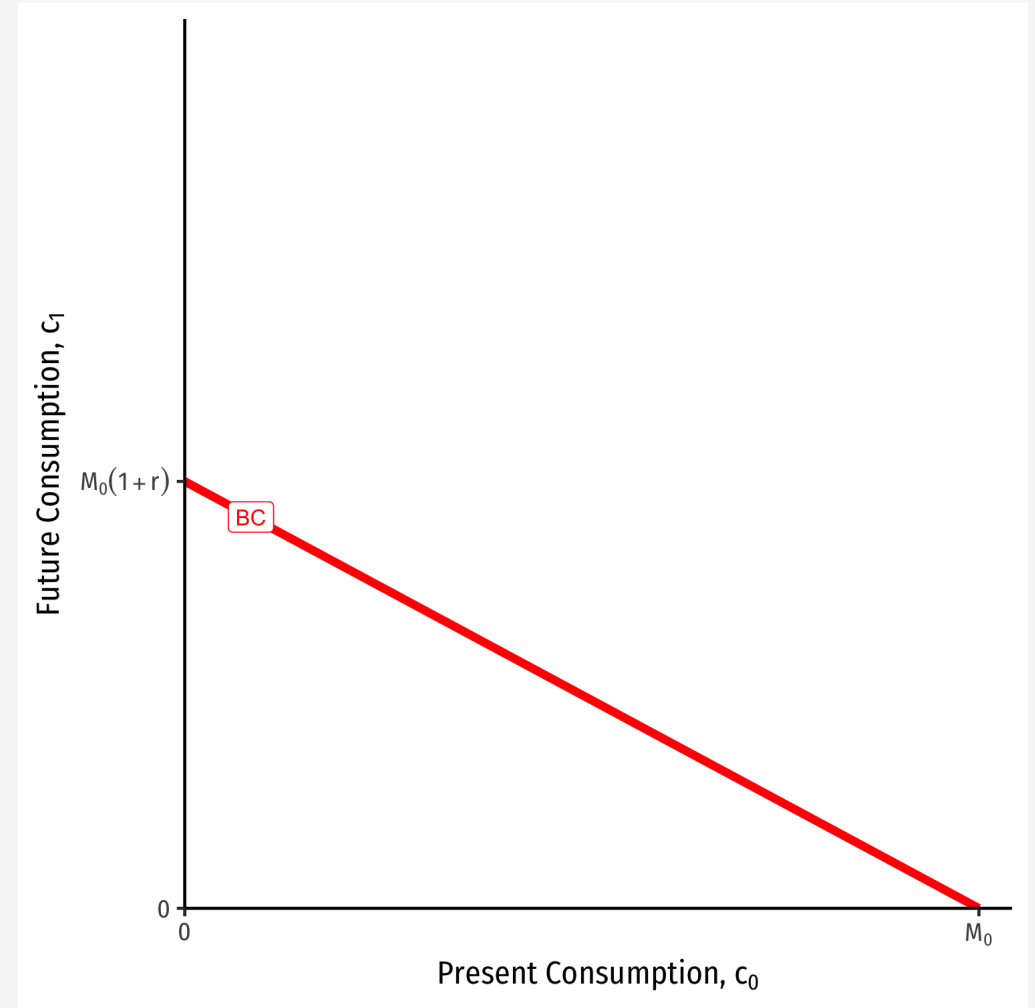


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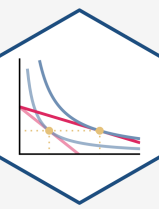


- **Opportunity cost** of consumption today  $\backslash$   $((c_0)\backslash)$  is  $\backslash(1+r\backslash)$ 
  - Forgo opportunity to save and invest to earn interest (and consume more) next period
- Let the price of future consumption be \$1
  - Then the slope of **budget constraint** is

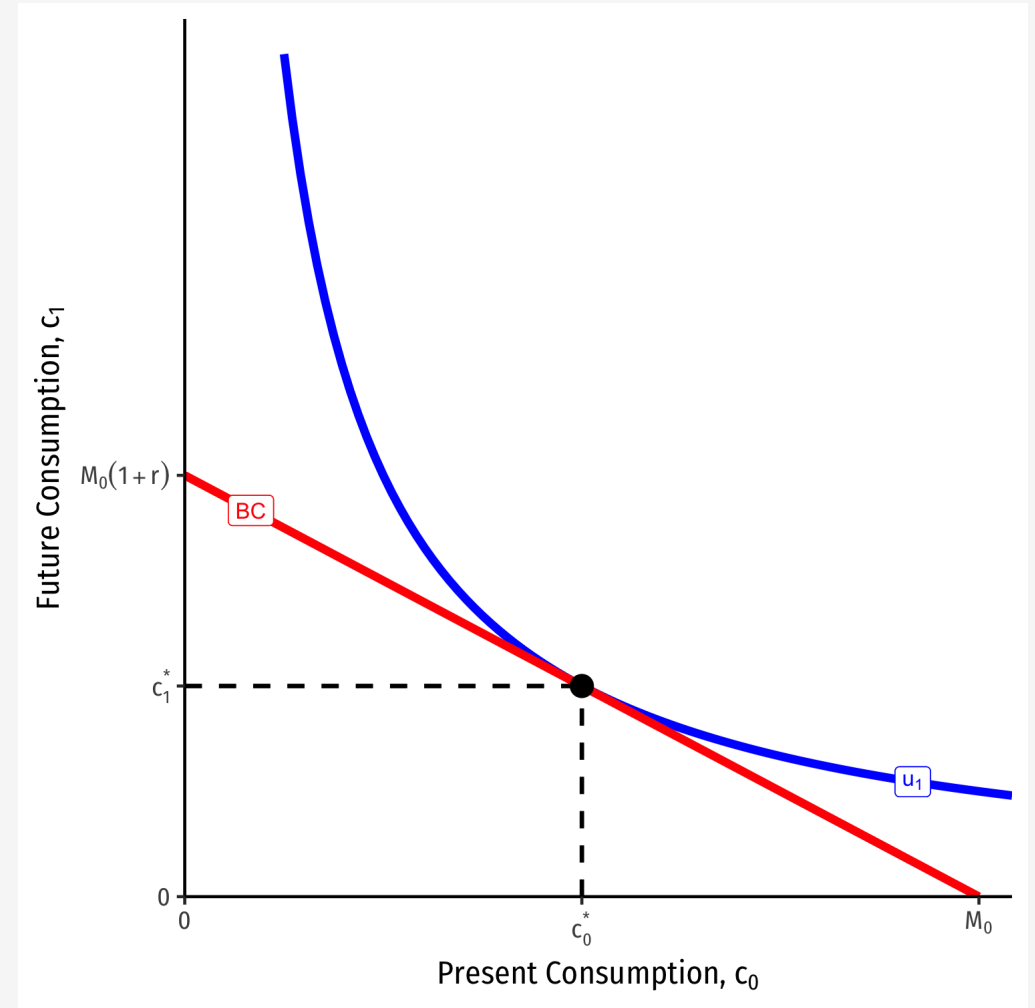
$$\frac{p_{c_0}}{p_{c_1}} = -\frac{(1+r)}{1} = -(1+r)$$



