Chapter 5

Consumption and Investment

Dr. Matt D'Urso

(Colgate University)

Intertemporal Decisions

- Households make **intertemporal decisions**
  - Decisions that affect variables across time (a type of dynamic decision)
  - Ex: Choosing how much to *save* so that you can consume today and in the future

- Like with everything in economics, this comes with a price

The Interest Rate

- The interest rate is the relative price of consumption today
  - If the rate is 4%, I can consume $100 today, or $104 next year
  - Impacts how much you choose to save

- Interest on savings is the opportunity cost of consuming

- Useless semantic point: the relative price of consuming today in this case is 1.04, which is (1 + interest rate). Saying just the interest rate is common shorthand.

Why Do Interest Rates Exist?

› Lenders need to be compensated for:

- Impatience: Rather have $100 today or that same $100 in a year?
- Opportunity cost: What you would have done with that $100
- Risk: World could end tomorrow and you'll never see that $100
- Market power: Micro class :(

Individual Savings Decisions

› Let's start with a basic *real* model of a savings choice:

› HH makes choices in two periods:

1. Today
2. Tomorrow

› They choose:

1. Consumption today (c)
2. Consumption tomorrow (c')
3. How much to save for tomorrow (s)

Saving vs Borrowing

› HH's save by lending to other HH's this period

› Next period, borrowers pay back the loan

› Similar to what happens by saving in a bank

Given Variables

- The HH takes as given
  - Income today (y)
  - Income tomorrow (y')
  - Interest rate (r)

- We've assumed an **endowment economy**
  - Income is given in both periods

- The **endowment point (*E*)** will always be feasible
  - Meaning the budget line MUST ALWAYS go through this point
  - This income (y, y') is given to the consumer regardless

Intertemporal Budget Constraint

› Two budget constraints:

- $y = c + s$
- $y' + (1+r)s = c'$

› After some algebra we can create one budget constraint:

$$y + \frac{y'}{(1+r)} = c + \frac{c'}{(1+r)}$$

– We've eliminated the savings choice from the equation

Plot-able Budget Line

› Now define: $w^e \equiv y + \frac{y'}{(1+r)}$

  – **Net present lifetime wealth:** total income *value* in both time periods

› After some more algebra:

$$c' = -(1+r)c + (1+r)w^e$$

Analyzing the Budget Line

- $c' = -(1+r)c + (1+r)w^e$

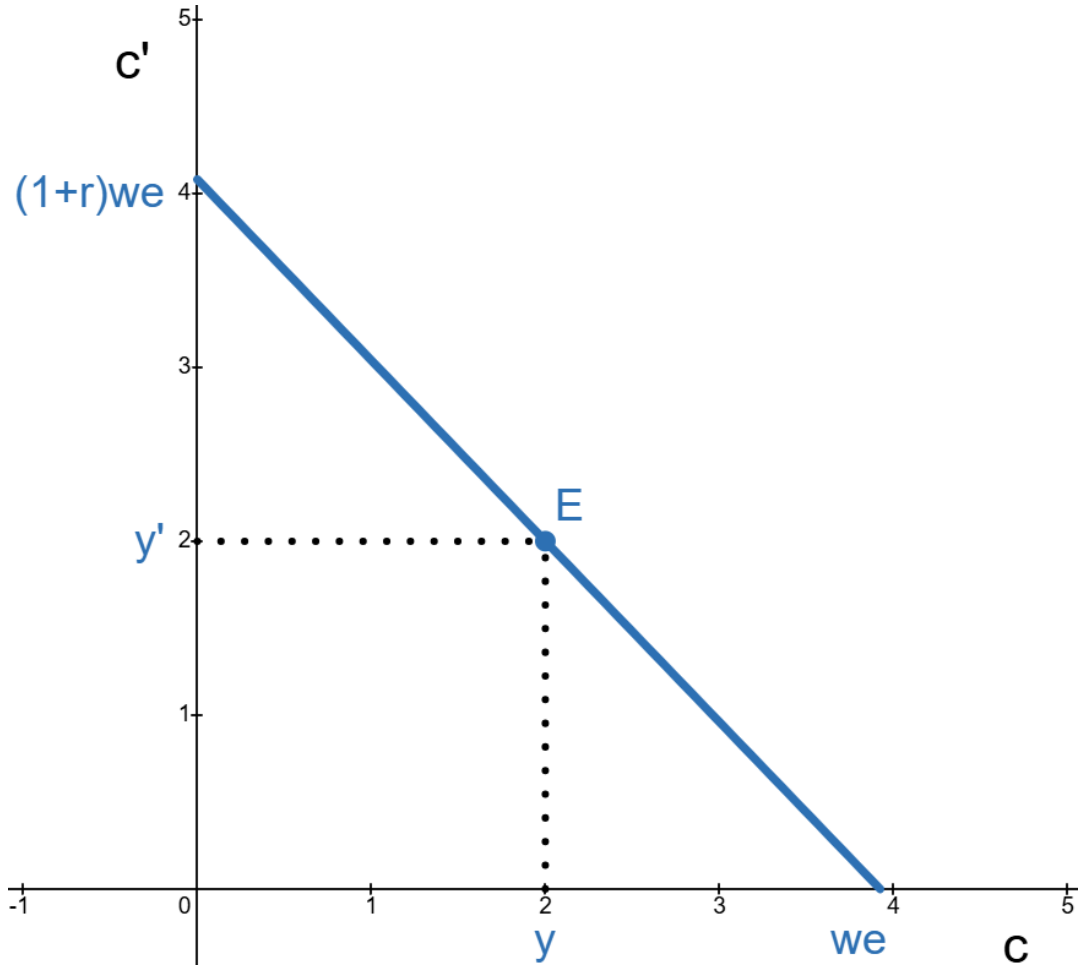
› Future consumption is the amount of wealth you didn't spend in the past, plus the interest from saving it

  – Consume nothing in the past: $c' = w^e(1+r)$ ➔ y-intercept

  – Making $-(1+r)$ the slope (note the negative sign)

