

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



Outline



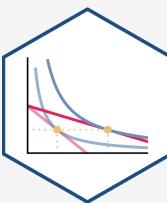
Labor Market for Competitive Firm

Labor Market for a Monopoly

Monopsony Power

Monopoly Power in Labor Markets: Unions

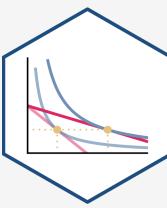
What is Capital?



- 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



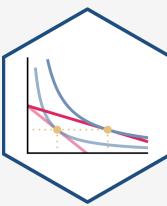
What is Capital?



- 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



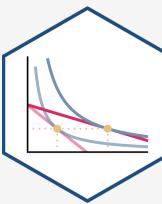
What Is Capital?



- 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...



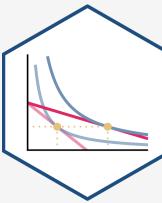
What Is Capital?



- 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”



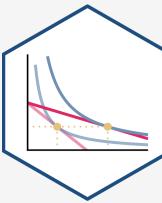
What Is Capital?



- 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**



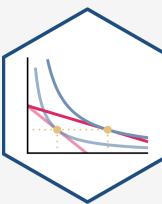
What Is Capital?



- 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

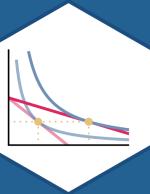


Capital Markets



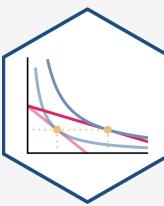
- Firms (and households) get money for investment today by participating in **capital markets**
- The funds in capital markets come from individual savings





The Time Value of Money

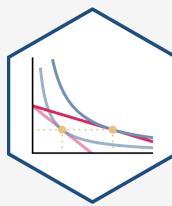
Present vs. Future Goods



- 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



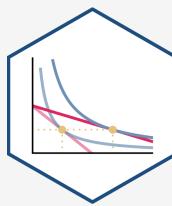
Present vs. Future Goods



- **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



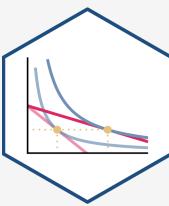
Present vs. Future Goods



- 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[†] is worth different amounts over time

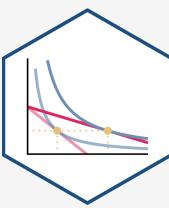
$$\begin{aligned*} PV &= \frac{FV}{(1+r)^n} \\ FV &= PV(1+r)^n \end{aligned*}$$

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

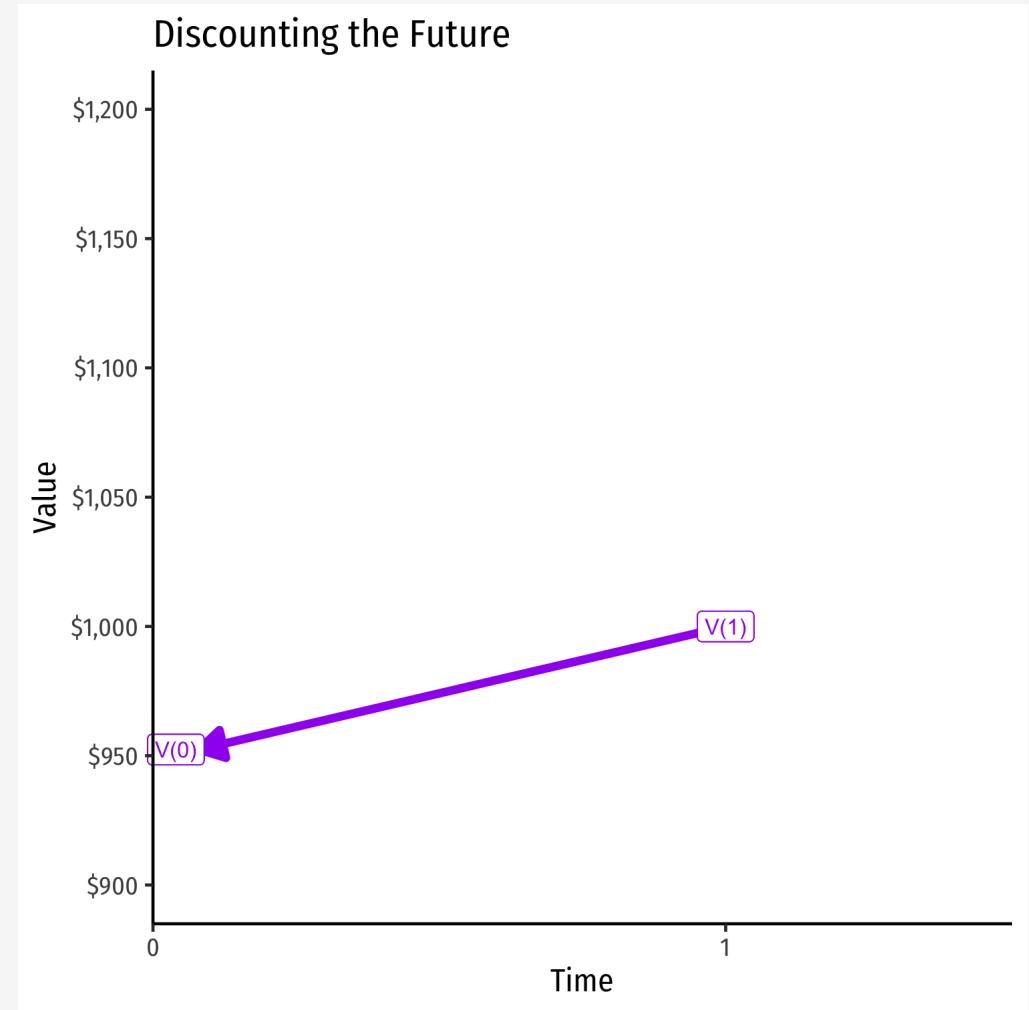


[†] Or income, or consumption...

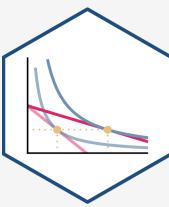
Present vs. Future Goods



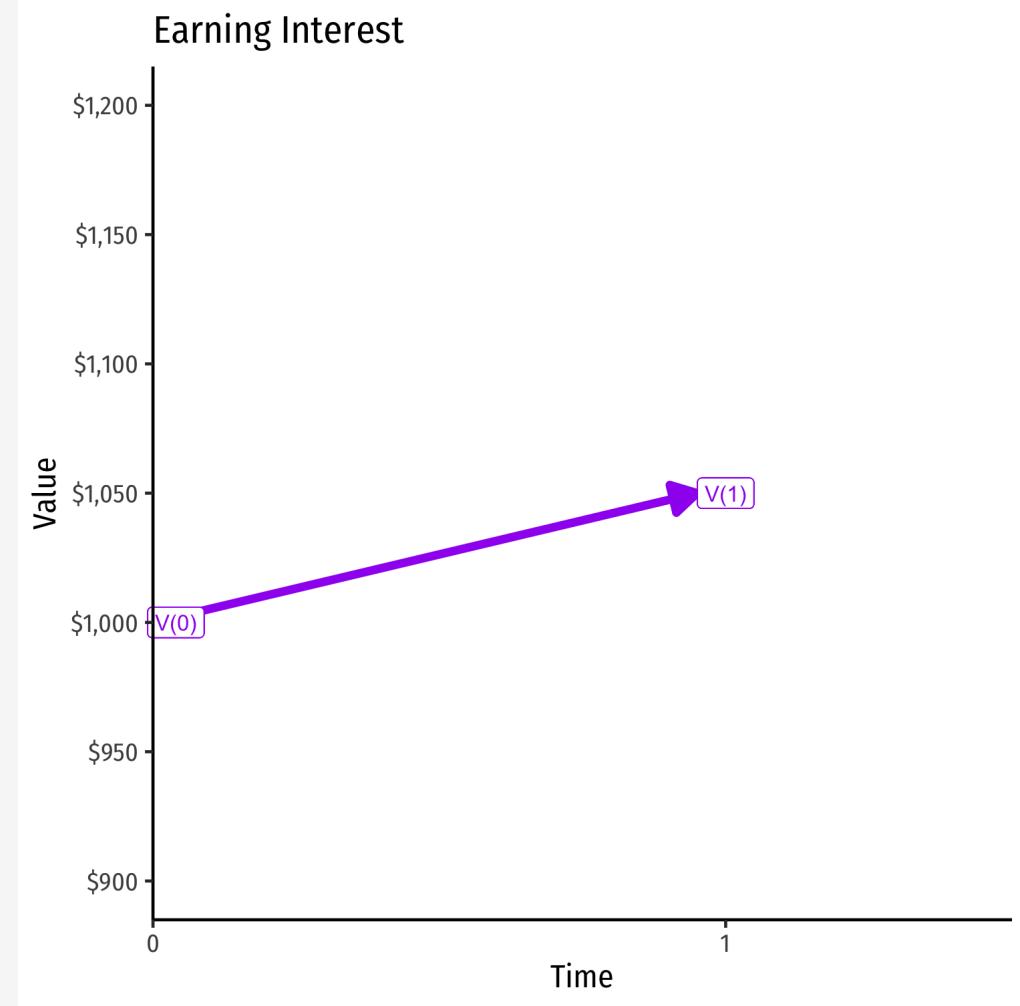
- **Example:** what is the present value of getting \$1,000 one year from now at 5% interest?

