

LECTURE 18
SAVING AND INVESTMENT IN THE LONG RUN

March 20, 2018

- I. OVERVIEW
- II. REVIEW OF THE INVESTMENT DEMAND CURVE
- III. SAVING AND INVESTMENT
 - A. The uses of Y^*
 - B. Equilibrium
 - C. Decomposing national saving into private and public saving
- IV. NATIONAL SAVING AND THE REAL INTEREST RATE
 - A. Utility maximization
 - B. The supply of saving curve
 - C. Example: A tax cut
- V. THE DETERMINANTS OF INVESTMENT AND THE REAL INTEREST RATE IN THE LONG RUN
 - A. Equilibrium r^* and I^*
 - B. Example: A tax cut revisited
 - C. Example: A new technology that raises future MRP_K 's
- VI. STOCK PRICES
 - A. Financial capital versus physical capital
 - B. Stock price equals the PV of expected future dividends
 - C. What affects stock prices?
 - D. Efficient markets hypothesis

Economics 2
Spring 2018

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LECTURE 18

Saving and Investment in the Long Run



March 20, 2018

Midterm 2 Reminders

- Thursday, March 22nd, 2:10–3:30.
- You do ***not*** need a blue book.
- If your GSI is Wesley Huang (Sections 111 & 112) or Maxime Sauzet (Sections 103 & 104), go to 10 Evans; if your GSI is Erik Johnson (Sections 113 & 114), go to 101 Life Sciences Addition.
- DSP Students: You should have received an email from the course assistant (Todd Messer) about arrangements. If you haven't, please contact him (messertodd@berkeley.edu).
- Everyone else come to usual room (2050 VLSB).

Announcements

- You should have handed in Problem Set 4.
 - ***Answer sheet will be posted this evening.***
- Professor office hours this week are ***today*** (Tuesday, March 20), 4:00–6:00 p.m.