  – ***WHY is the (abs. val.) of the slope (1+r)?***

Plotting in the (*c*,*c*') Space



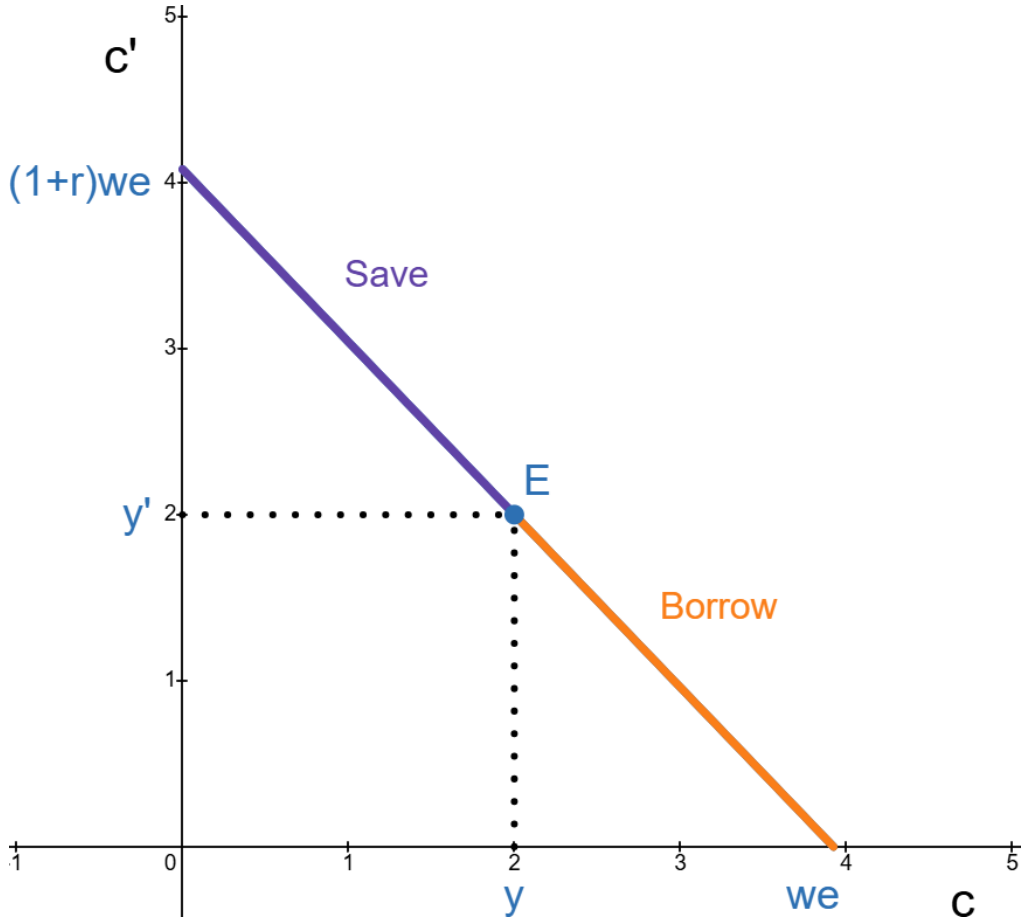
To Borrow or Save?

- Starting from what they're given (*E*), the HH can:
  - Save, consume more later

    or

  - Borrow, consume more now

- Why do we know the HH will be on a point on the budget line?



Unpacking HH Utility

- We know the HH wants to maximize utility
  - Last ch. we didn't dive into the utility function
  - Now, we'll talk about the time component

- Assume HHs value the future *less* than the present
  - Doesn't have to be by a lot; even just .01% less will work
    - Prefer to have something today, or that same thing a year from now?

- Define: $\boldsymbol{\beta} \in [0,1)$ as constant that expresses how much the HH values the future relative to the present

The Household's Problem

› The HH's problem is:

$$\max\{U(c, c')\} \text{ st: } w^e = c + \frac{c'}{(1+r)}$$

- Maximize utility from c and c', subject to their budget
  - Remember w^e is total lifetime wealth
- Where $U = u(c) + \beta u(c')$
- Notice there's our β placing a weight on the value of c'

Marginal Rate of Substitution

› Just as in the last chapter, we have a *MRS:*

$$MRS_{c,c'} = \frac{MU(c)}{\beta MU(c')} = (1+r)$$

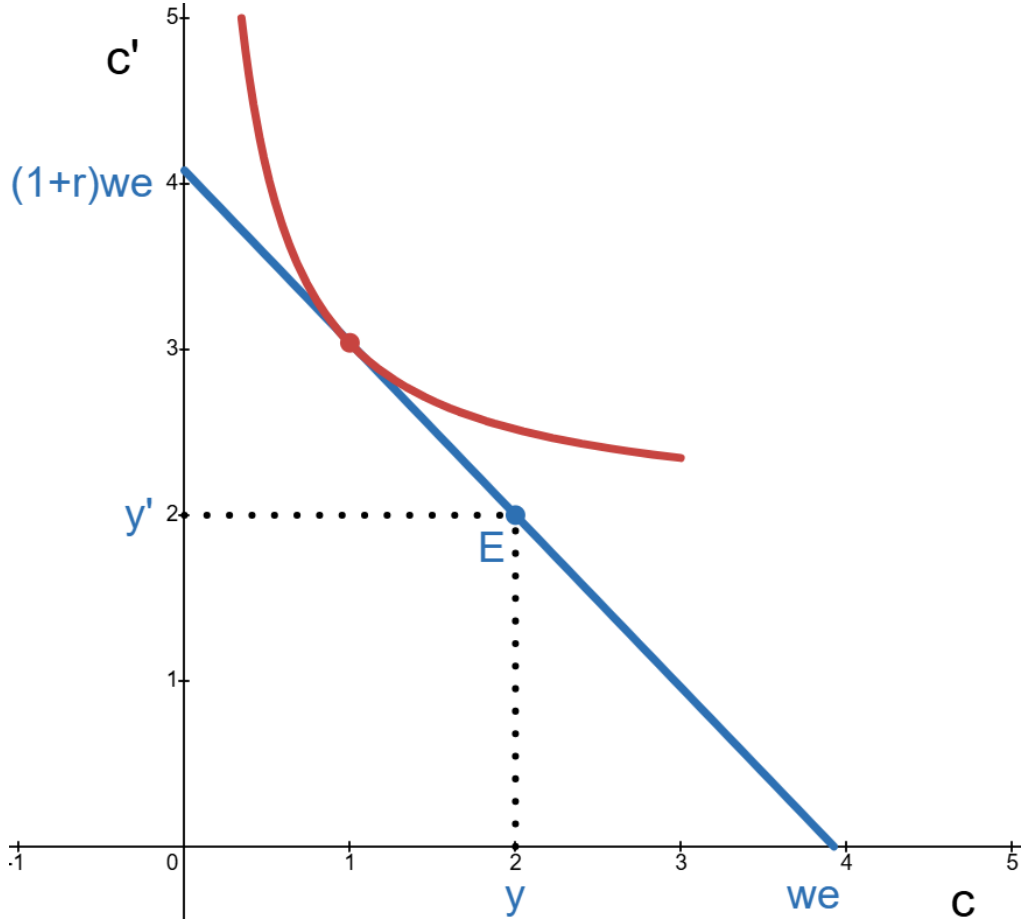
› Again, this is our HH market clearing condition