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


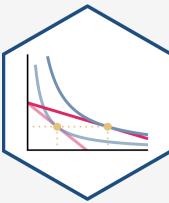
Present vs. Future Goods



- **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:

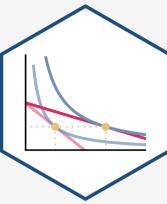
$$\$ \$ \frac{72}{r} \$ \$$$

- This is known as the **rule of 72**¹



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

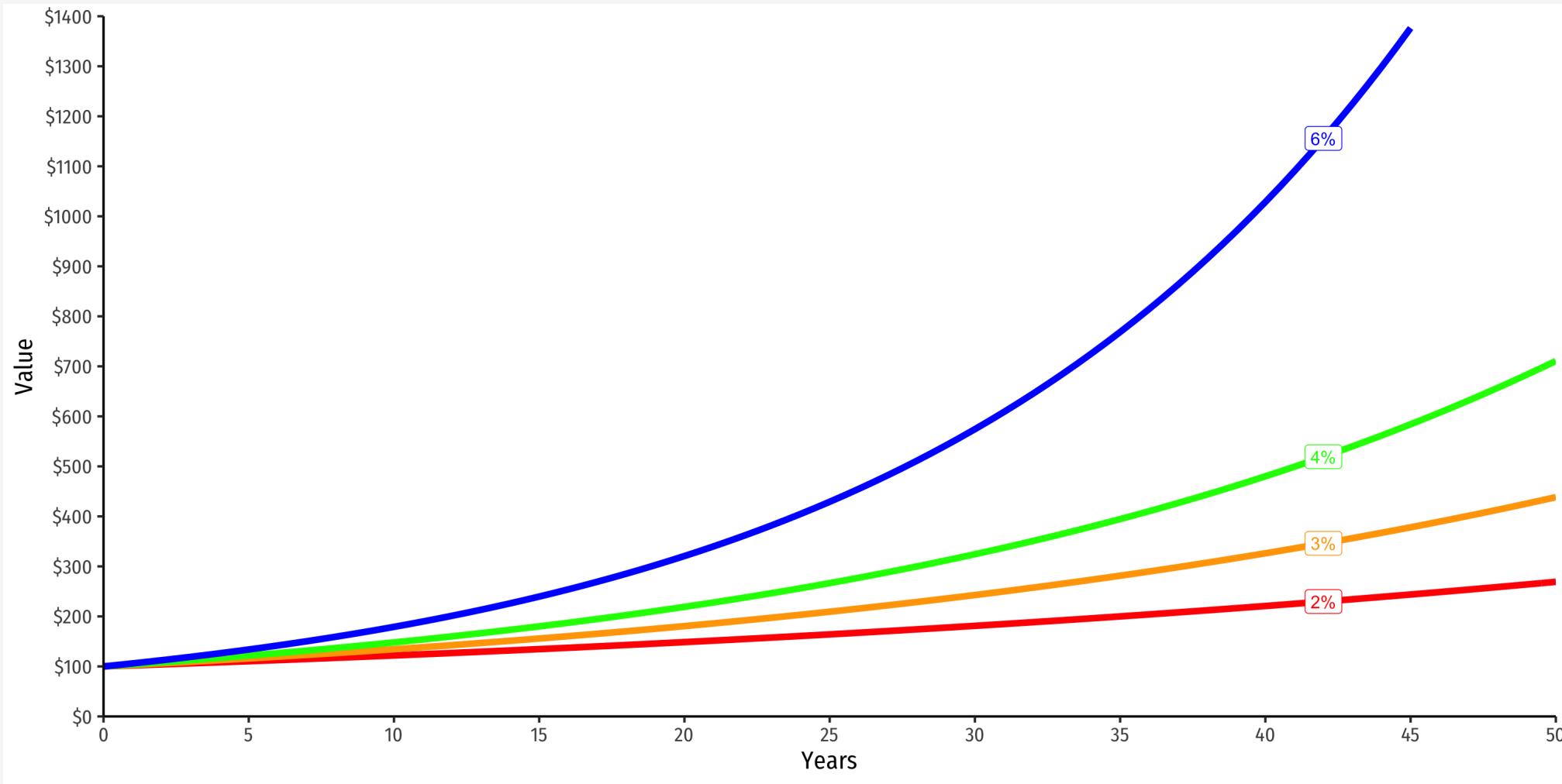
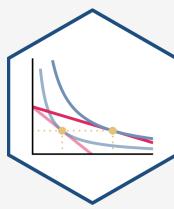
Rule of 72



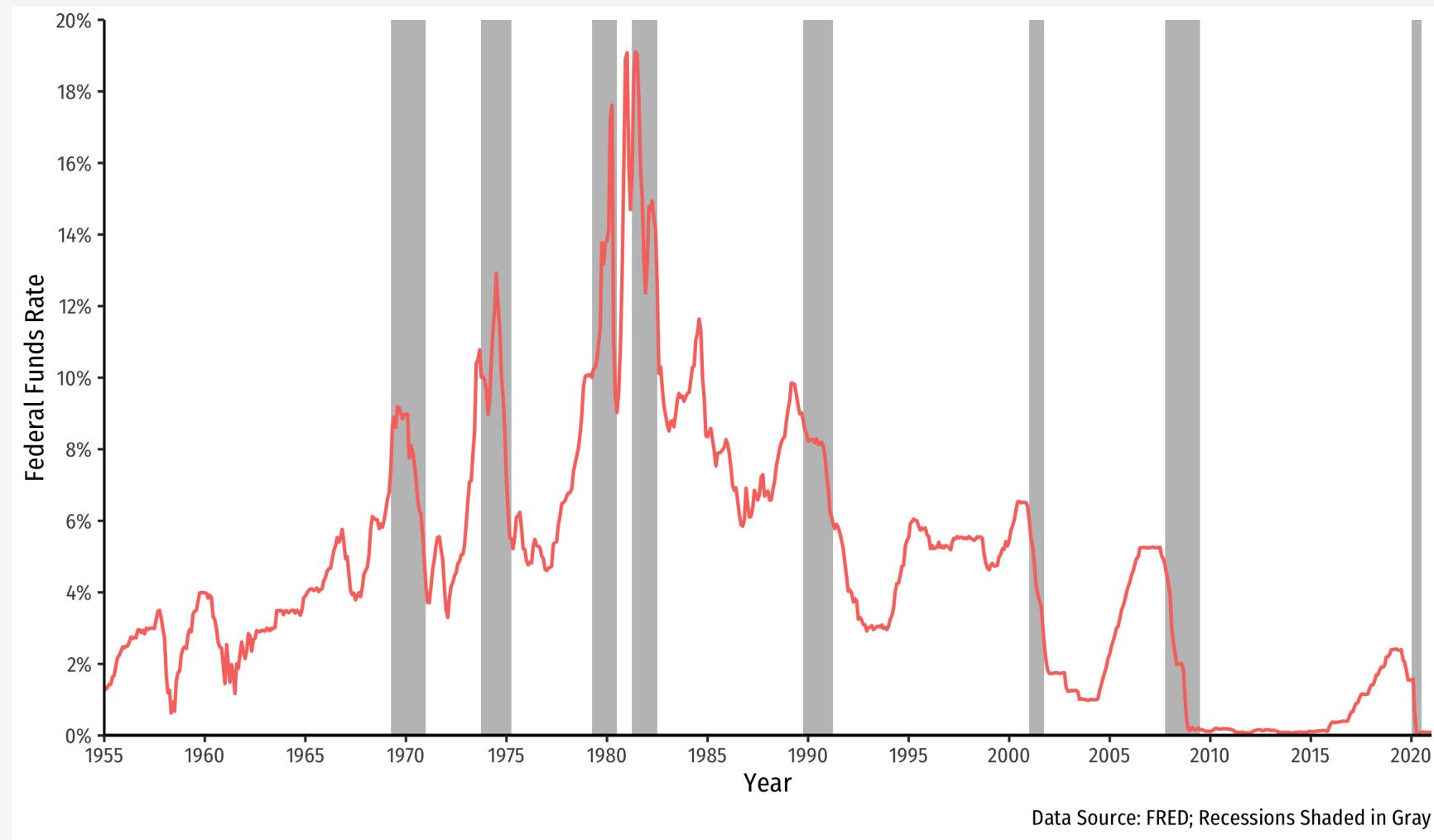
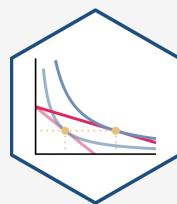
Example:

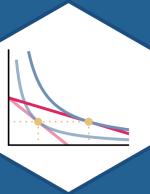
- If interest rate is 2%, your money doubles in $\left(\frac{72}{2}=36\right)$ years
- If interest rate is 3%, your money doubles in $\left(\frac{72}{3}=24\right)$ years
- If interest rate is 4%, your money doubles in $\left(\frac{72}{4}=18\right)$ years
- If interest rate is 6%, your money doubles in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

Compounding Interest



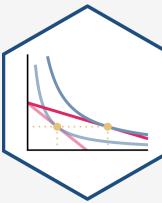
Historical Interest Rates





Individual Savings Decisions

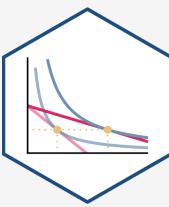
Individual Savings Decisions



- 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)



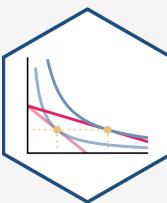
Individual Savings Decisions



- 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 is today's income



Individual Savings Decisions

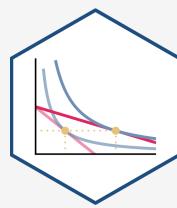


$\$\$u(c_1, c_2) \$\$$

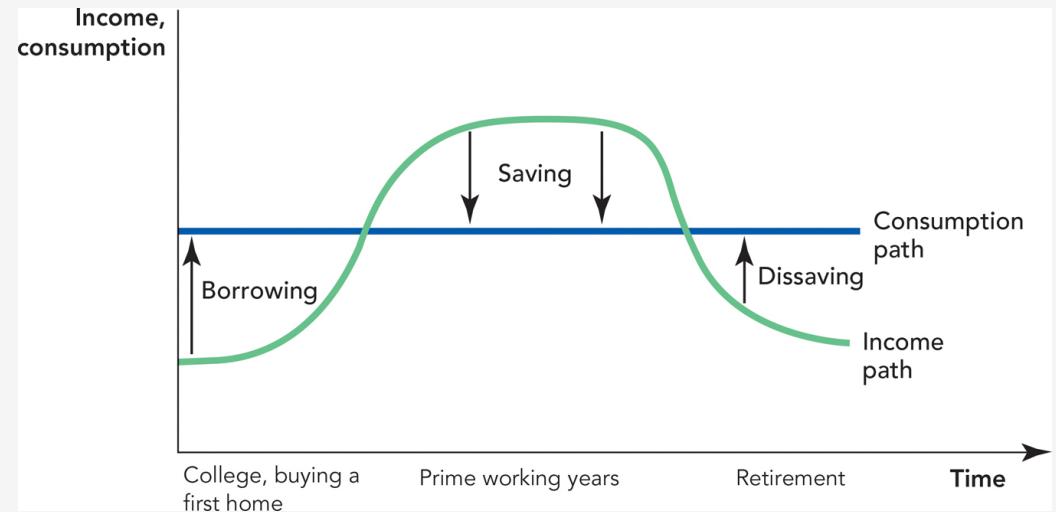
- Individuals have a “**time preference**” between present consumption and future consumption
 - In general, everyone prefers consumption today over consumption in the future
 - We place a **premium** on present consumption and **discount** future consumption
 - This is where the idea of **interest**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