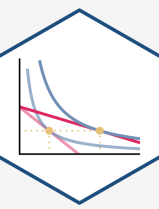
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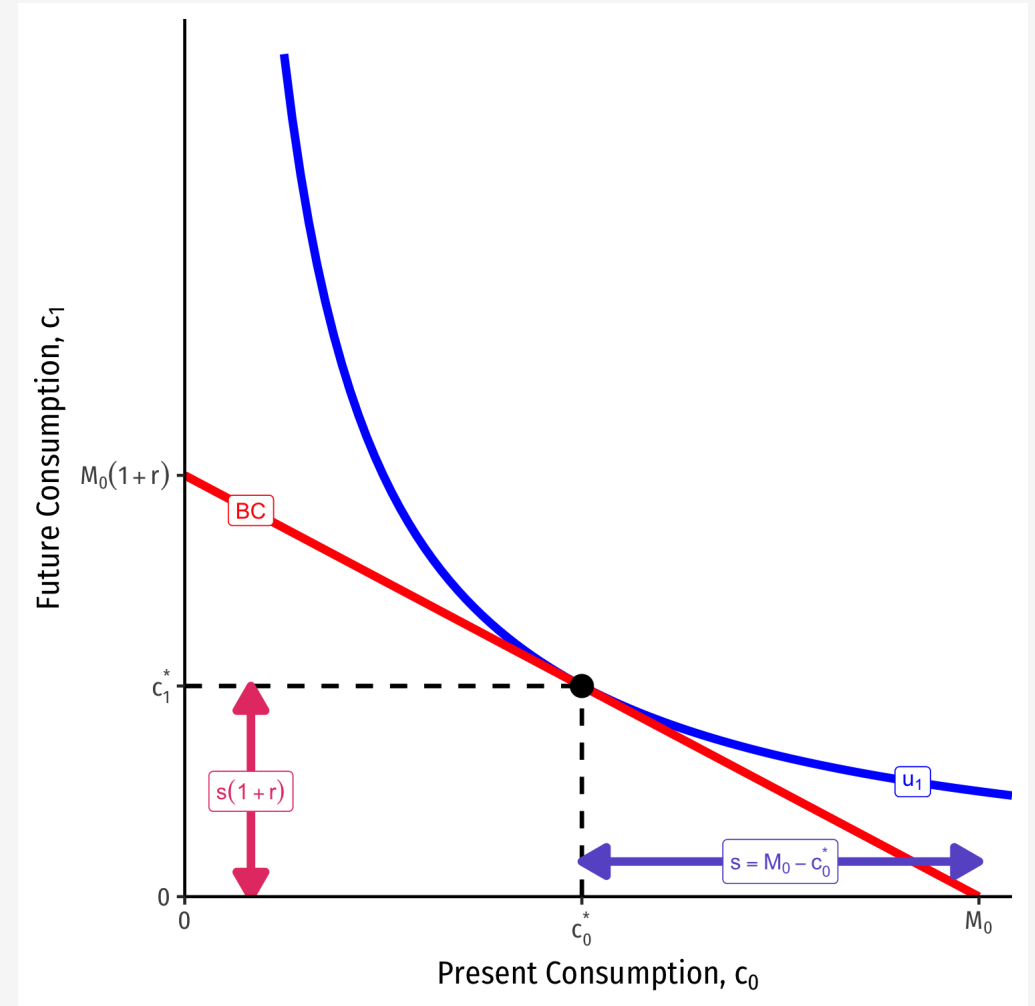
- Consumer maximizes utility subject to budget constraint at  $(A)$ :  $((c_0^*, c_1^*))$



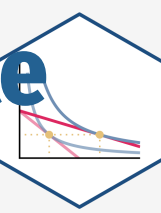
# Individual Savings Decisions



- Consumer maximizes utility subject to budget constraint at  $(A)$ :  $((c_0^*, c_1^*))$
- Consumes  $(c_0^*)$  today, saving  $(s = M_0 - c_0^*)$  to consume  $(c_1^* = s(1+r))$  next period



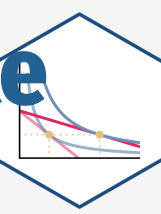
# Individual Savings Decisions: A Change in Interest Rate



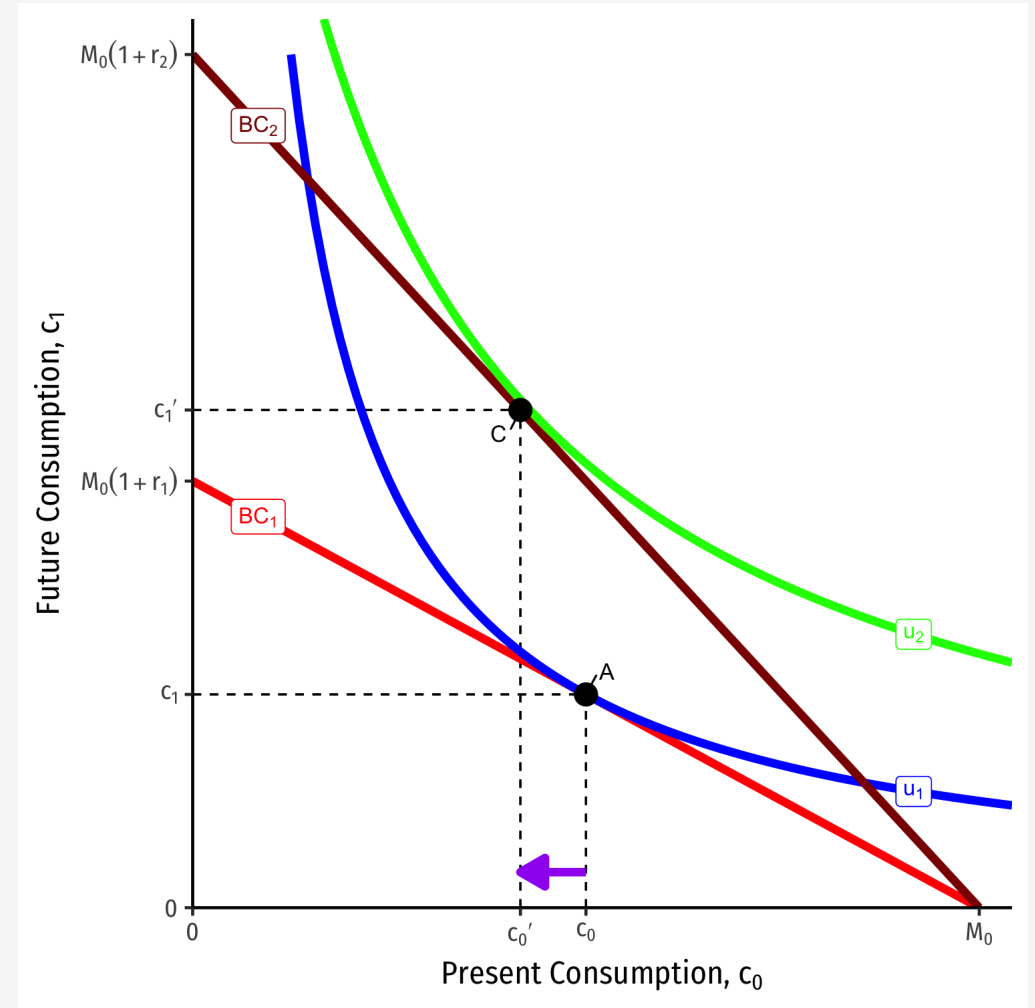
- What will happen to the optimal savings decision if **interest rate  $(r)$  increases?**
- It depends!
- Consumption is a normal good, but this makes savings “inferior”  $M_0 - c_0$ 
  - $(\uparrow c_0 \implies \downarrow s)$
- Again, **income and substitution effects** are important!