- Interest must afford enough consumption tomorrow to make up for the utility lost by giving up consuming today
- HH is indifferent between marginal increase in *c* or *c′*

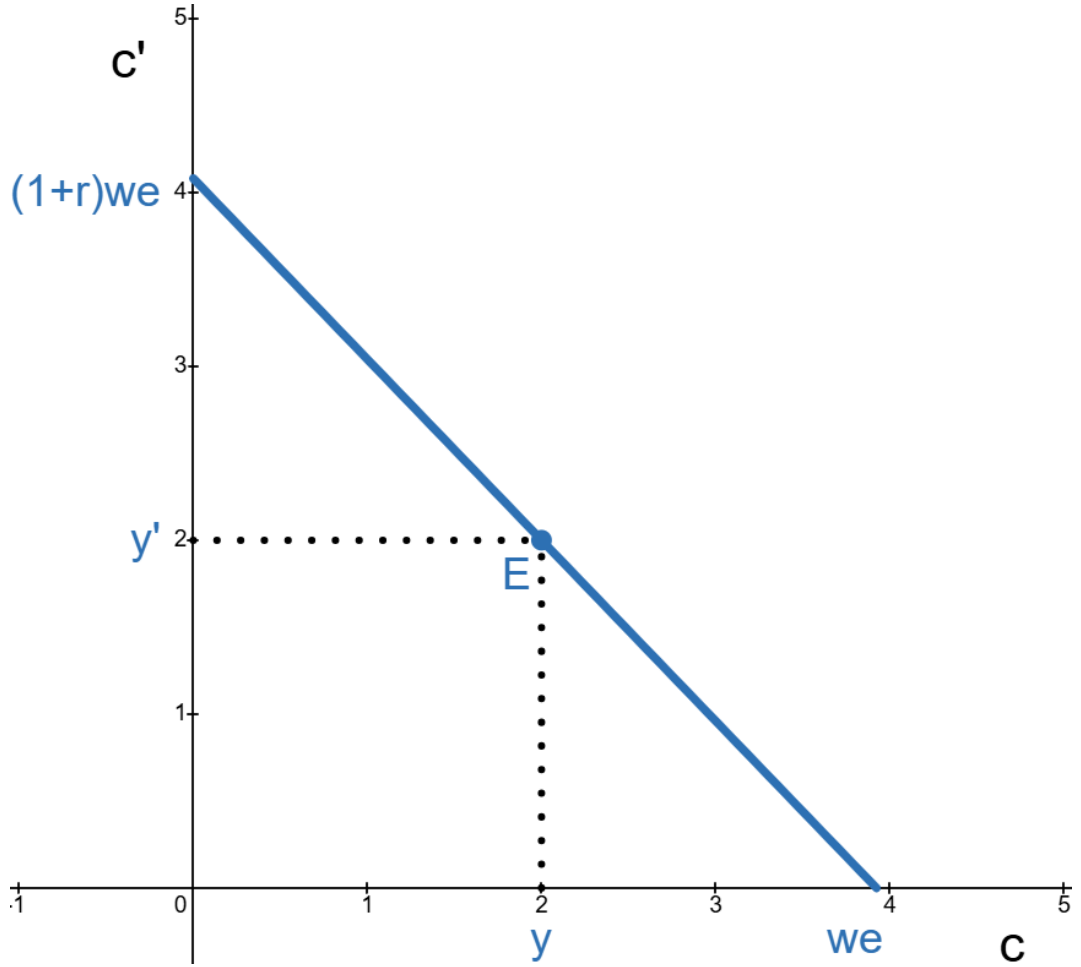
Proof (not required)

Consumption Choice of Saver (lender)

- Given this utility, HH picks:
  - $c = 1$
  - $c' = 3$
- Savings = 1
  - Why?
- What is the slope of IC at (c, c')?



What Does the Borrowing Case Look Like?



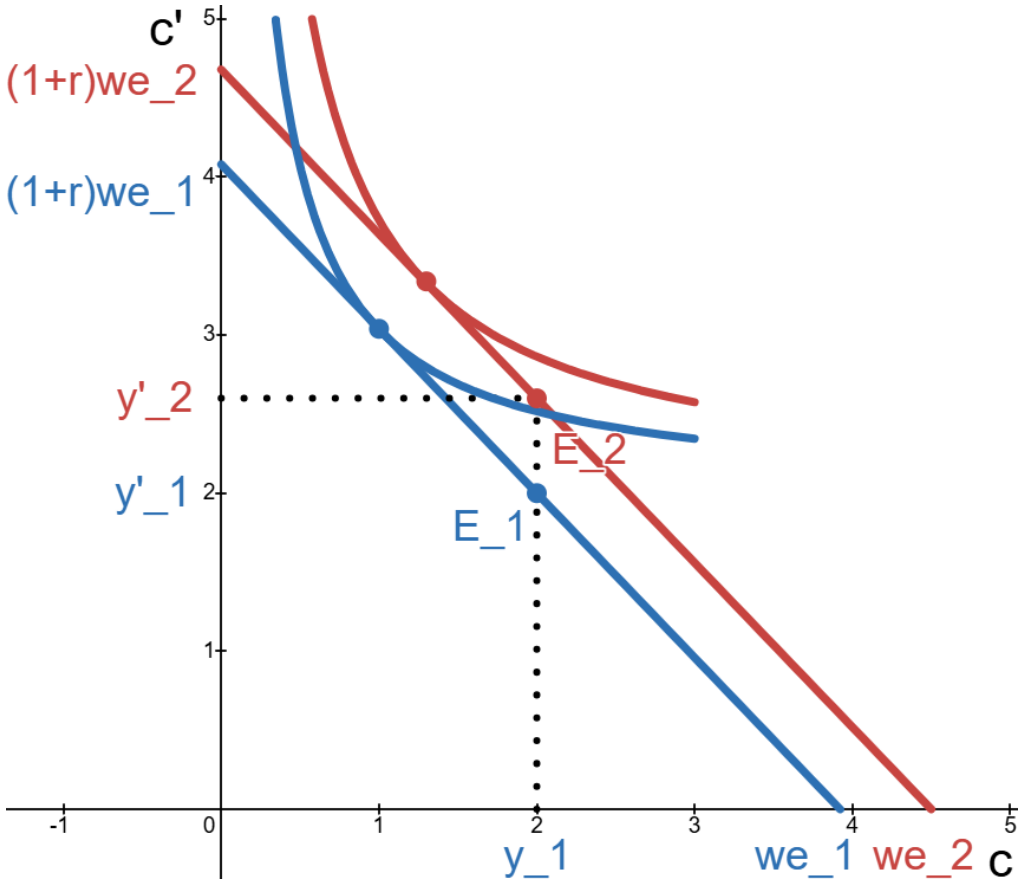
Change in Future Income

- Assume the HH gets a boost in future income: $y'_1 \rightarrow y'_2$
  - Endowment increases
  - Budget must go through point new E' point