I. OVERVIEW

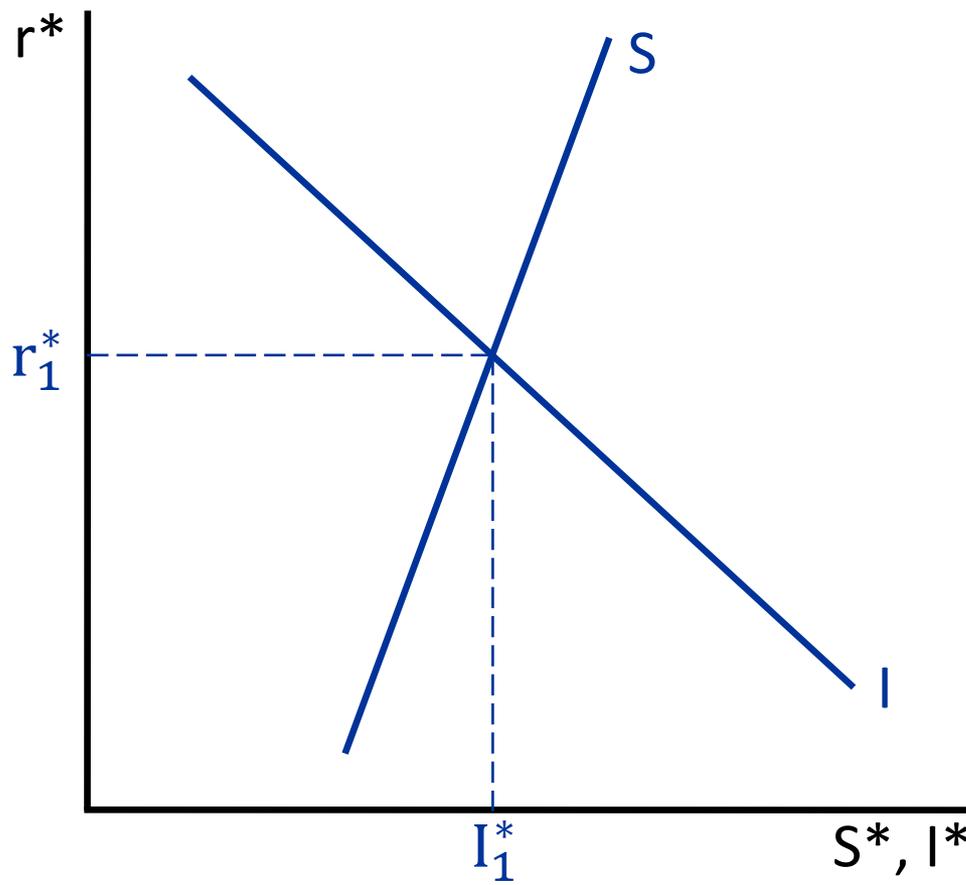
Aggregate Production Function

$$(1) \quad \frac{Y^*}{\text{POP}} = \frac{Y^*}{N^*} \cdot \frac{N^*}{\text{POP}}$$

$$(2) \quad \frac{Y^*}{N^*} = f\left(\frac{K^*}{N^*}, T\right)$$

$$(3) \quad \frac{Y^*}{\text{POP}} = f\left(\frac{K^*}{N^*}, T\right) \cdot \frac{N^*}{\text{POP}}$$

Where We're Headed: The Long-Run Saving and Investment Diagram



Here S is saving, I is investment, and r is the real interest rate (and $*$ denotes a long-run value).

II. REVIEW OF THE INVESTMENT DEMAND CURVE

The Condition for Profit Maximization

- Capital is an input into production, so one might think profit-maximization implies that a firm will buy new capital goods (that is, invest) to the point where $MRP_K = \text{Purchase Price of Capital Goods}$.
- But: The purchase price is paid immediately, and a capital good has a marginal revenue product for many years in the future.
- Thus, the condition for profit-maximization is:
$$PV(\text{Stream of } MRP_K\text{'s}) = \text{Purchase Price}$$
- Aside: If we want to be precise, it's really ***expectations*** of the stream of MRP_K 's, not the actual MRP_K 's.

Writing Out the Condition for Profit Maximization

$$\frac{MRP_{K1}}{(1+r)^1} + \frac{MRP_{K2}}{(1+r)^2} + \frac{MRP_{K3}}{(1+r)^3} + \dots + \frac{MRP_{Kt}}{(1+r)^t}$$

= Purchase Price,

where:

- MRP_{Kn} = Marginal revenue product in year n
- r = interest rate (expressed as a decimal)
- t = number of years in the future the piece of capital will have a marginal revenue product.

Why Does Investment Demand Fall When the Interest Rate Rises?

- Recall: the condition for profit-maximization is:

$$PV(\text{Stream of } MRP_K\text{'s}) = \text{Purchase Price}$$

- If the interest rate rises, $PV(\text{Stream of } MRP_K\text{'s})$ falls.
- To restore the condition for profit-maximization, firms need to reduce their investment (which increases $MRP_K\text{'s}$).