# Individual Savings Decisions: A Change in Interest Rate

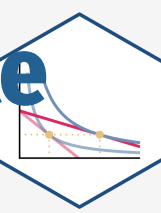


- (Overall) Price effect:  $(A \rightarrow C)$ 
  - Higher rate  $(r)$  leads to less consumption today  $(c_0)$  and therefore, more saving  $(s)$
- Upward sloping savings supply curve

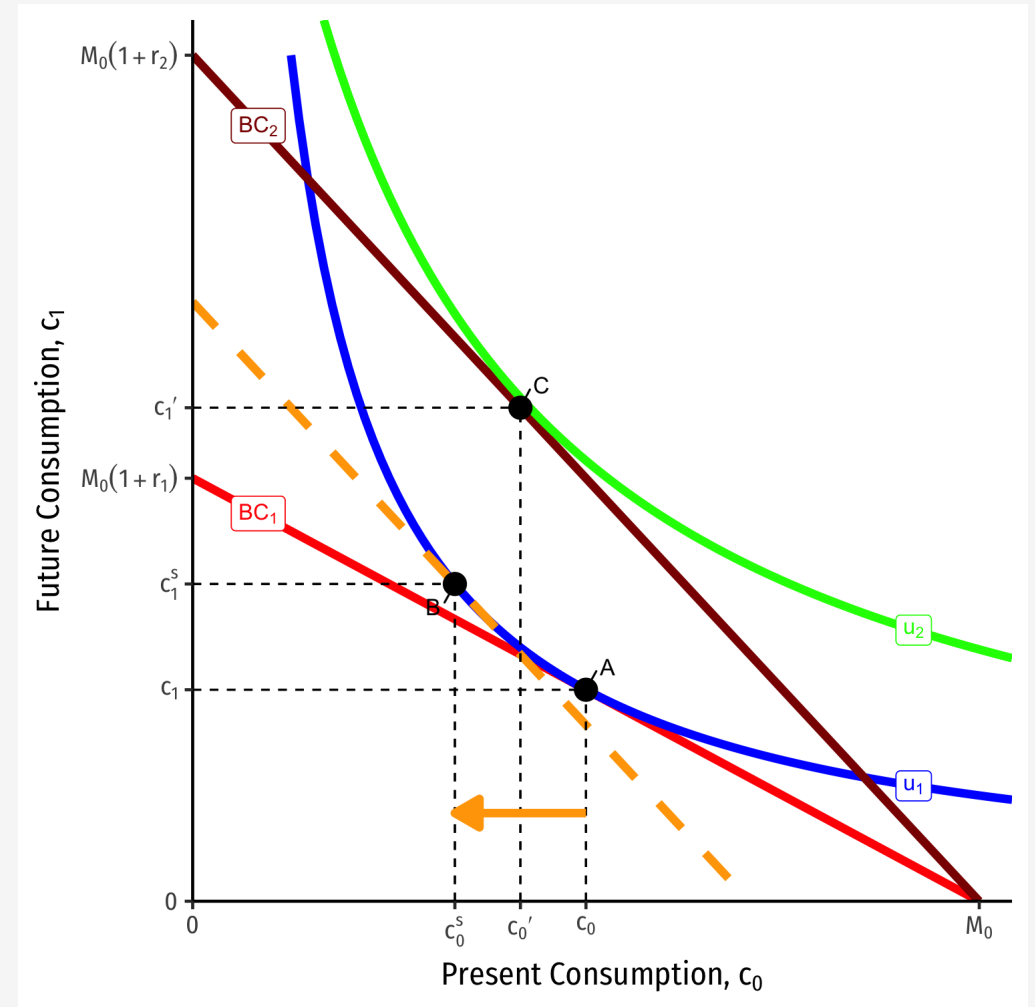




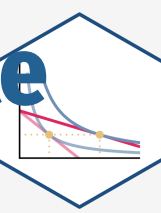
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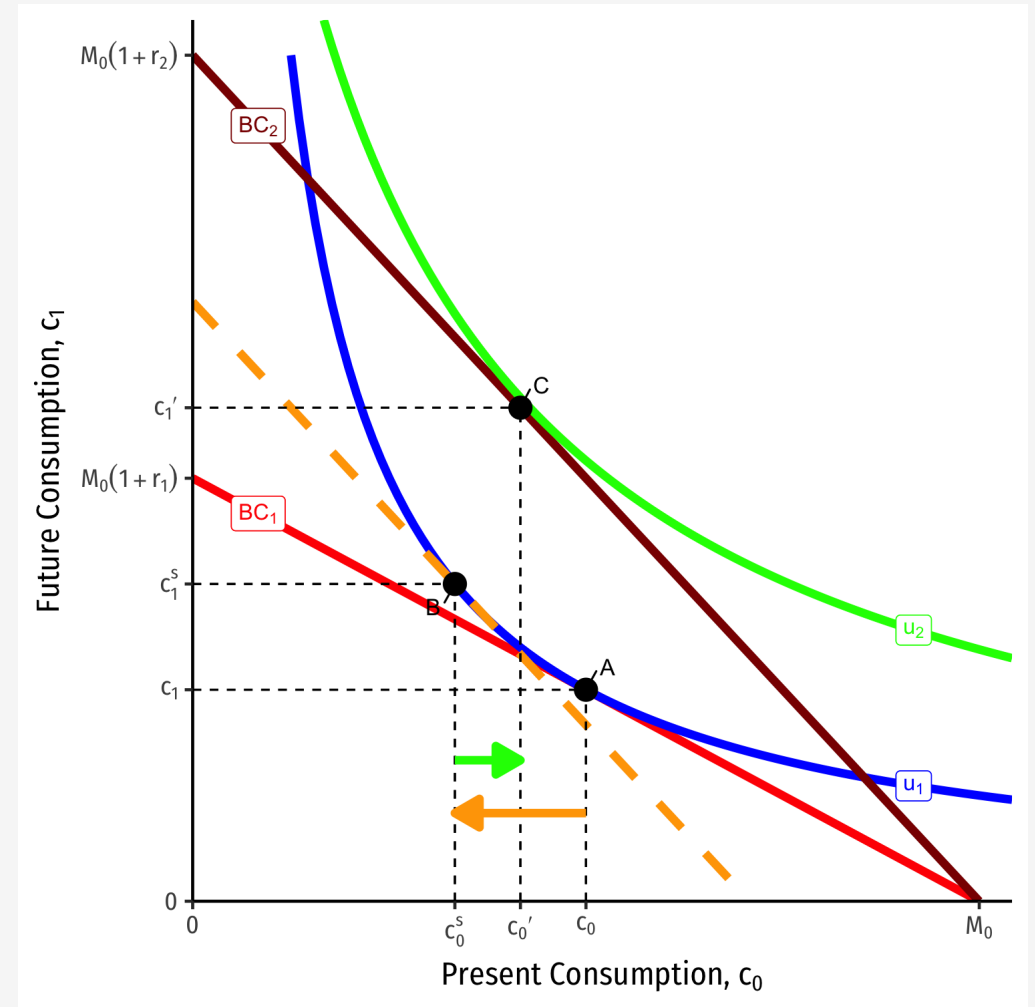
- **Substitution effect:** as interest rate  $(r)$  increases, the price of present consumption  $(c_0)$  is increasing, so consume less today
  - Thus, save more
- Graphically: under higher rate  $(BC_2)$ , substitute more  $(c_1)$  for less  $(c_0)$  (more saving) holding utility constant
  - $(A \rightarrow B)$ : more  $(c_1)$ , less  $(c_0)$  (more  $(s)$ )