- Wealth must also increase: $w^e_2 = y_1 + \frac{y'2}{(1+r)}$

Graphing an Increase in Future Income

- Wealth increased:
  - Both w^e and $(1+r)we$ must increase
- No change in $r \rightarrow$ slope stays the same
- Pure <u>wealth effect</u>



Wealth Effect from Change in Endowment

› There is only a wealth effect in this case
  – No substitution effect

› **Why?** the relative price, *r*, did not change

The substitution effect only occurs when the relative price changes. The relative price is the rate at which the HH ***substitutes*** one good for another

Change in Interest Rate: Two Cases

- Recall the slope of the budget was –(1+*r*)
  - Changing *r* changes the slope

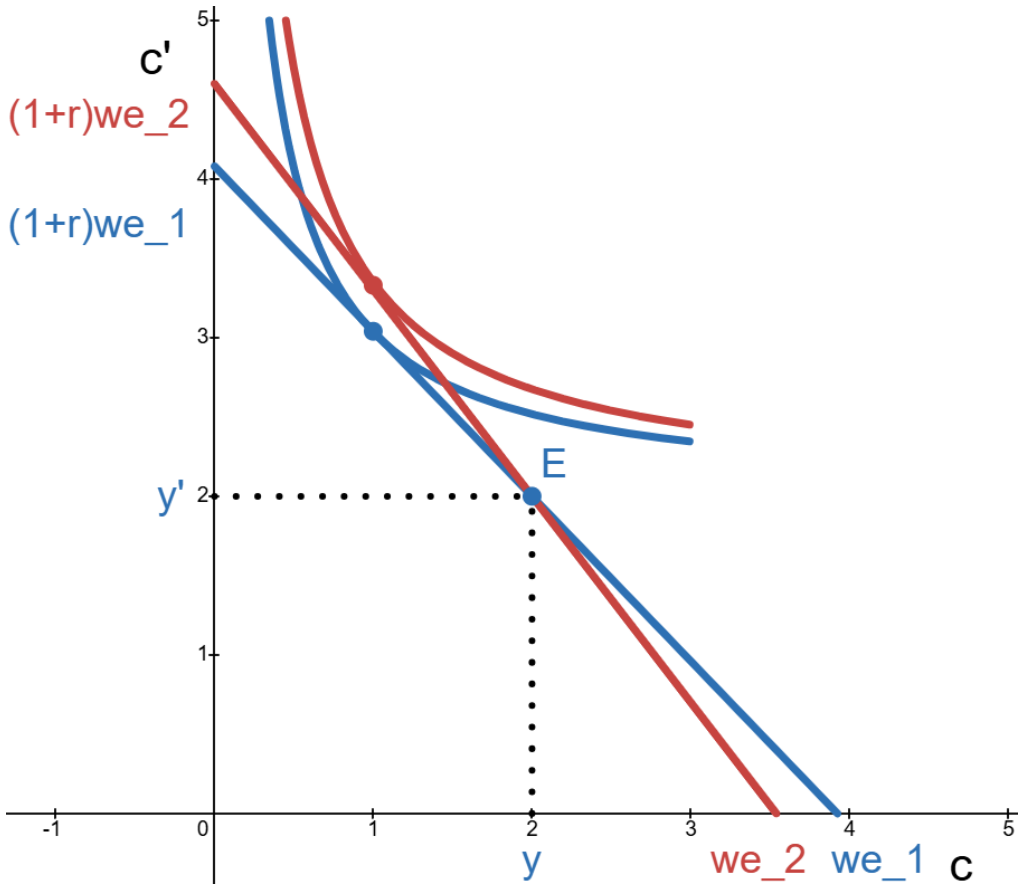
- The endowment doesn't change
  - Budget must still go through point *E*

Increase in *r* for Lenders & Borrowers

- Lenders make money on interest
  - Increase in *r* means they have more lifetime wealth
- Borrowers have to pay interest
  - Increase in *r* means they have less lifetime wealth
- Reverse is true for a fall in *r*

Increase in *r* for Lenders

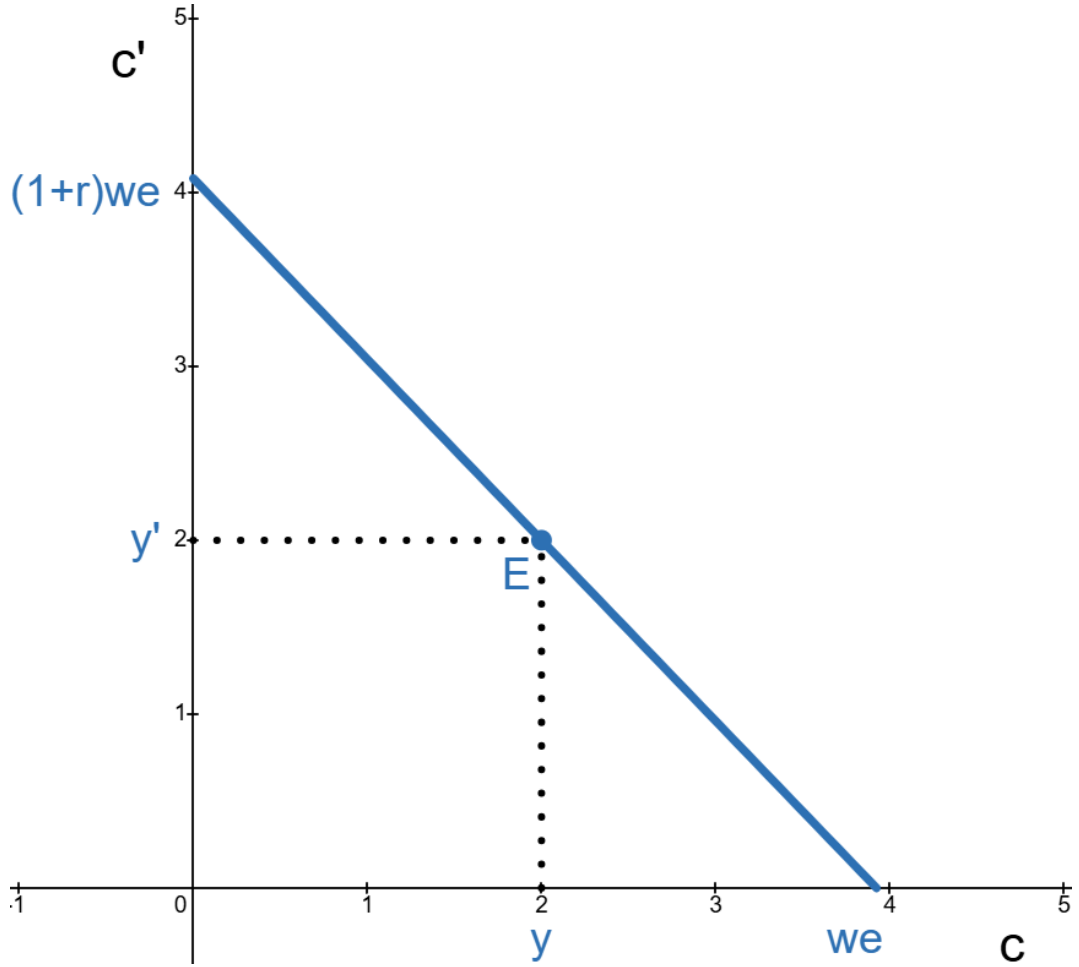
- Lender is on a higher IC
  - More utility
- Future consumption rose
- Current consumption…?