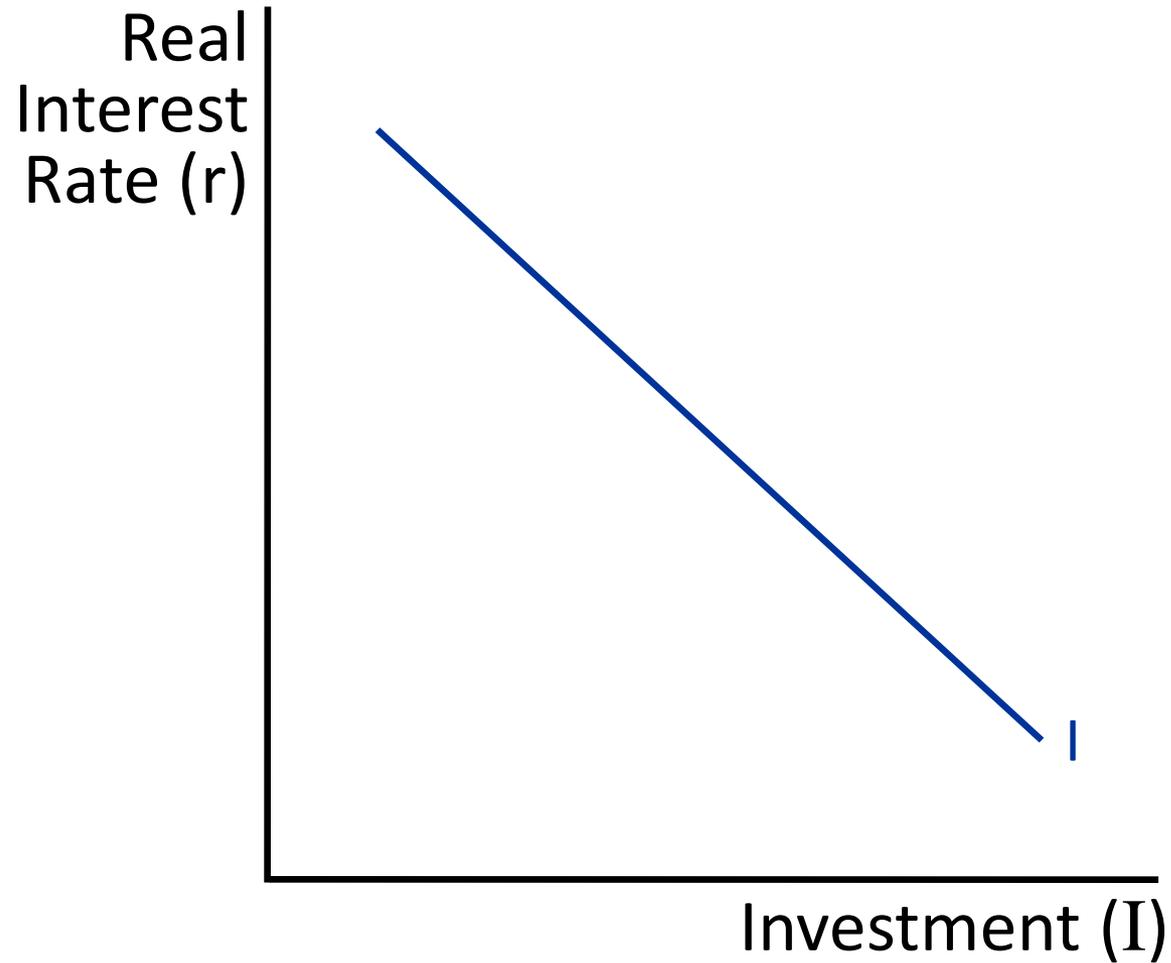
Why Does Investment Demand Depend on the *Real* Interest Rate? Version 1

- Think of doing everything in real (that is, inflation-adjusted) terms.
- Then the condition for profit-maximization is: Present value of the stream of real MRP_K 's, with the present value computed using the real interest rate, equals the real purchase price.
- If inflation rises with no change in the real interest rate, nothing in that condition changes, and so investment demand does not change.
- But if the real interest rate rises, the present value falls, and so investment demand falls.