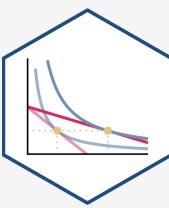
Individual Savings Decisions



- 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 $\backslash(<\backslash)$ preferred consumption: **borrow** money
 - When actual income $\backslash(>\backslash)$ preferred consumption: **save** (and **lend**) money

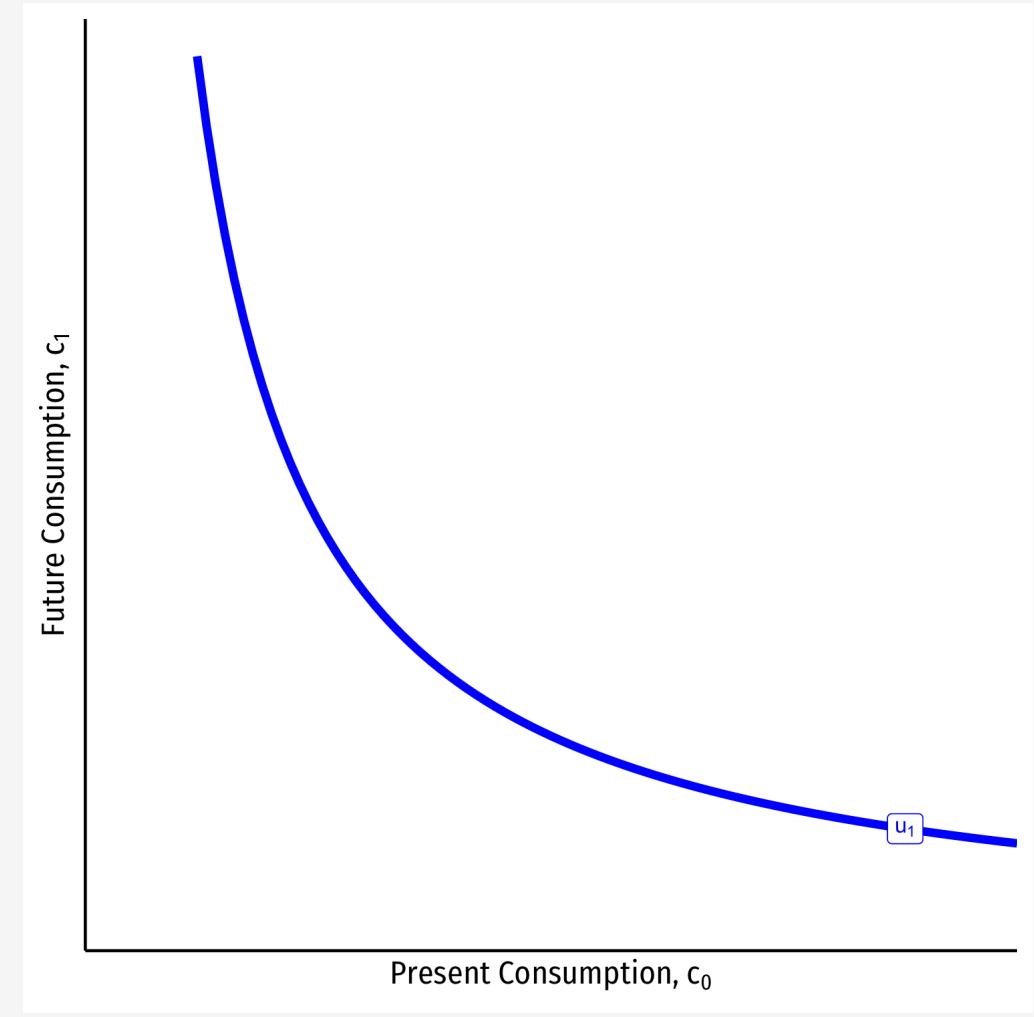


Individual Savings Decisions

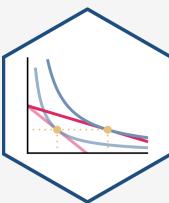


$\$u(c_1, c_2)\$$

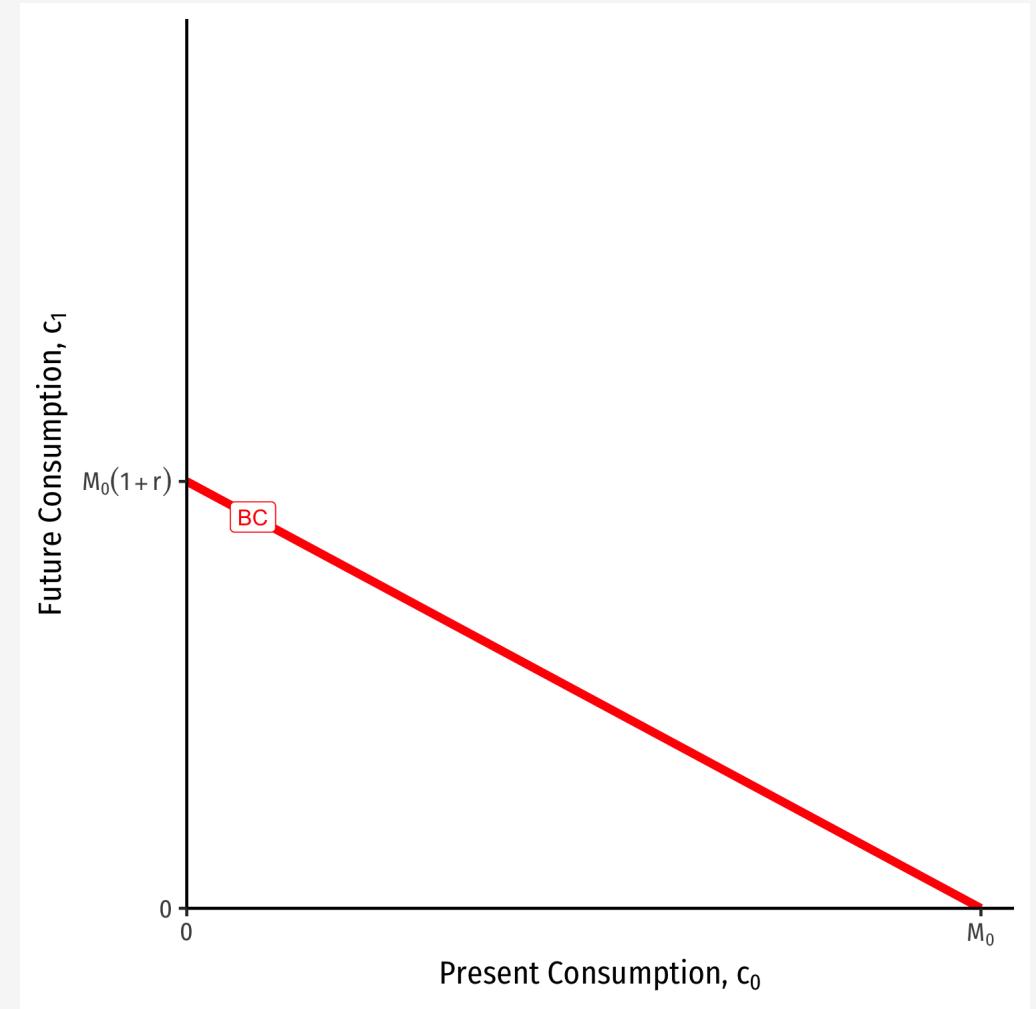
- **Marginal rate of (intertemporal) substitution:** rate at which person gives up future consumption (c_1) to obtain more present consumption (c_0)
 - The slope of the indifference curve!



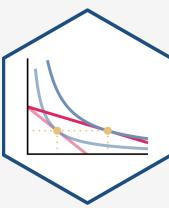
Individual Savings Decisions



- 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)

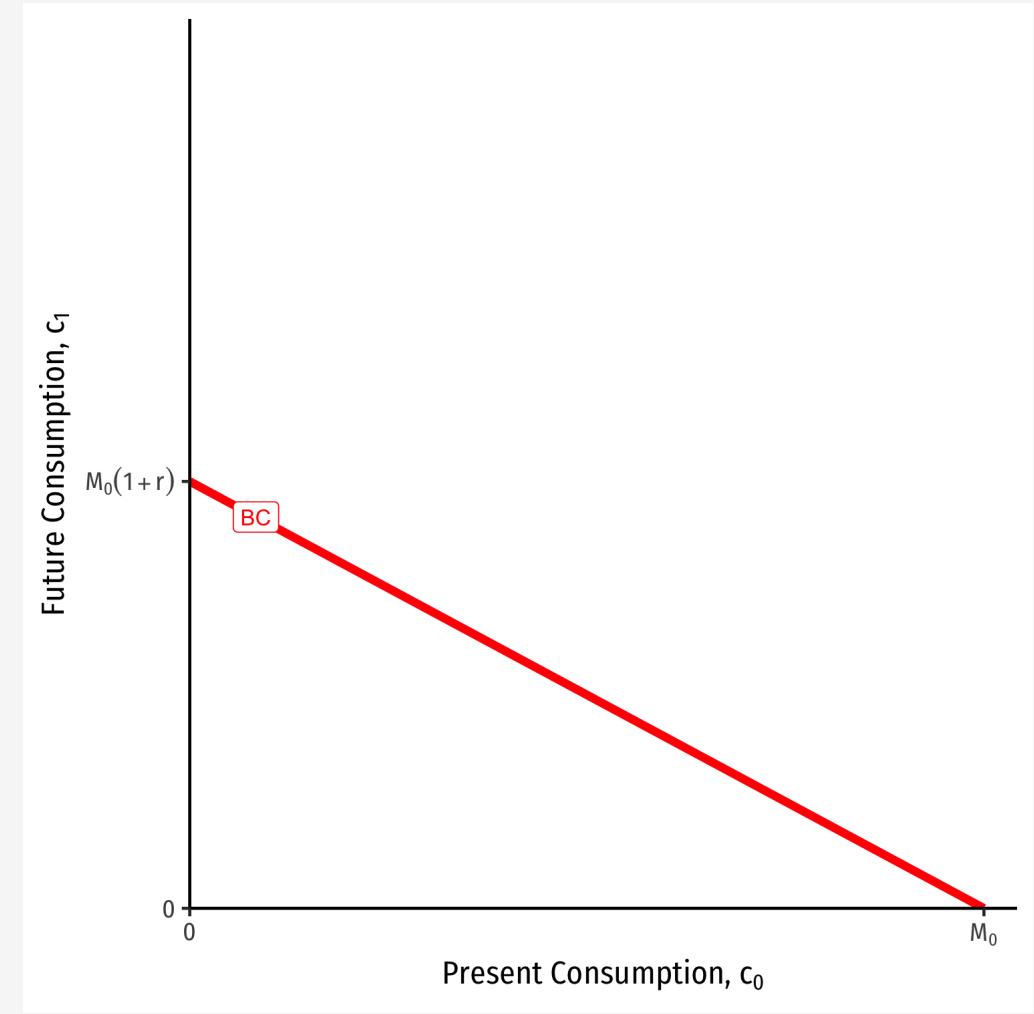


Individual Savings Decisions

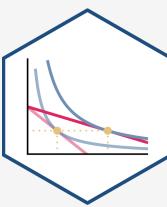


- Opportunity cost of consumption today $((c_0))$ is $\backslash(1+r\backslash)$
 - Forgo opportunity to save and invest to earn interest (and consume more) next period
- Let the price of future consumption be \$1
 - Then the slope of budget constraint is