Wealth and Substitution Effects (again)

- Cannot say what happened to current consumption (c)
- **Wealth effect:** lender has more lifetime income ➔ consume more c and c'
- **Substitution effect:** relative price of c has risen ➔ consume more c' and less c
  - Substitute away from relatively expensive good

Increase in *r* for Borrowers



For an Increase in *r*

- HH's borrow less and lend more
  - Savings increase

- The quantity supplied of **loanable funds** increases
  - Resources available to be loaned out

Lending to Firms

› So far we looked at HH's lending to other HH's

› Now we'll include firms in the model

Why do Firms Borrow?

- Firms borrow in order to fund investment
  - Ch. 3: investment in capital goods, not the stock market

- Capital **depreciates** with use so they have to update it
  - Rather a brand new computer or one that's been used for years?

- Depreciation rate is denoted by $\boldsymbol{\delta}$
  - Depreciated capital is then: δk
  - Roughly 7%/year in aggregate

A Timing Assumption

- Our variable *k* represents total capital today, but…

- Investment will not change *k*
  - Building a new machine does not happen instantly
  - There is time before you see returns on majority of investments

- Investment will change *k′*
  - "one-period time-to-build"
  - Current *MPk* doesn't matter; future *MPk′* matters

Capital Accumulation

- Remaining capital after period: $(1-\delta)k$
- Capital for next period: k'
- Investment: i

- Investment required to get to k':

$$\boldsymbol{i = k' - (1-\delta)k}$$

  - Difference between where you are and where you want to be

The Demand for *k′*

› Firms invest so that MB = MC

› Equilibrium condition here is:

$$MPk' = (r + \delta)$$

› **Marginal benefit:** *MPk′*

– Firms invest for the future, so we're concerned with *k′*

› **Marginal cost:** price of borrowing + loss via depreciation

– This is the real **user cost** of a unit of capital

One Final Adjustment for Graphing

› Usually, we work with prices on the y-axis

› Conveniently, we can subtract over δ:

$$MPk' - \delta = r$$

› Remember, *r* is a relative price like *w*

- Recall this is a representative firm so k = K
- Either notation is acceptable

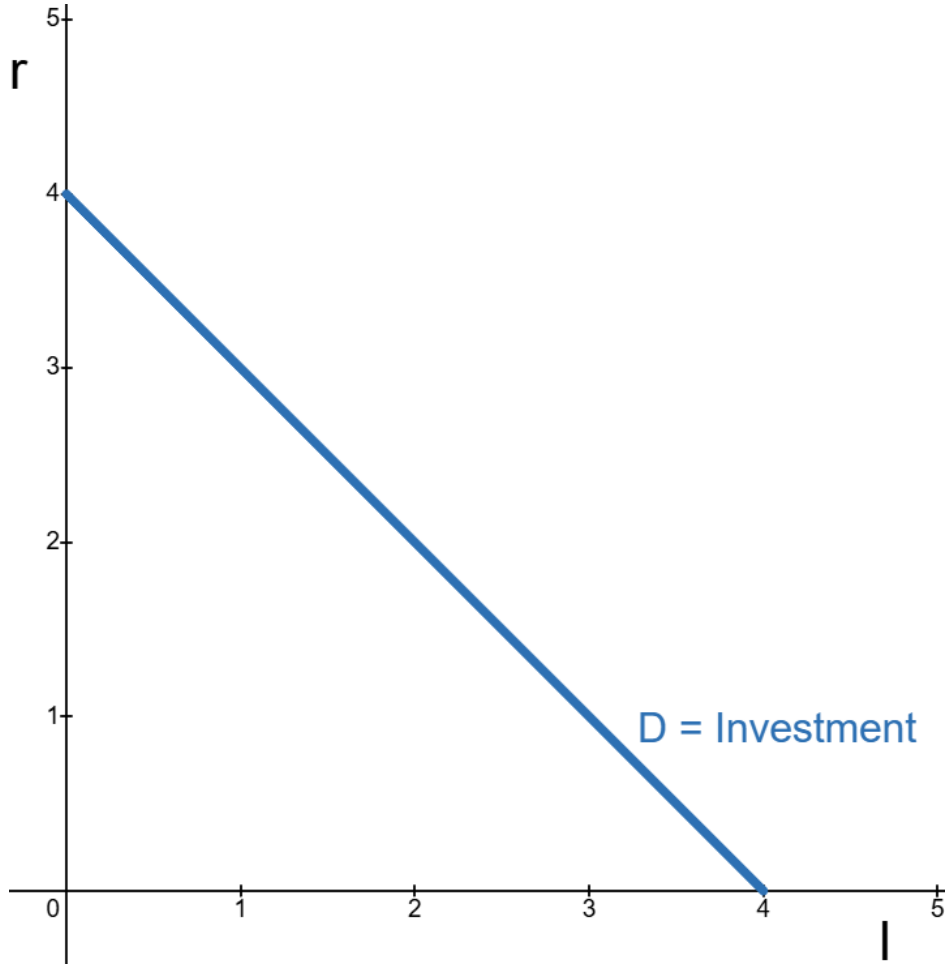
Proof (Not required)