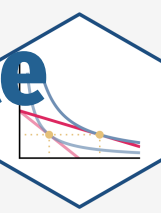
# Individual Savings Decisions: A Change in Interest Rate



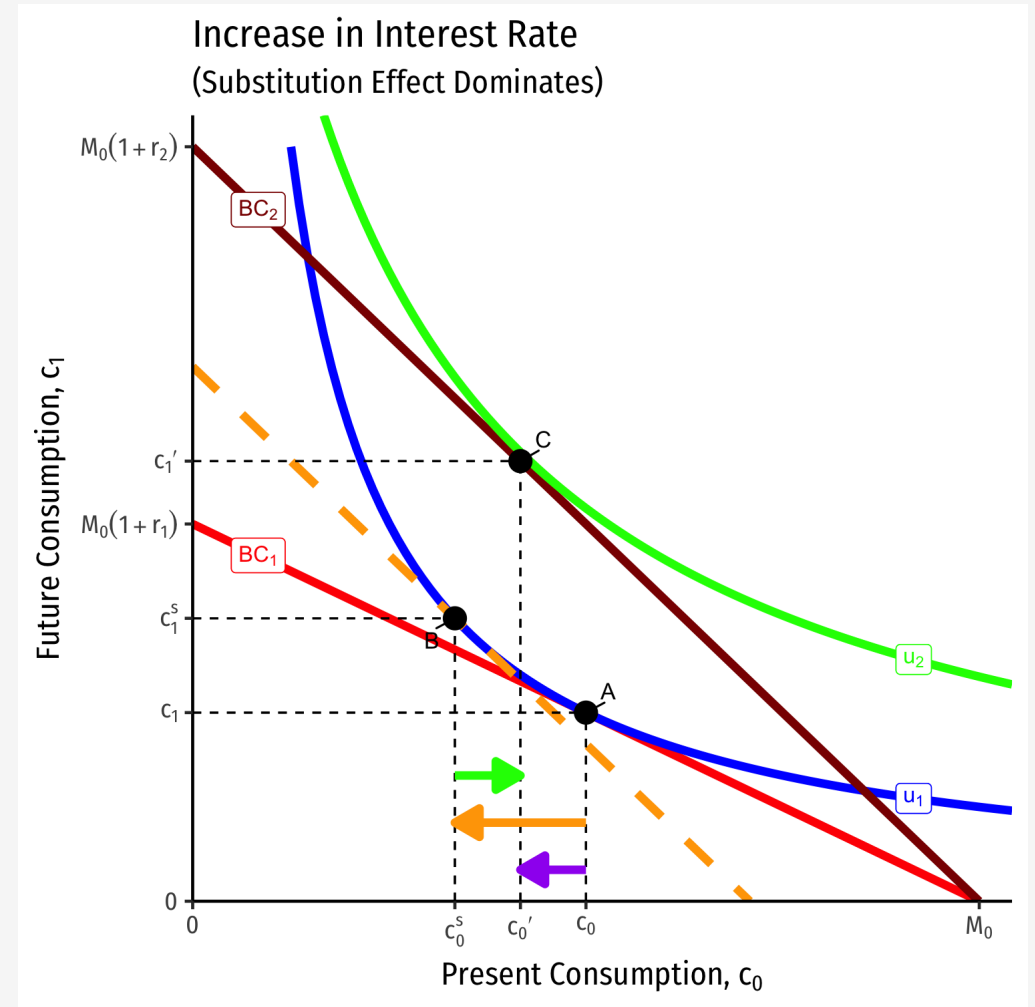
- **Real income effect:** the higher interest rate makes you wealthier in real terms, so buy more of everything (including  $c_0$ ), meaning **save less!**
  - $(B \rightarrow C)$ : attain higher indifference curve  $(u_2)$
  - “Inferior” good: higher interest rates induce *more* consumption today (and less saving)



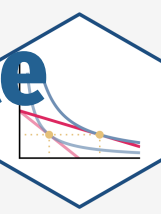
# Individual Savings Decisions: A Change in Interest Rate