Why Does Investment Demand Depend on the *Real* Interest Rate? Version 2

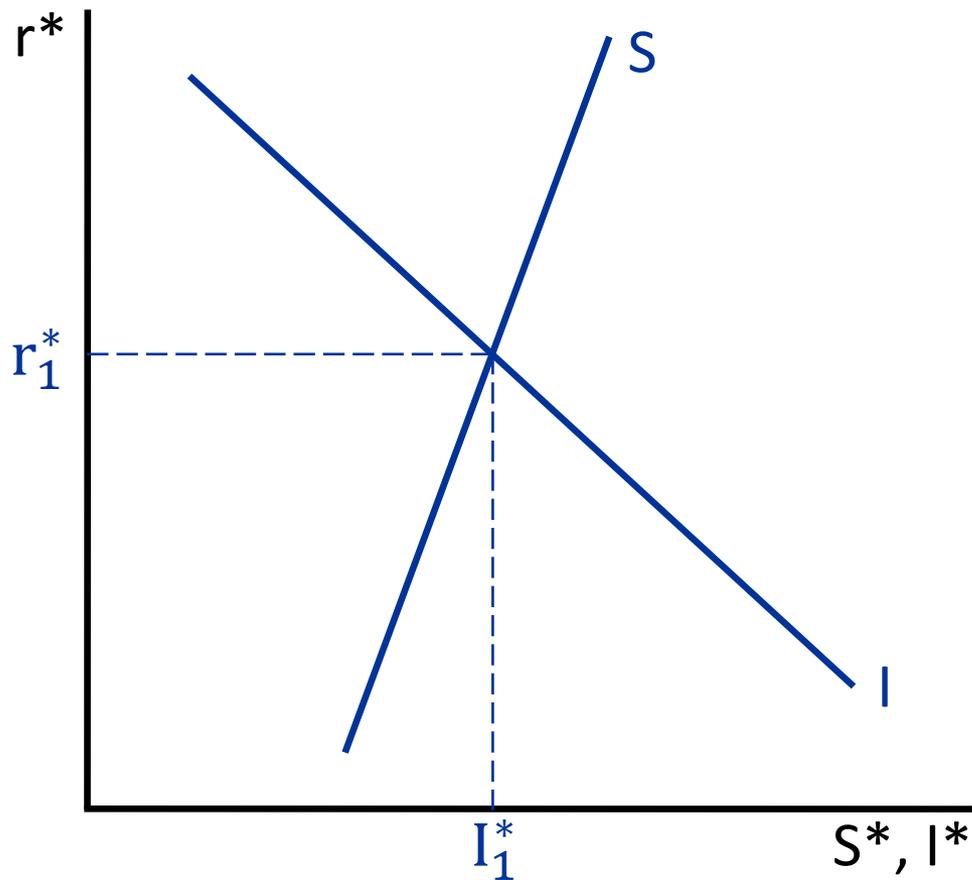
- For a competitive firm, PV(Stream of Future MRP_K 's)
$$= \frac{MP_K \cdot P_1}{(1+i)^1} + \frac{MP_K \cdot P_2}{(1+i)^2} + \frac{MP_K \cdot P_3}{(1+i)^3} + \dots + \frac{MP_K \cdot P_t}{(1+i)^t}$$
- Recall that $i = r + \pi$.
- If i rises only because π rises, PV won't change because the P 's will also rise, and so investment demand does not change.
- If i rises because r rises, PV will fall, and so investment demand falls.