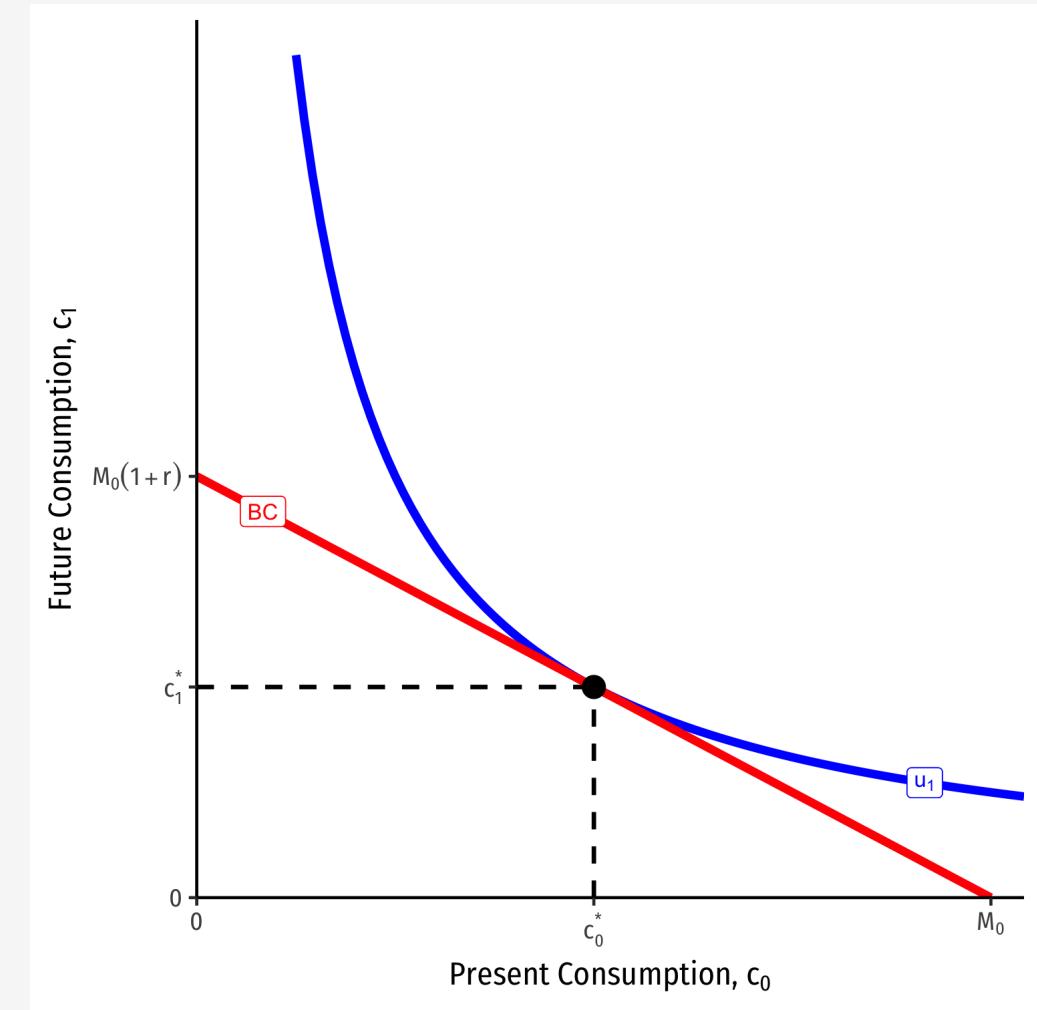
$$\$\$-\frac{p_{c_0}}{p_{c_1}}=-\frac{(1+r)}{1}=-(1+r)\$\$$$



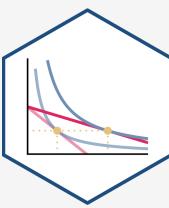
Individual Savings Decisions



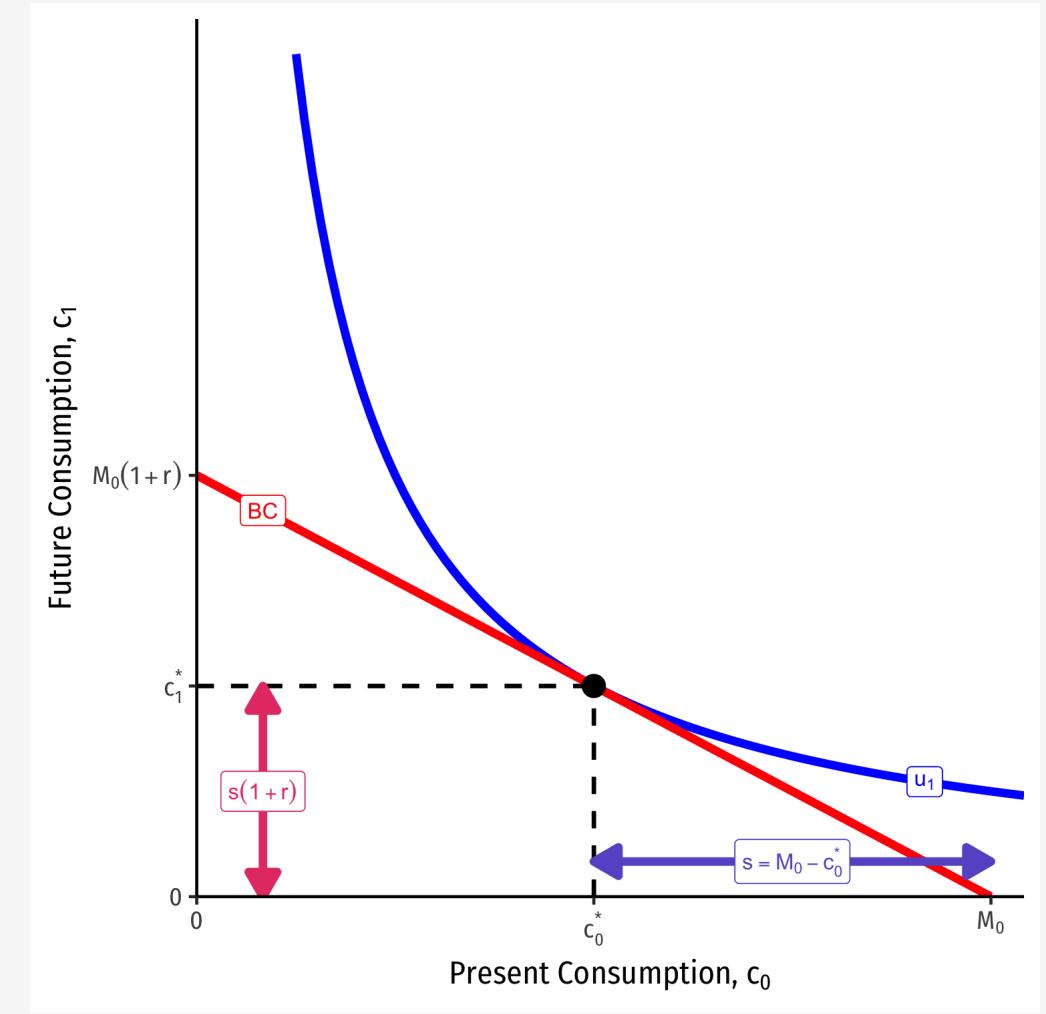
- Consumer maximizes utility subject to budget constraint at $\backslash(A\backslash)$: $\backslash((c_0^*\backslash\text{star}, c_1^*\backslash\text{star})\backslash)$



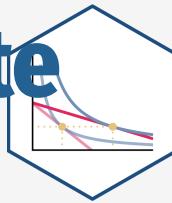
Individual Savings Decisions



- Consumer maximizes utility subject to budget constraint at (A) : $((c_0^*, c_1^*))$
- Consumes (c_0^*) today, saving $(\color{#6A5ACD}{s = M_0 - c_0^*})$ to consume $(\color{#e64173}{c_1^*} = s(1+r))$ next period



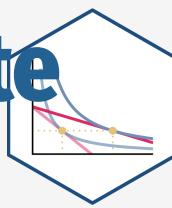
Individual Savings Decisions: A Change in Interest Rate