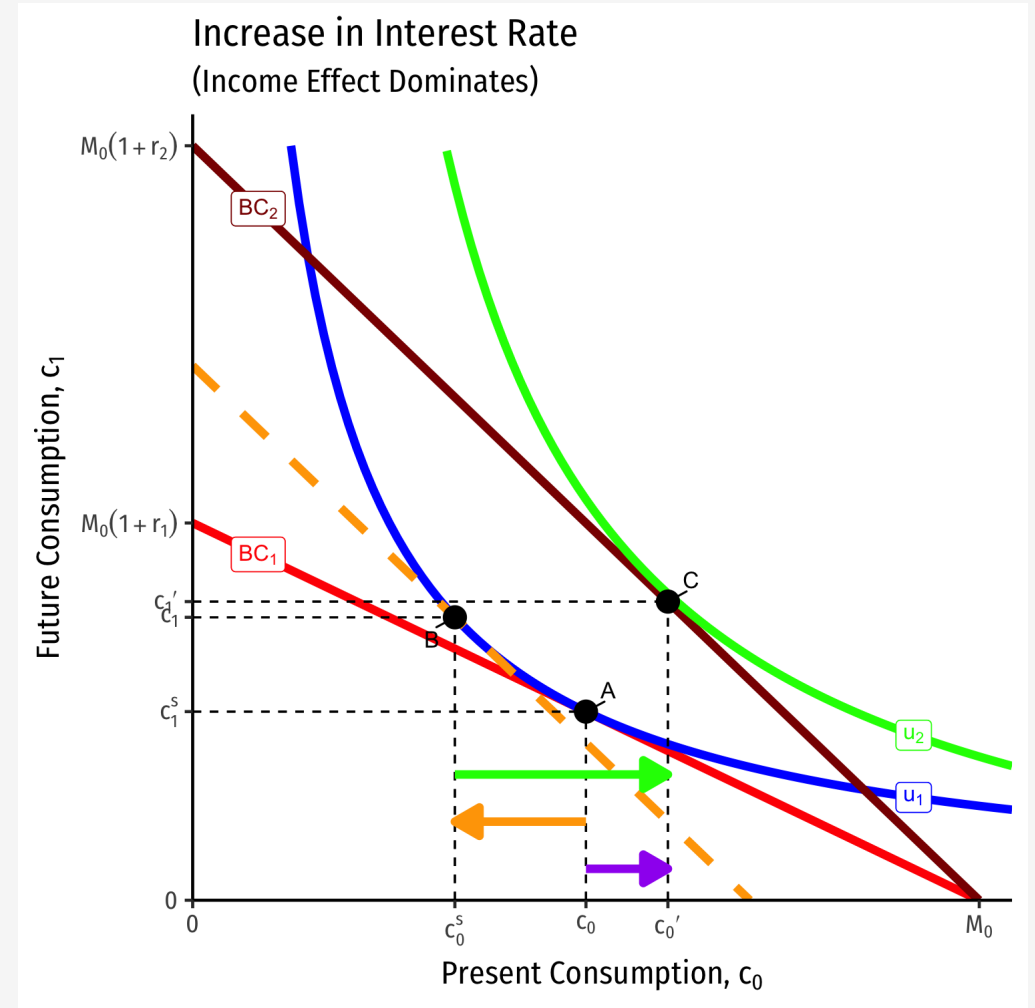
- Income & substitution effects cut against each other
- If **Substitution effect**  $(>)$  **Income effect**, then we get a positive **price effect**:
  - **Increase in interest rate** causes **more saving** (less present consumption)
- Matches our intuition, **upward-sloping savings supply curve**

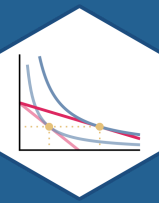


# Individual Savings Decisions: A Change in Interest Rate



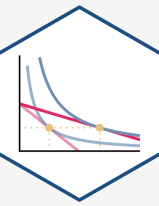
- If **Income effect** > **Substitution effect**, leading to a negative **price effect**:
  - **Increase in interest rate** causes **less saving** (more present consumption)
  - “Giffen-style” scenario, but **plausible** for saving! (unlike consumer goods)
- Intuition: imagine having a savings target (for rainy day, or retirement), and interest rates increase



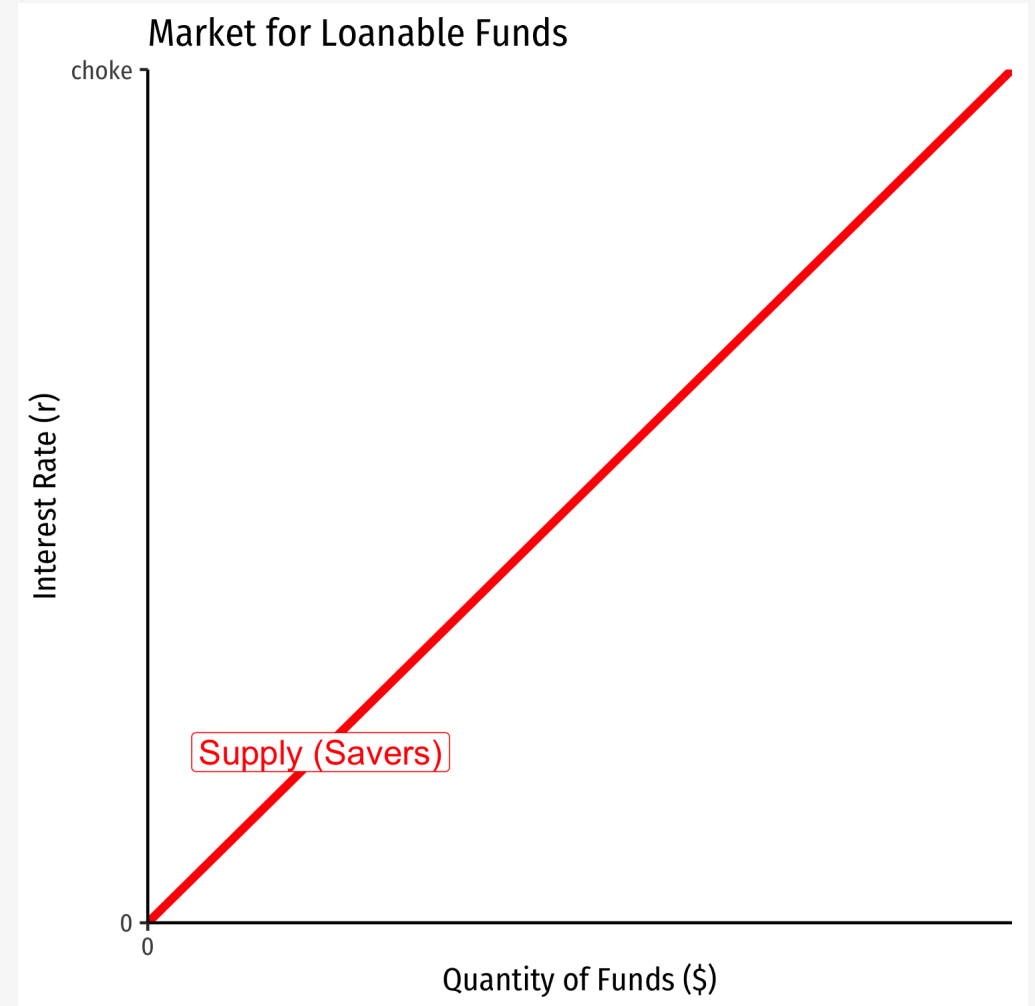


# The Market For Loanable Funds

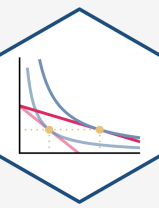
# The Market for Loanable Funds



- In general, an upward sloping **market supply curve**
- Giving up money today in exchange for claim on future repayment with interest
  - Individuals that loan their savings are called **capitalists** 🤔
- Individuals supply more (less) savings at higher (lower) interest rates