Investment Demand Curve



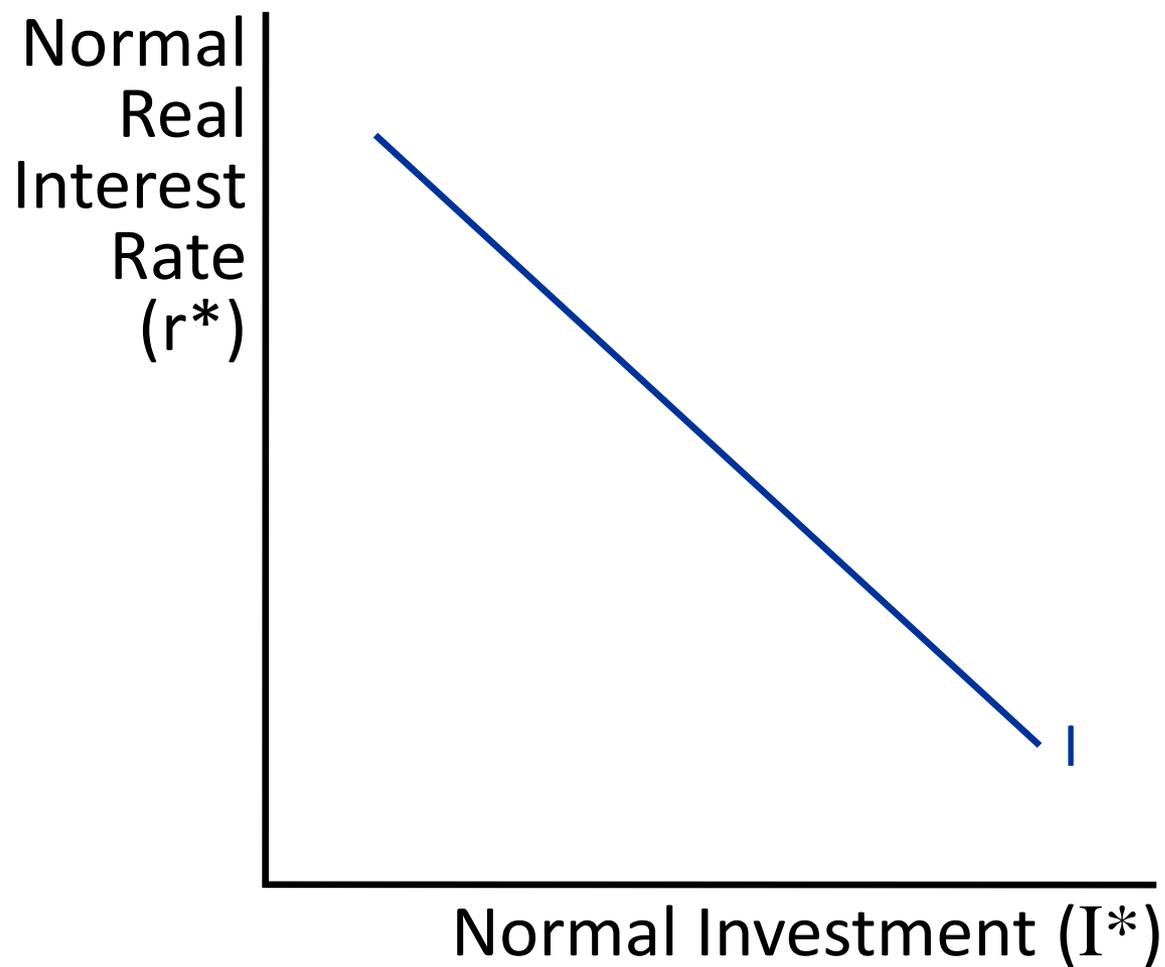
III. SAVING AND INVESTMENT

Where We're Headed: The Long-Run Saving and Investment Diagram



Here S is saving, I is investment, and r is the real interest rate (and $*$ denotes a long-run value).

The Relationship between Normal Investment and the Normal Real Interest Rate



The Uses of Potential Output

- Consumption (C^*)
- Investment (I^*)
- Government purchases (G^*)
- Net Exports (NX^*)

Stars denote normal, long-run values.

For now, we will assume that $NX^* = 0$.

Equilibrium Condition

$$Y^* = C^* + I^* + G^*$$

We can rearrange this as:

$$Y^* - C^* - G^* = I^*$$

- $Y^* - C^* - G^*$ is normal national saving supply (S^*).
- I^* is normal investment demand.
- Thus, equilibrium requires $S^* = I^*$.

Private and Public Saving

$$\begin{aligned} S^* &= Y^* - C^* - G^* \\ &= Y^* - C^* - G^* + (T^* - T^*) \\ &\quad \text{(where } T^* \text{ is normal tax revenue)} \\ &= \underbrace{(Y^* - T^* - C^*)}_{\text{Private Saving}} + \underbrace{(T^* - G^*)}_{\text{Public Saving}} \end{aligned}$$

- Thus, we can write the equilibrium condition as:
 - $S^* = I^*$; or as
 - $Y^* - C^* - G^* = I^*$; or as
 - $(Y^* - T^* - C^*) + (T^* - G^*) = I^*$.

IV. NATIONAL SAVING AND THE REAL INTEREST RATE

The Supply of Saving

- Recall: Normal national saving (S^*) = $Y^* - C^* - G^*$.
- Y^* is determined by K^*/N^* , technology, and N^*/POP .
- We take G^* as given.
- So: To understand what determines S^* , we need to understand what determines C^* .