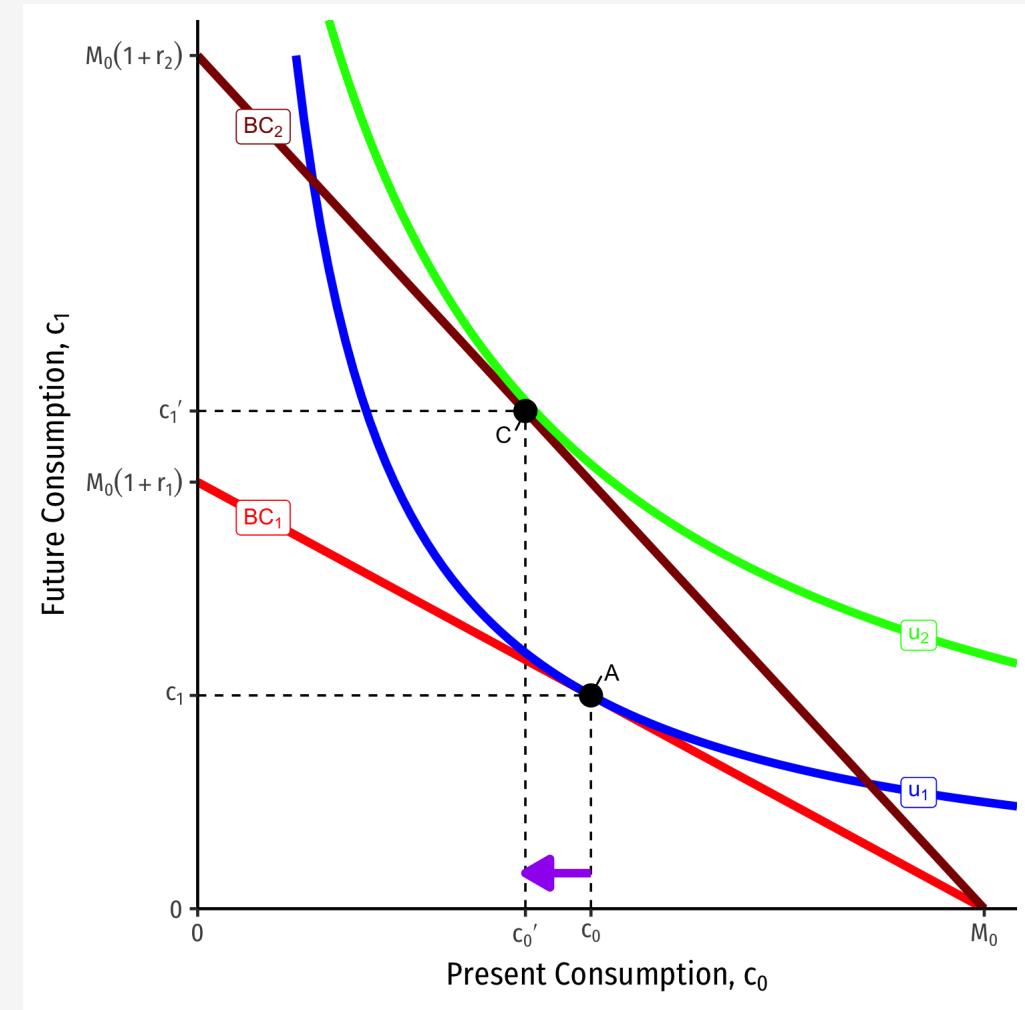
- What will happen to the optimal savings decision if **interest rate r increases?**
- It depends!
- Consumption is a normal good, but this makes savings “inferior” $\$s = M_0 - c_0 \$$
 - $\uparrow c_0 \implies \downarrow s$
- Again, **income and substitution effects** are important!



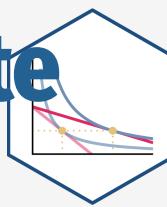
Individual Savings Decisions: A Change in Interest Rate



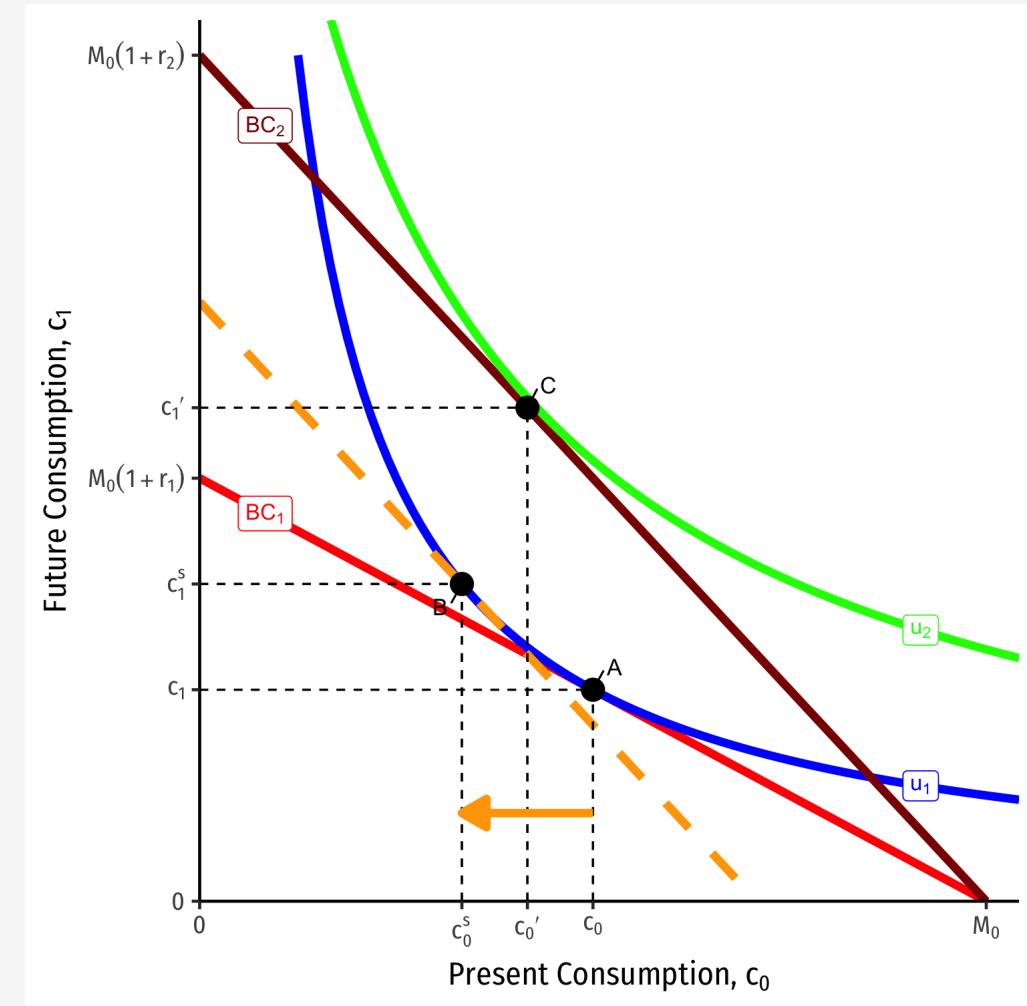
- (Overall) Price effect: $A \rightarrow C$
 - Higher rate r leads to less consumption today c_0 and therefore, more saving s
- Upward sloping **savings supply curve**



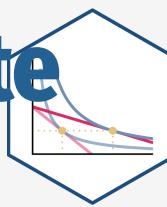
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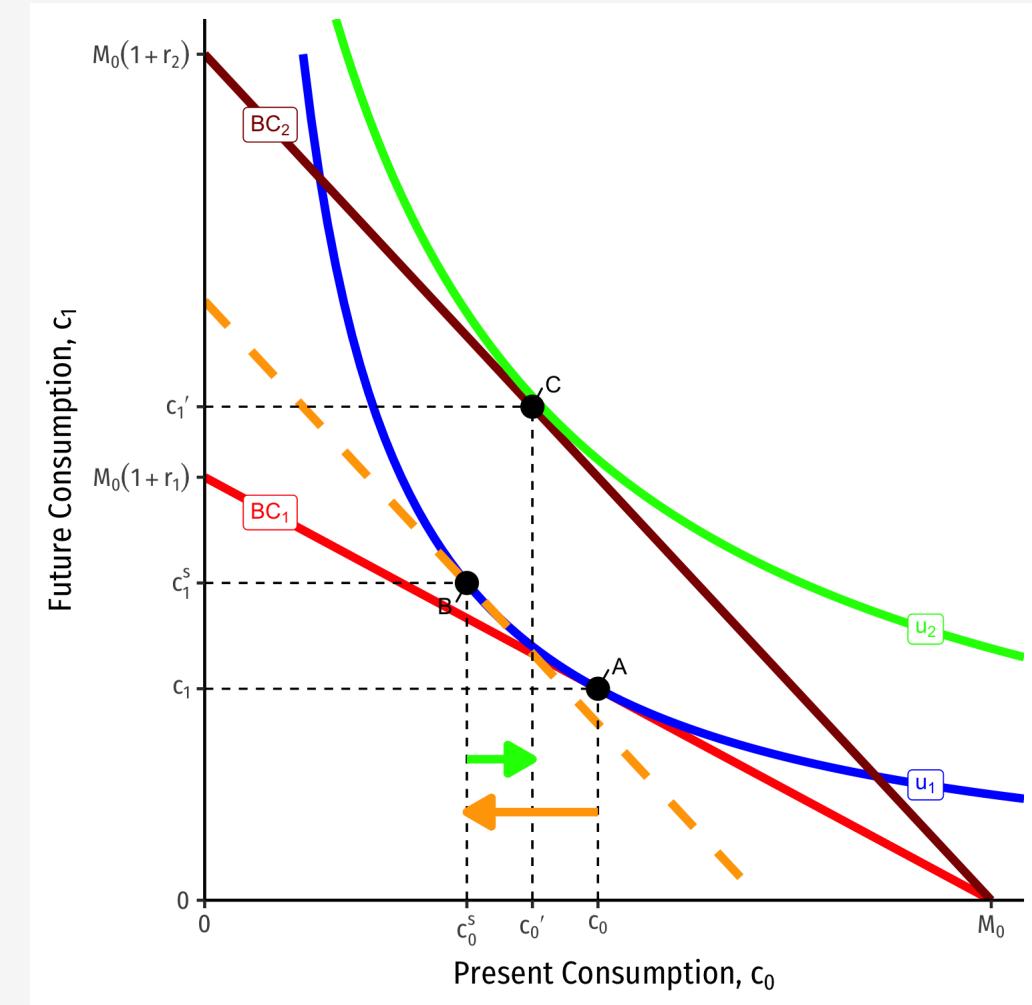
- **Substitution effect:** as interest rate (r) increases, the price of present consumption (c_0) is increasing, so consume less today
 - Thus, save more
- Graphically: under higher rate (BC_2) , substitute more (c_1) for less (c_0) (more saving) holding utility constant
 - $(A \rightarrow B)$: more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



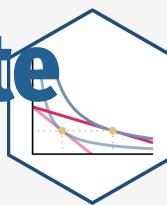
Individual Savings Decisions: A Change in Interest Rate