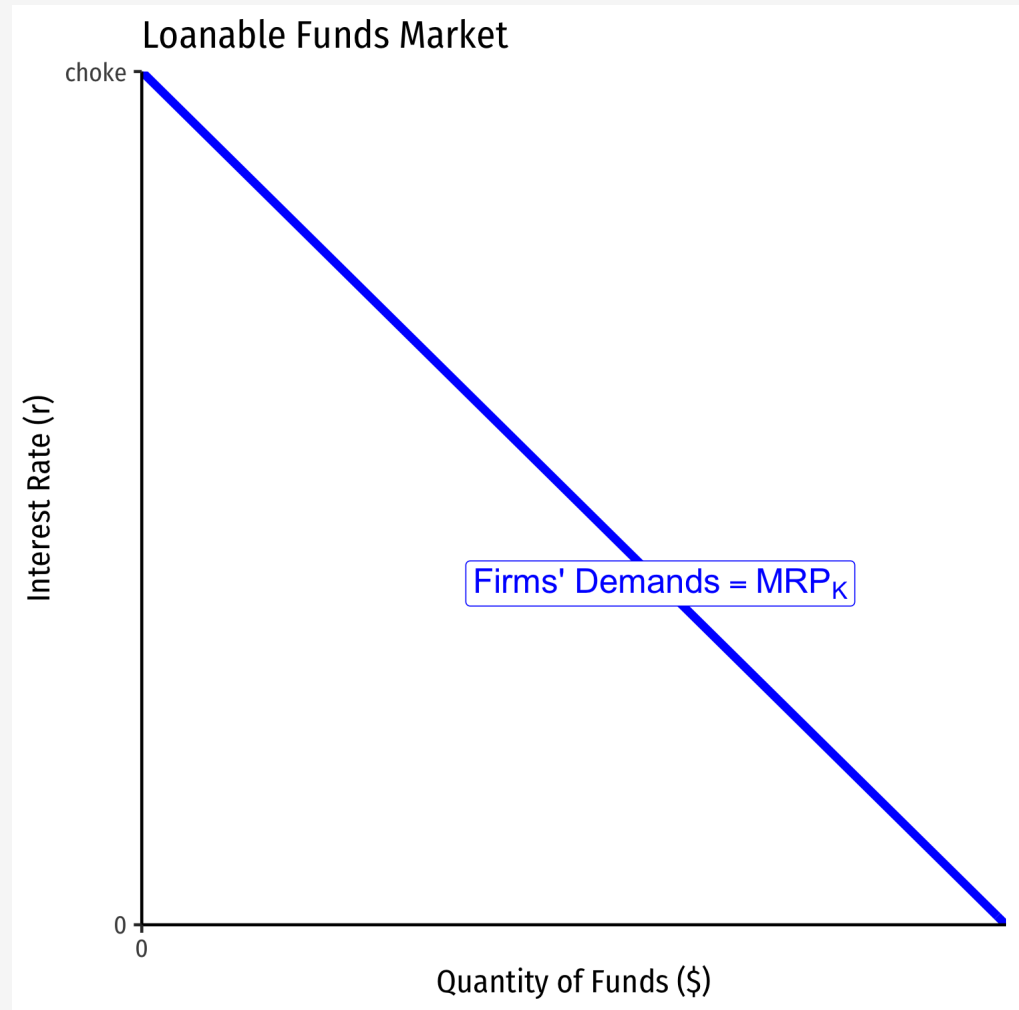
# Demand for Capital



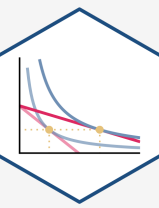
- As with labor, a **Firm's Demand for Capital**:

$$MRP_K = MP_K * MR(q)$$

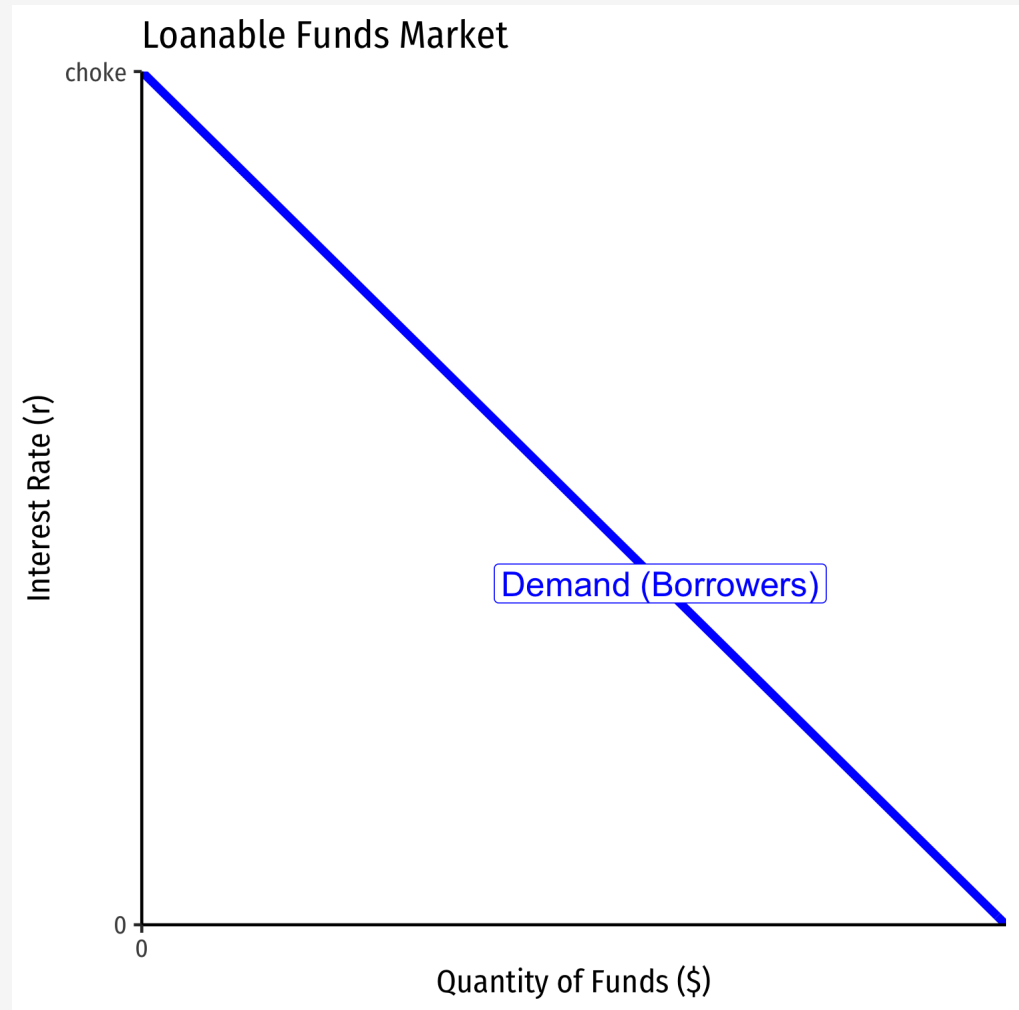
- $(MRP_K)$ : marginal revenue product of capital
- $(MP_K)$ : marginal product of capital
- $(MR(q))$ : marginal revenue
- Firms borrow money today in exchange for promising future repayment with interest