Relationship b/t *r* and Investment Demand

- Firms borrow to invest
  - The price of borrowing is *r*

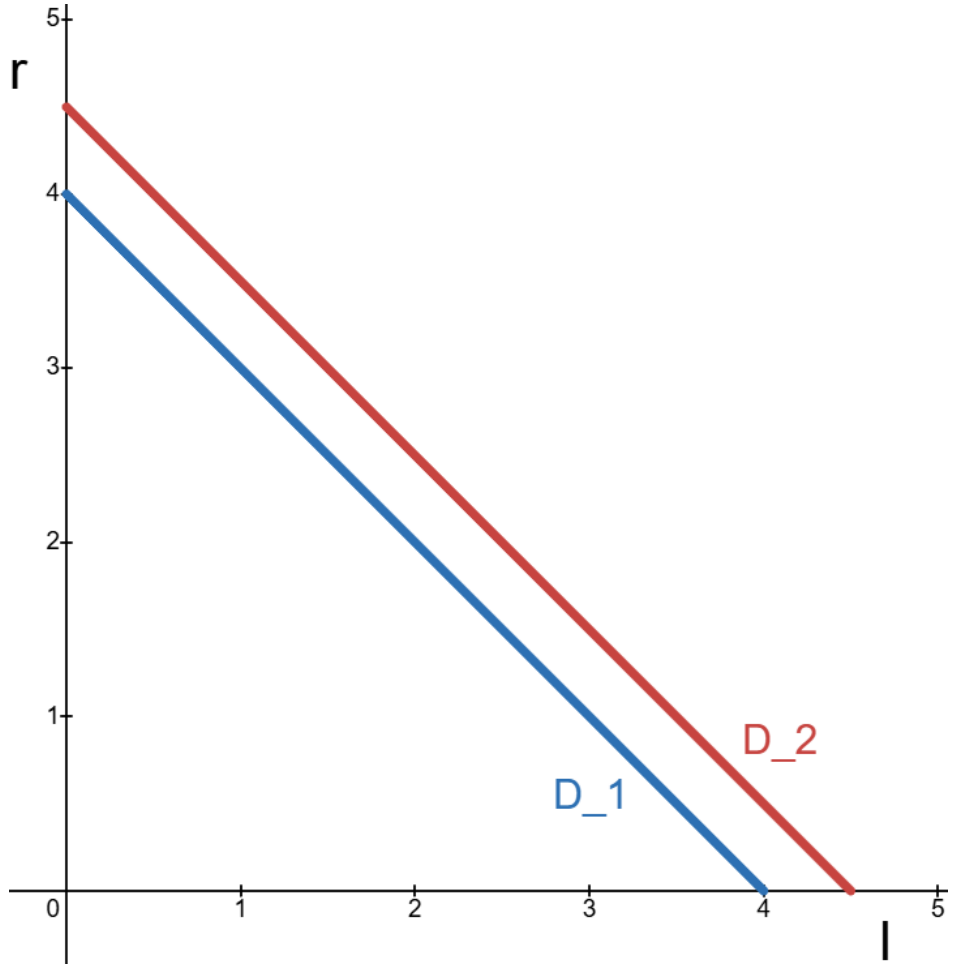
- Before we had *MPN* & *w*, now have *MPk'* & *r*
  - If *w* is higher than *MPN*, firms don't hire
  - Now, if *r* is higher than *MPk'* – *δ,* firms don't invest
  - Don't forget *δ*; firms don't want to pay for capital that they'll lose

Firm Investment Demand



Shifts of Demand Curve

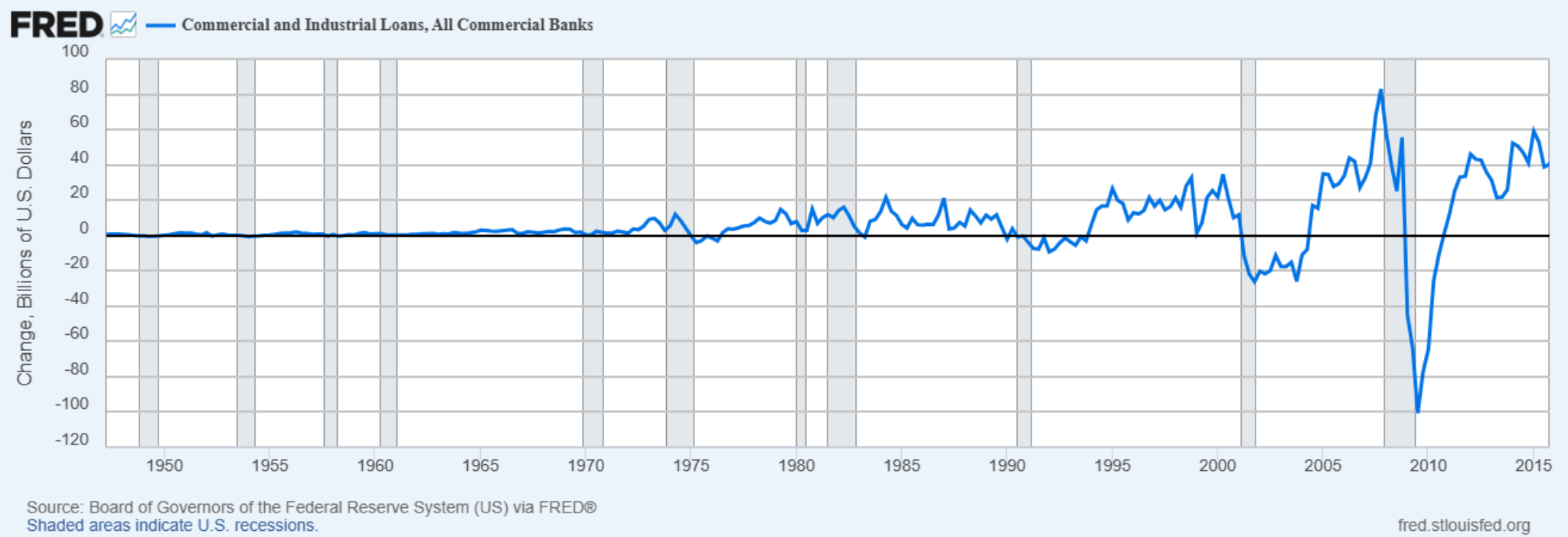
- Shift right if:
  - *MPk'* rises (*z'* or *n'* rises)
  - *k* falls
  - *δ* falls