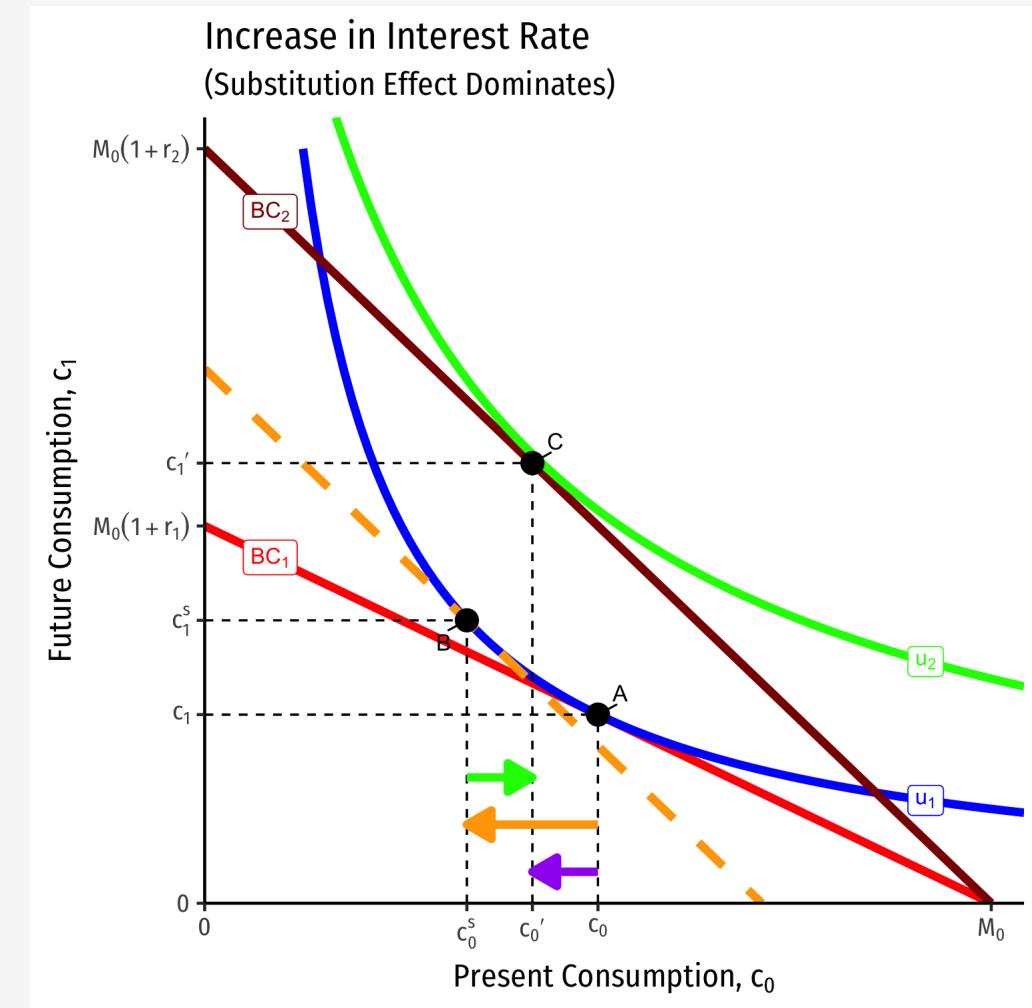
- **Real income effect:** the higher interest rate makes you wealthier in real terms, so buy more of everything (including c_0), meaning **save less!**
 - $B \rightarrow C$: attain higher indifference curve u_2
 - “Inferior” good: higher interest rates induce *more* consumption today (and less saving)



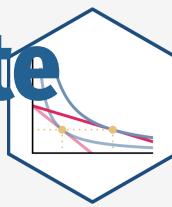
Individual Savings Decisions: A Change in Interest Rate



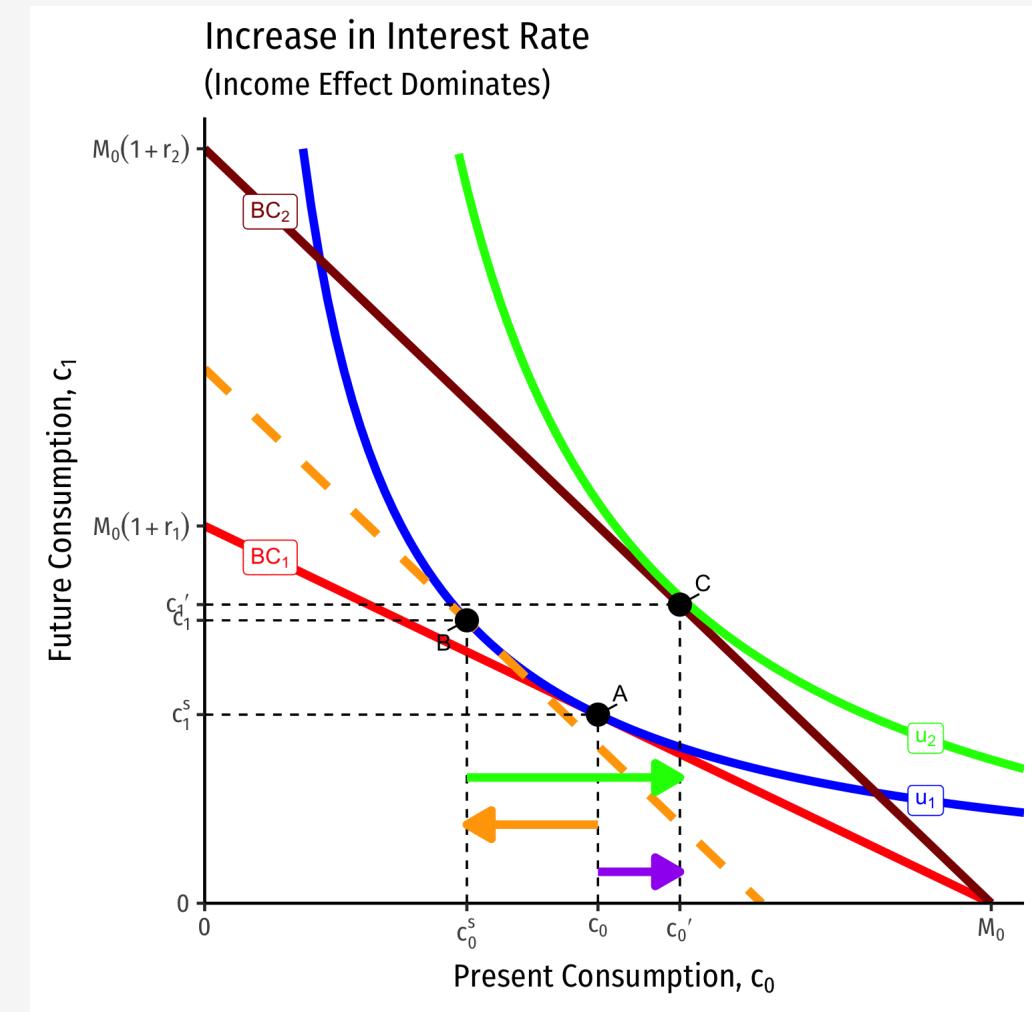
- Income & substitution effects cut against each other
- If Substitution effect $\backslash(>\backslash)$ Income effect, then we get a positive price effect:
 - **Increase in interest rate** causes **more saving** (less present consumption)
- Matches our intuition, **upward-sloping savings supply curve**

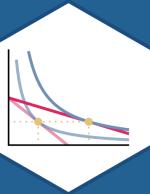


Individual Savings Decisions: A Change in Interest Rate



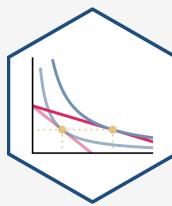
- If **Income effect > Substitution effect**, leading to a negative price effect:
 - **Increase in interest rate** causes **less saving** (more present consumption)
 - “Giffen-style” scenario, but **plausible** for saving! (unlike consumer goods)
- Intuition: imagine having an savings target (for rainy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