# Demand for Capital

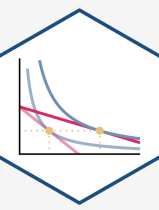


- Note in general, firms are not the only borrowers of funds!
- Individuals borrow money to attain higher consumption than their current income
  - Mortgages, auto loans, student loans, etc.
- Governments also borrow money to attain higher spending levels than their current taxation

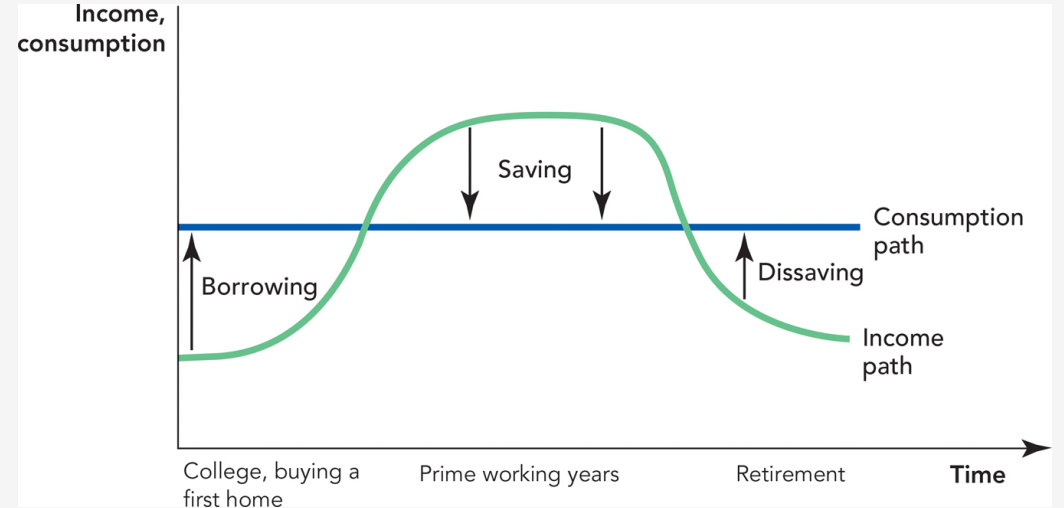




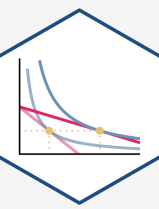
# Individual Borrowing Decisions



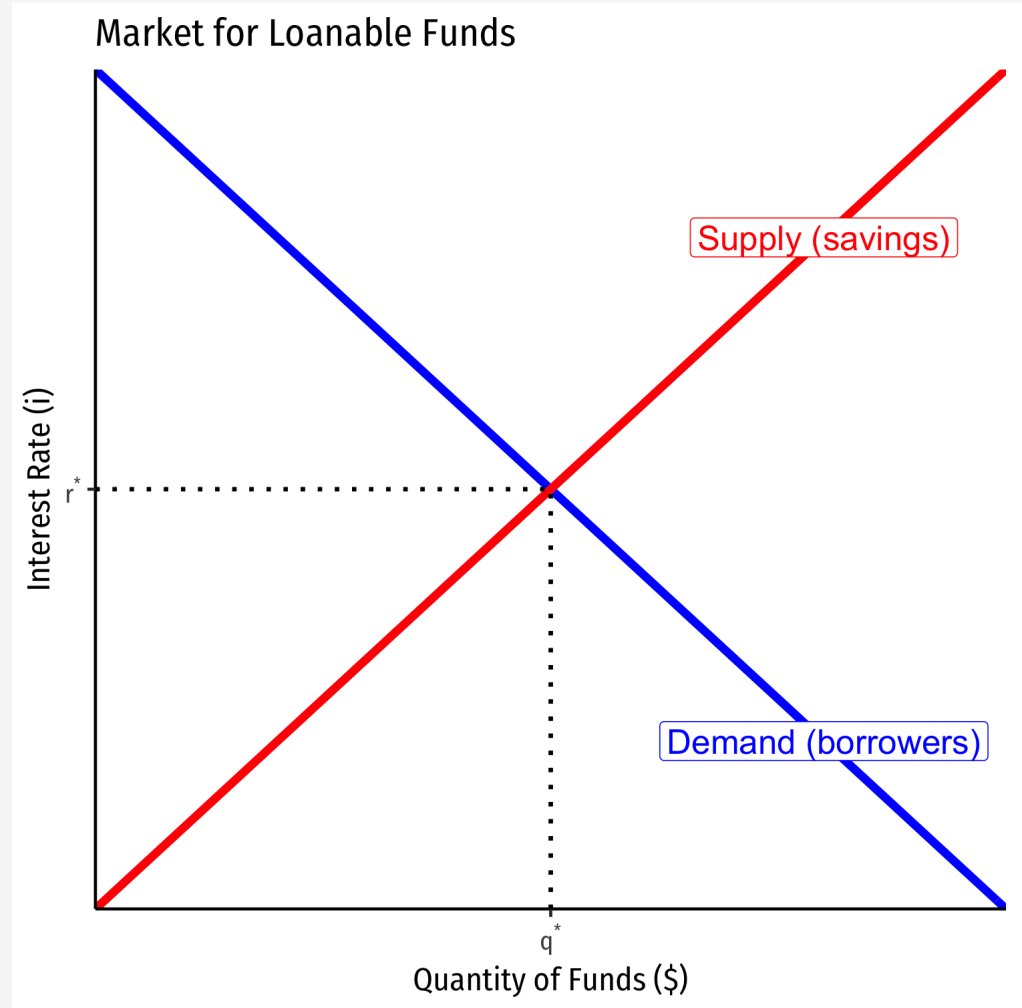
- Again, consider the “life cycle” of decisions
- People like to “smooth” their consumption over time, rather than experience sudden, discontinuous jumps in consumption level
  - When actual income  $\lt$  preferred consumption: **borrow** money
  - When actual income  $\gt$  preferred consumption: **save** (and lend) money