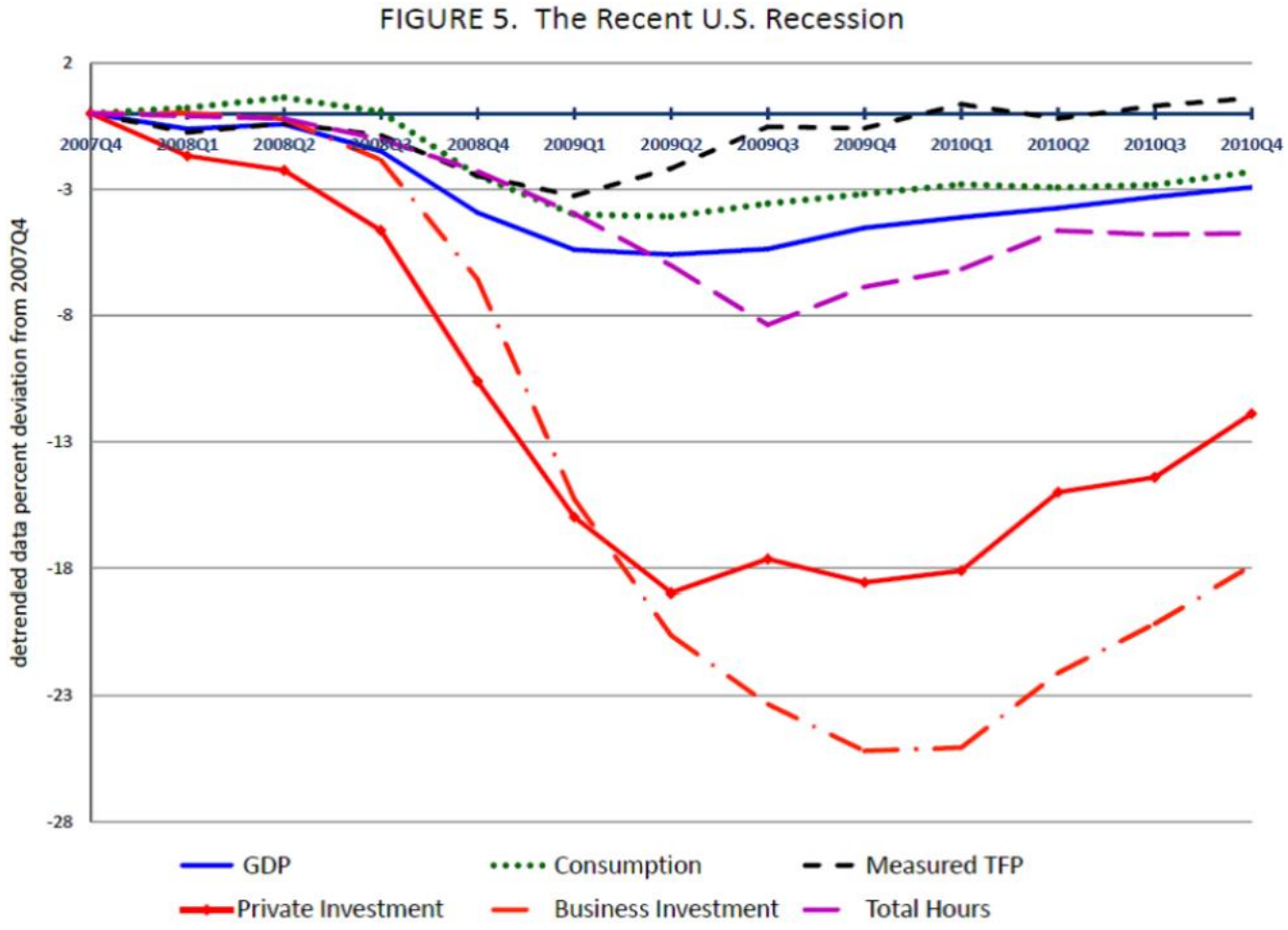
Assumptions?

› What assumption have we made that is so fundamentally obvious that we may have overlooked it?

C&I Loans: Change, Billions of U.S. Dollars



Borrowed Funds → Investment



(Khan and Thomas, 2013. Figure 5)

Savings and Investment

- Investment *must* come from savings
  - In fact, in a **closed economy**, *savings* = *investment*
    - Closed economy = without international trade
  - Can't invest what's been consumed, so you can only invest from your savings

- We can see that by looking at Private and Gov't Savings

Private & Government Savings

- **Private savings:** $S_{pvt} = Y - C + Tr + Int - T$
  - Income (Y)
  - Consumption (C)
  - Transfers from gov't [ex: Social Security] (TR)
  - Interest on gov't debt (INT)
  - Taxes paid (T)

- **Government (public) savings:** $S_{gov} = T - G - Tr - Int$
  - Taxes collected (T)
  - Government purchases (G)
  - Transfers to households (Tr)
  - Interest payments on debt (Int)

Supply of Savings in a Closed Economy

- Total savings: $S = S_{pvt} + S_{gov}$
- $S = (Y - C + TR + INT - T) + (T - G - TR - INT)$
- Supply of Savings is:

$$\boldsymbol{S = Y - C - G}$$

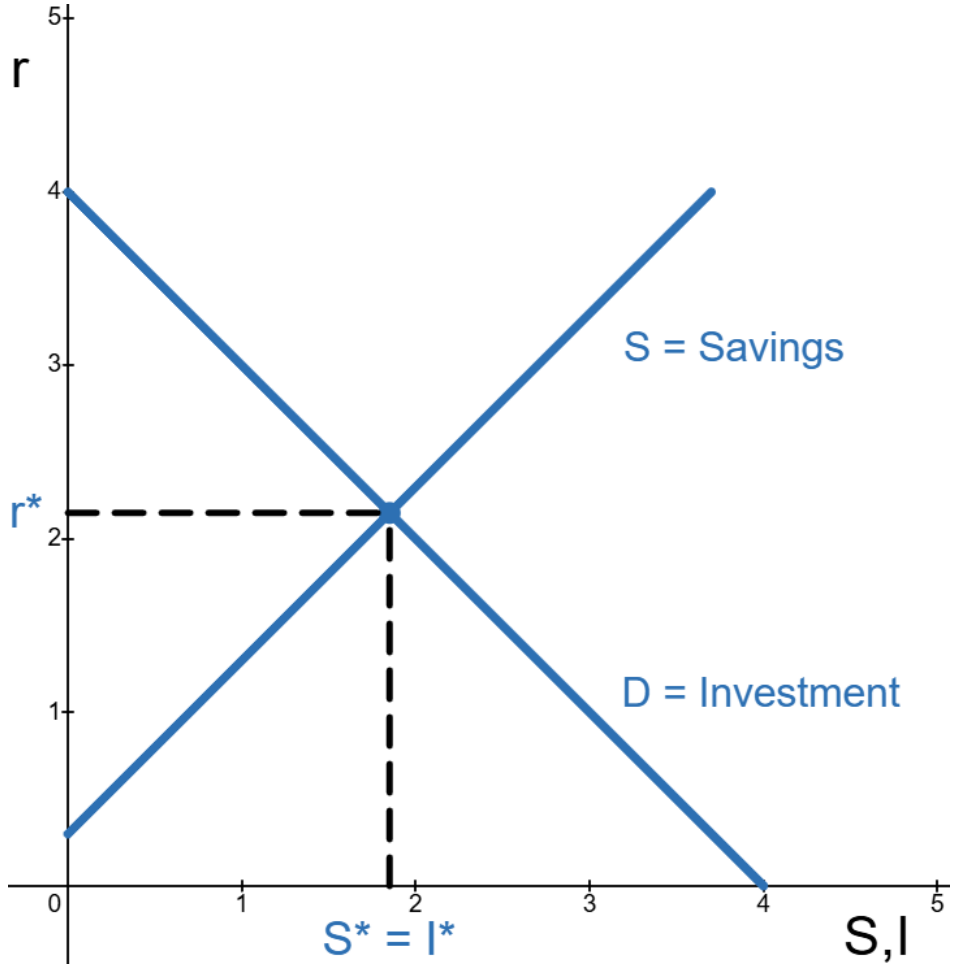
The Goods Market and $S = I$

- From last slide: $S = Y - C - G$
- Market clearing in Goods Market: $Y = C + I + G$ ~~$+ NX$~~
  - $NX = 0$ in closed economy
- $S = (C + I + G) - C - G$
- **$S = I$**

The Loanable Funds Market

- In a closed economy, investment must come from savings
- The **loanable funds market** is where HHs provide savings to be used for investment
  - Supply: HH (net) savings
  - Demand: Firm investment
  - Price: *r* determines the quantities supplied/demanded
- Market clearing is an interest rate where quantity demanded = quantity supplied

Equilibrium



Equilibrium in the Data

Sector	$ Net Lending (+) / Net Borrowing (-) billions
Domestic businesses	768.032
Households and institutions	563.766
Federal government	-1,958.199
State and local government	-357.520
Rest of world	983.921

Current taxes and transfer payments to the rest of the world: Net lending or net borrowing (-) (BEA, 2026).

- Statistical discrepancy is assumed to be 0.

Shifts in Savings Supply

1. Changes to HH wealth will shift the supply curve
   - Increasing current income shifts supply curve right
   - Increasing future income shifts supply curve left
   - Why?

2. Changes to Gov spending also shift the supply curve

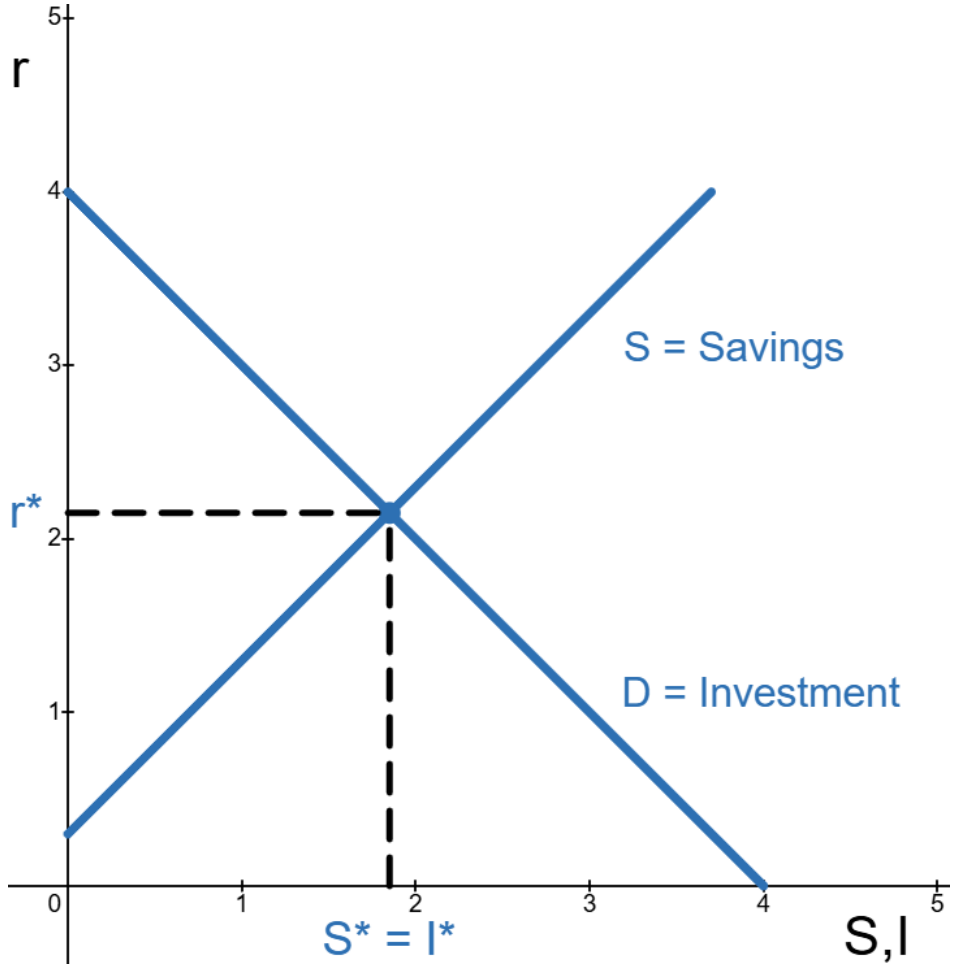
Effect of Government Spending

- HH saving decision is micro-founded
  - Supply of Private Savings

- No real standard approach for Government Savings
  - Gov acts as its own "aggregate agent" anyway

- Can just directly look at increase in *G*
  - Decrease in Government Saving

Increase in *G*; Fall in S_{gov}



References

1. Board of Governors of the Federal Reserve System (US), Commercial and Industrial Loans, All Commercial Banks [BUSLOANS], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/BUSLOANS, February 2, 2026.

2. Khan, Aubhik, and Julia K. Thomas. "Credit shocks and aggregate fluctuations in an economy with production heterogeneity." *Journal of Political Economy* 121.6 (2013): 1055-1107.

3. U.S. Bureau of Economic Analysis, Current taxes and transfer payments to the rest of the world: Net lending or net borrowing (-), NIPAs [W162RC1Q027SBEA], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/W162RC1Q027SBEA, January 31, 2026.

A. All non-cited graphs for this course made by me on Desmos.

Copyright

- **© [2026] [Dr. Matt D'Urso]. All rights reserved.**
- The compilation, structure, original text, and design of these lecture slides are the intellectual property of [Matt D'Urso]. All third-party figures, images, quotes, and cited research remain the property of their respective copyright holders and are used here under fair use guidelines for non-commercial educational purposes.
- No part of these presentations may be reproduced, modified, republished, distributed, or converted into commercial works (including textbooks, online courses, or study materials for sale) without express written permission from the author.
- **Free for personal educational use.** *Downloads are for individual study only. Re-hosting, commercial distribution, or derivative works (such as turning these into a textbook or course package) are strictly prohibited without written consent.*