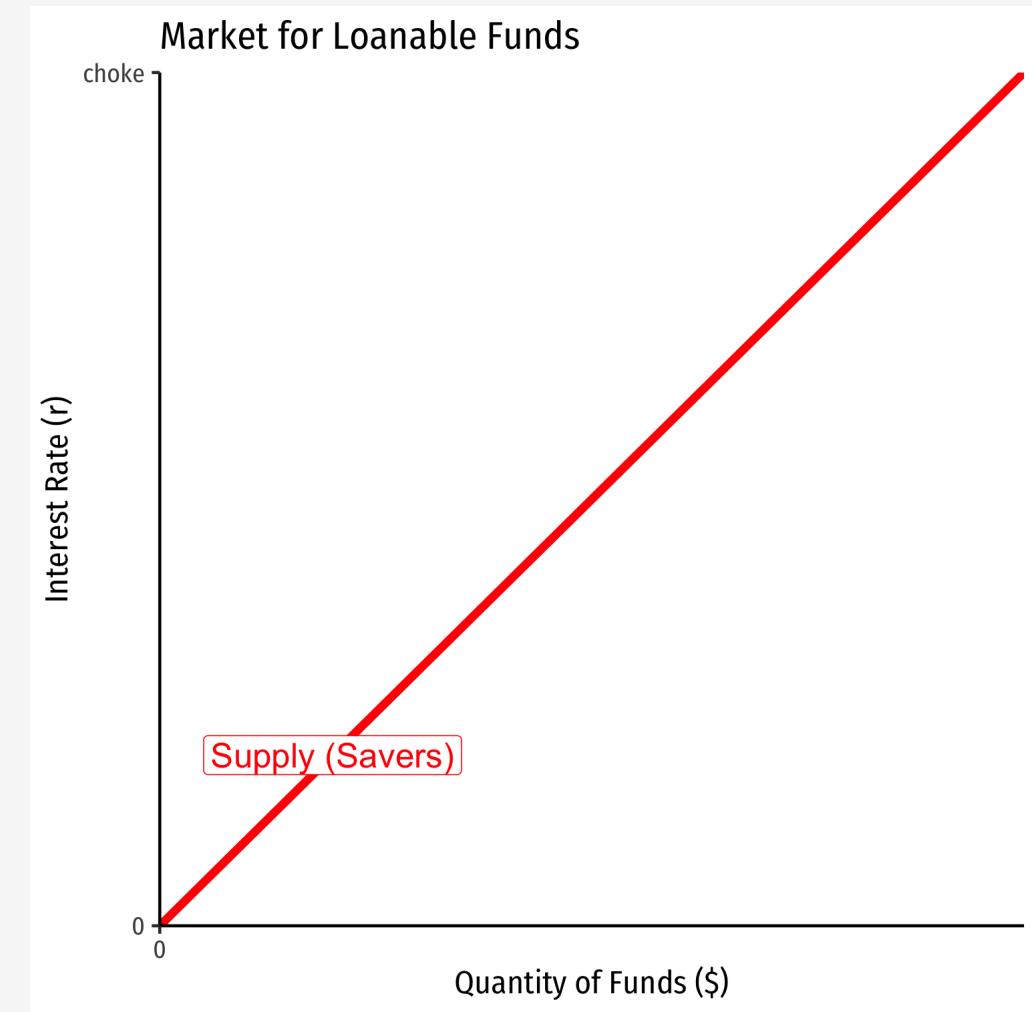


The Market For Loanable Funds

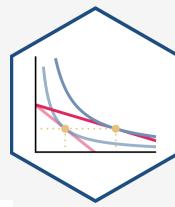
The Market for Loanable Funds



- 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



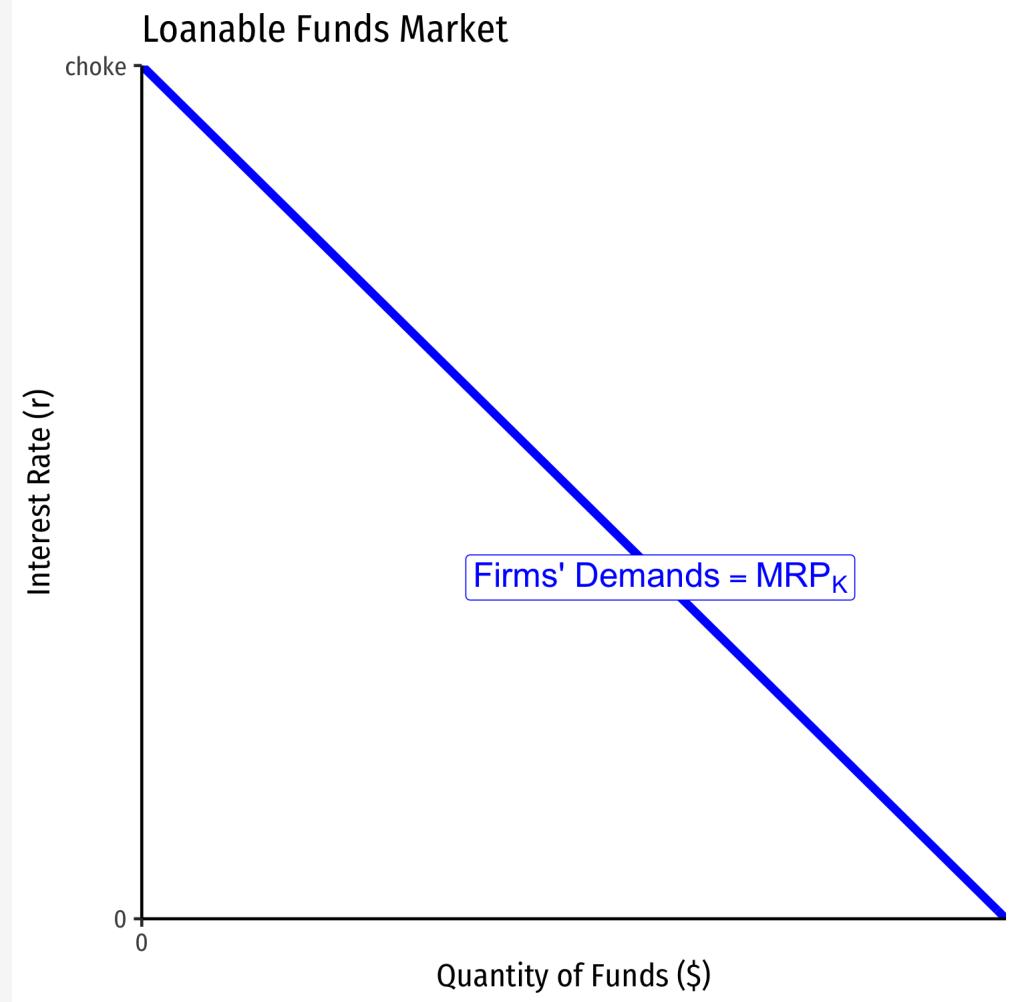
Demand for Capital



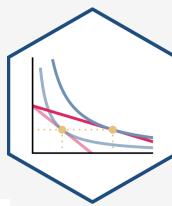
- As with labor, a **Firm's Demand for Capital**:

$$\text{Firms' Demand} = MRP_K = MP_K * MR(q)$$

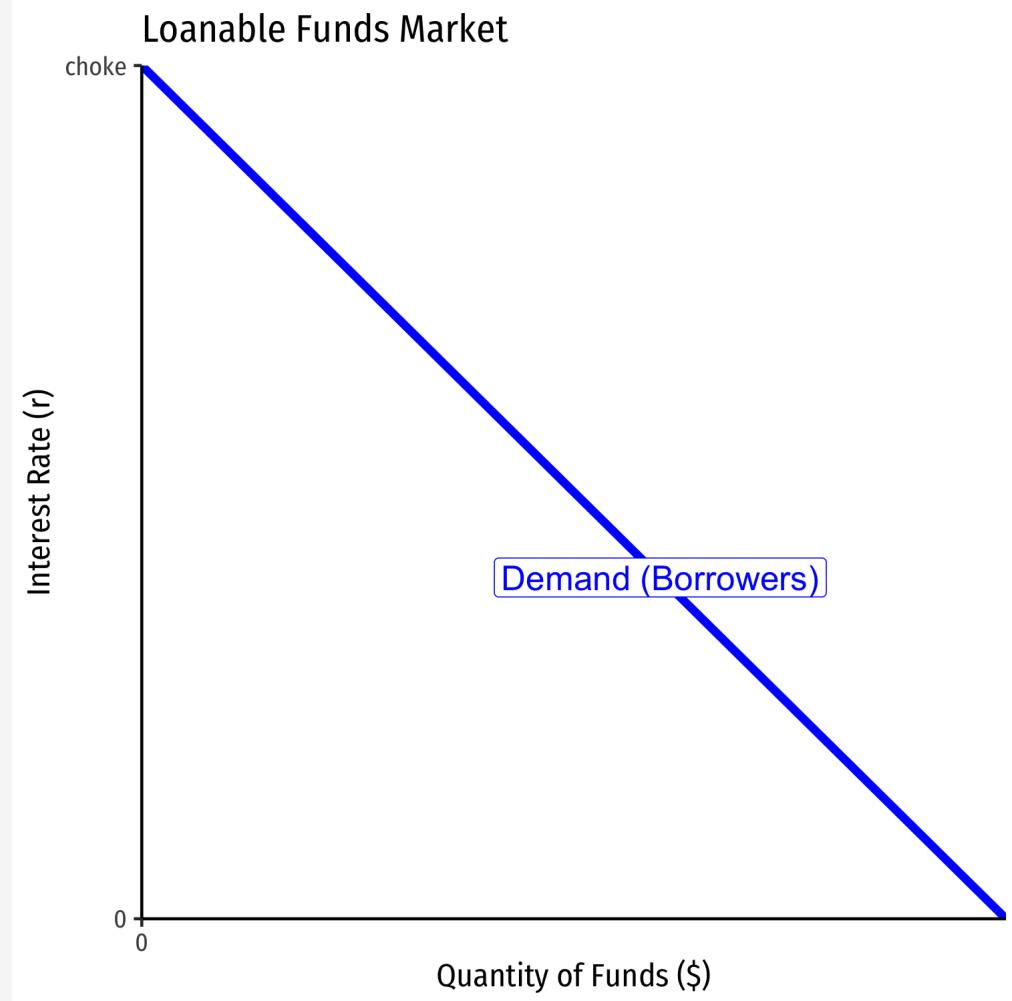
- \((MRP_K) \): marginal revenue product of capital
- \((MP_K) \): marginal product of capital
- \((MR(q)) \): marginal revenue
- Firms borrow money today in exchange for promising future repayment with interest



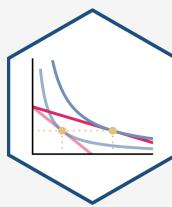
Demand for Capital



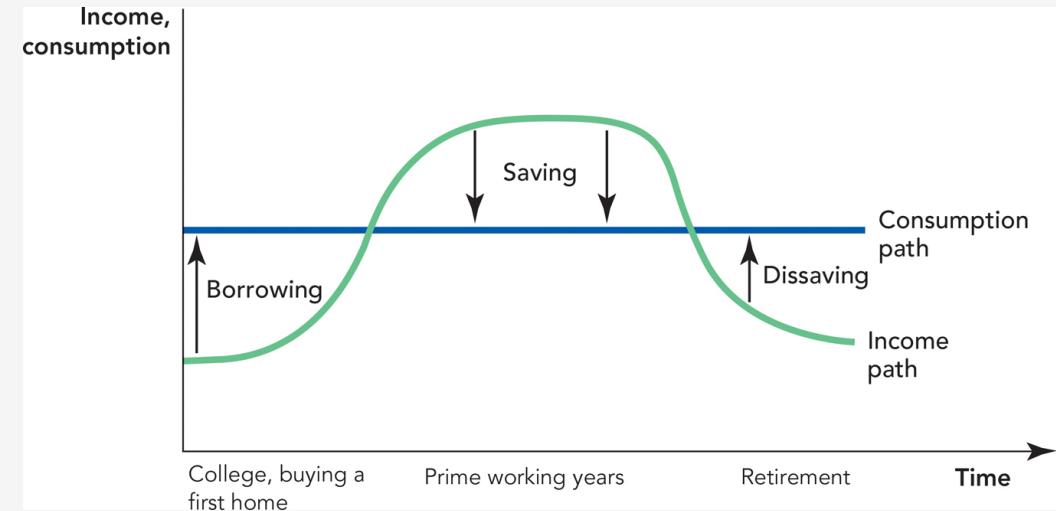
- Note in general, firms are not the only borrowers of funds!
- Individuals borrow money to attain higher consumption than their current income
 - Mortgages, auto loans, student loans, etc.
- Governments also borrow money to attain higher spending levels than their current taxation