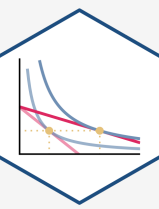
# Market for Loanable Funds



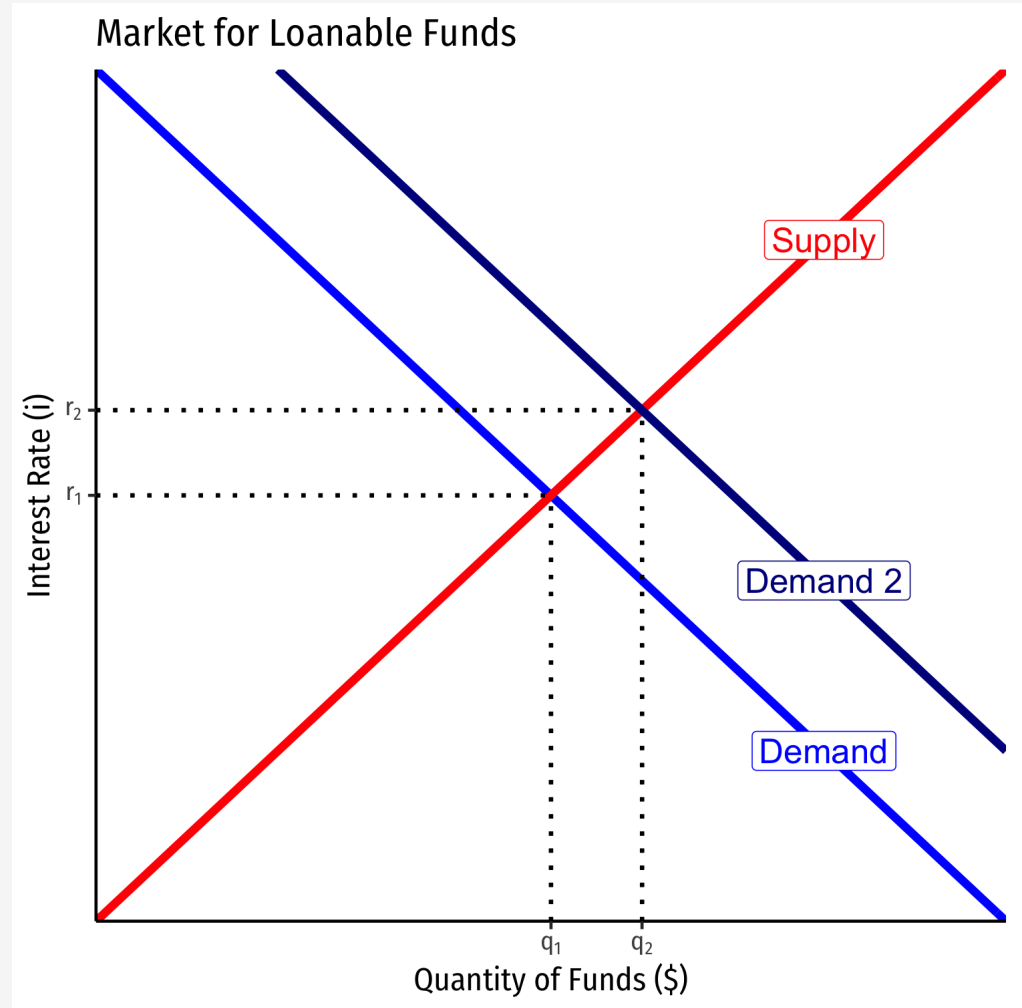
- Loanable funds market, where **savers** and **borrowers** exchange present & future money
- Equilibrium market interest rate  $(r^{\star})$



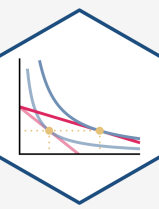
# Market for Loanable Funds



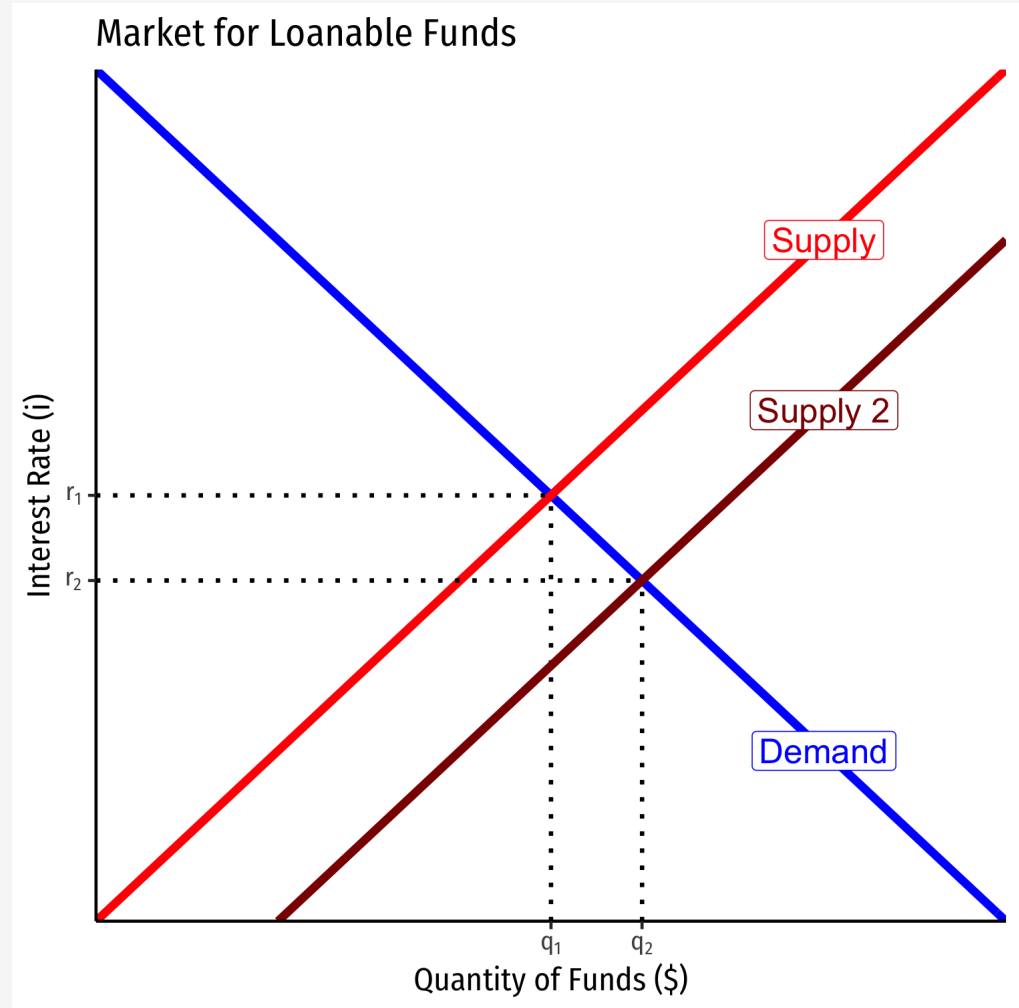
- An increase in Demand raises interest rate  $(r)$  and quantity of funds loaned/borrowed



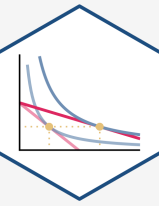
# Market for Loanable Funds



- An increase in **Supply** lowers interest rate  $(r)$  and quantity of funds loaned/borrowed



# Capital Markets



- Several mechanisms and types of financial markets by which borrowers and lenders exchange present for future money
- **Bond markets:** large companies (and governments) sell an I.O.U. to investors (“bondholders”), and will repay them with interest
- **Equity markets:** large companies sells shares of stock to investors (“shareholders”), in exchange for ownership stake
- **Banks:** savers deposit funds in bank (and are paid interest), and bank lends the deposits to borrowers (at higher interest rate)