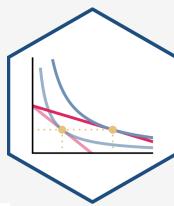
Individual Borrowing Decisions



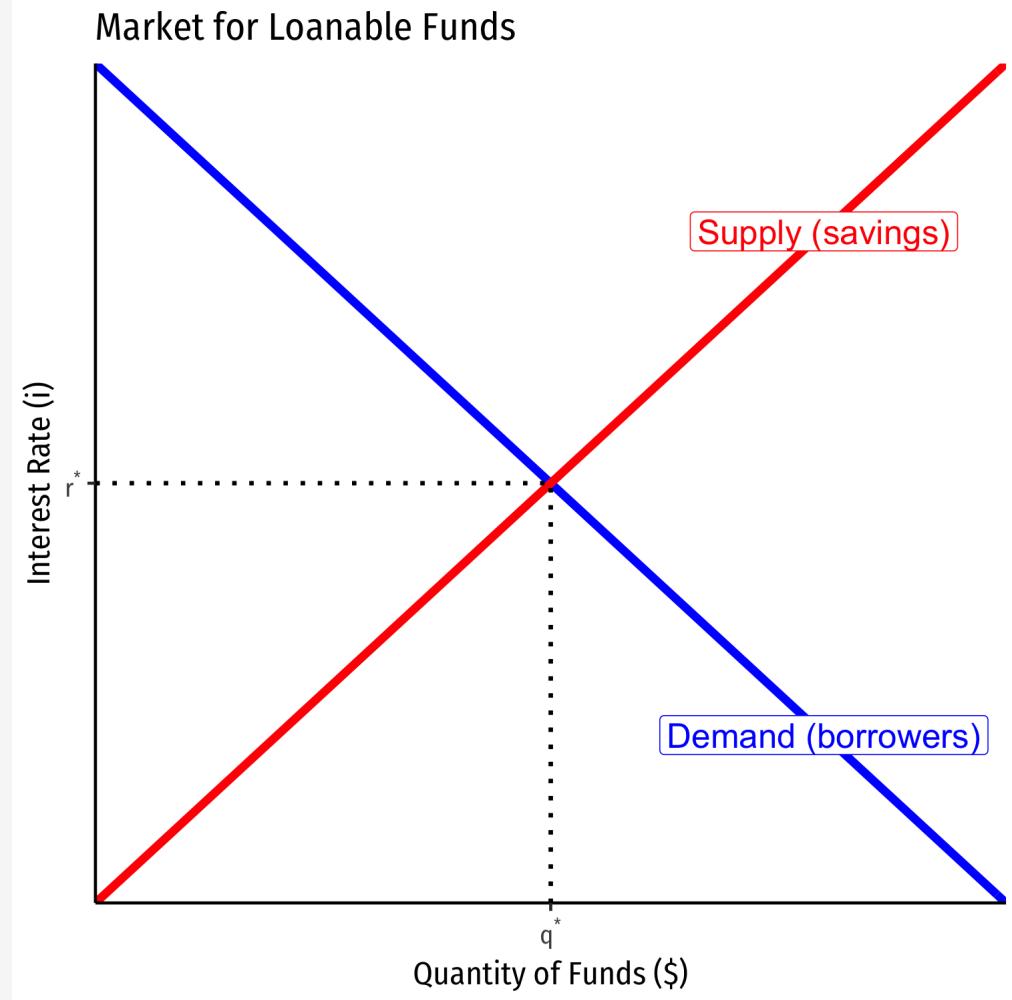
- Again, consider the “life cycle” of decisions
- People like to “smooth” their consumption over time, rather than experience sudden, discontinuous jumps in consumption level
 - When actual income $\langle < \rangle$ preferred consumption: **borrow** money
 - When actual income $\langle > \rangle$ preferred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



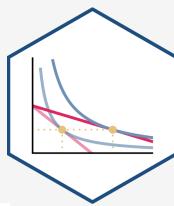
Market for Loanable Funds



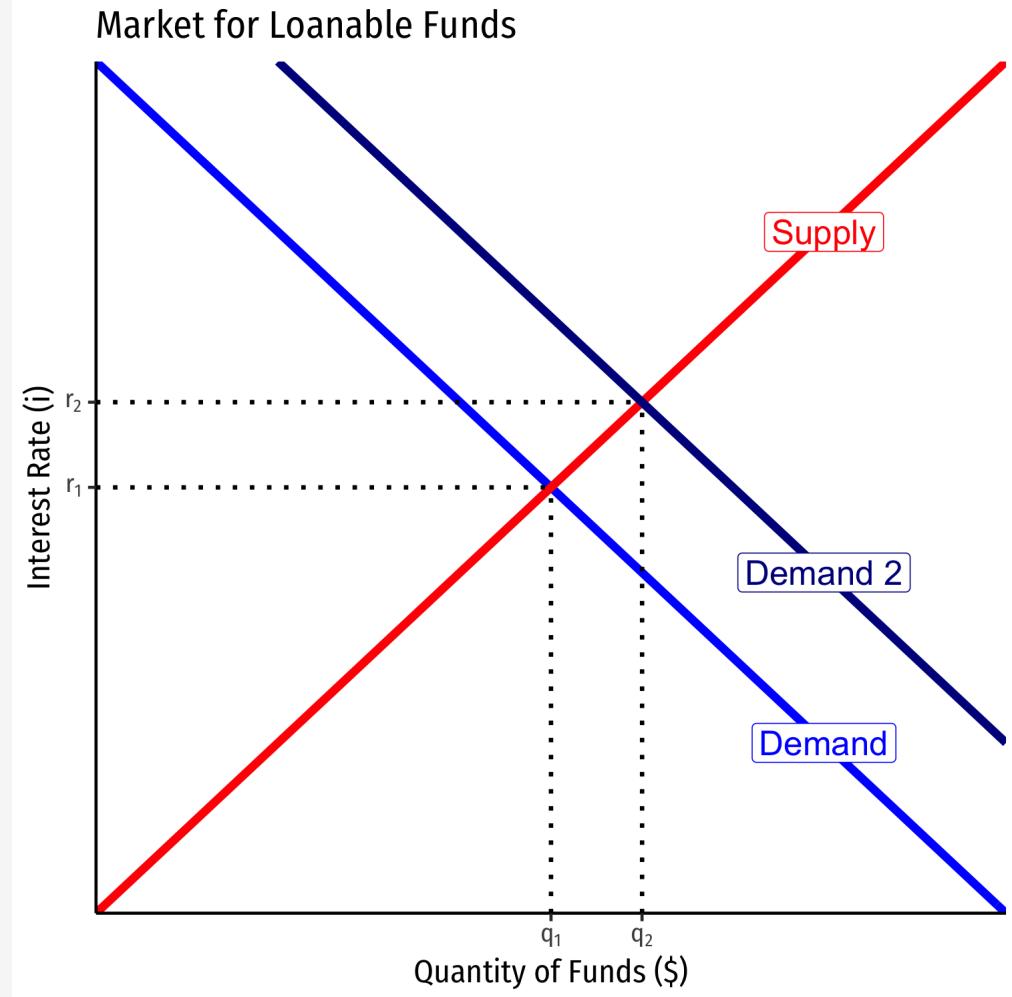
- Loanable funds market, where **savers** and **borrowers** exchange present & future money
- Equilibrium market interest rate \ (r^{\star})



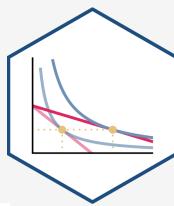
Market for Loanable Funds



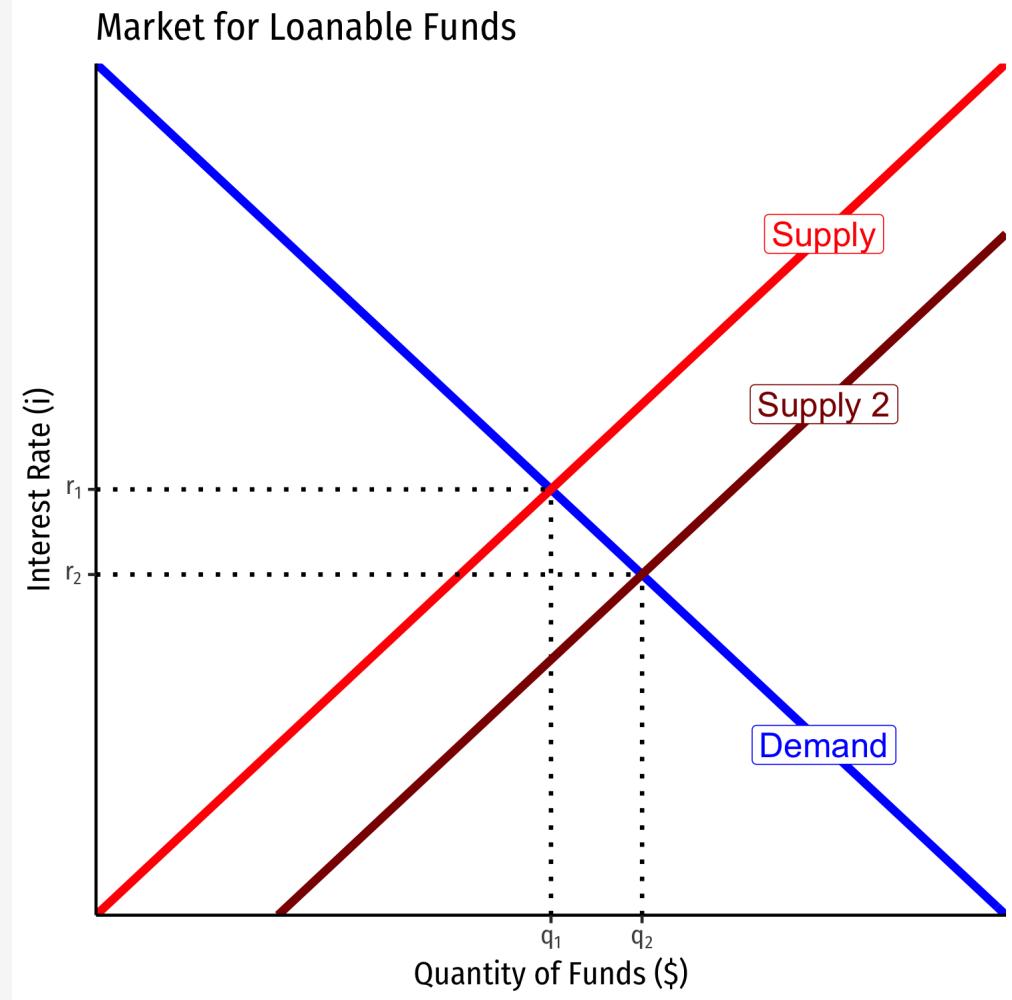
- An increase in Demand raises interest rate $\langle r \rangle$ and quantity of funds loaned/borrowed



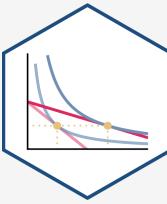
Market for Loanable Funds



- 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)