The Real Interest Rate and the Opportunity Cost of Current Consumption

- Think of a household trying to maximize its utility from consumption today and consumption in the future.
- If the real interest rate rises, the opportunity cost of consuming today rises: What you give up to consume today is higher because the real return you would earn on saving is higher than before.
- That is, the real interest rate is a component of the opportunity cost of current consumption.

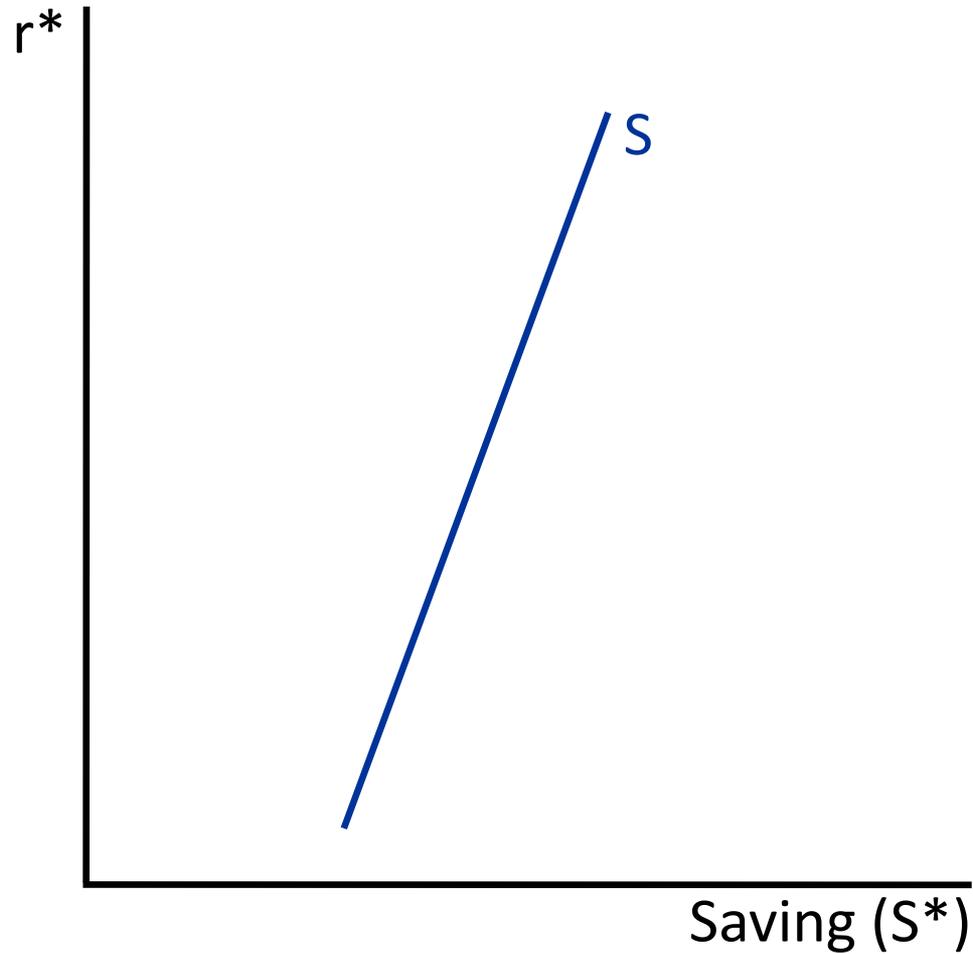
The Real Interest Rate and Saving

- The condition for utility maximization between consumption today and consumption in the future:

$$\frac{MU_{\text{current}}}{P_{\text{current}}} = \frac{MU_{\text{future}}}{P_{\text{future}}}$$

- If the real interest rate rises, the relative price (opportunity cost) of current consumption rises.
- To maximize utility, the household therefore needs to consume less today.
- That is, it needs to save more.

The Supply of Saving



Recall: $S^* = Y^* - C^* - G^*$

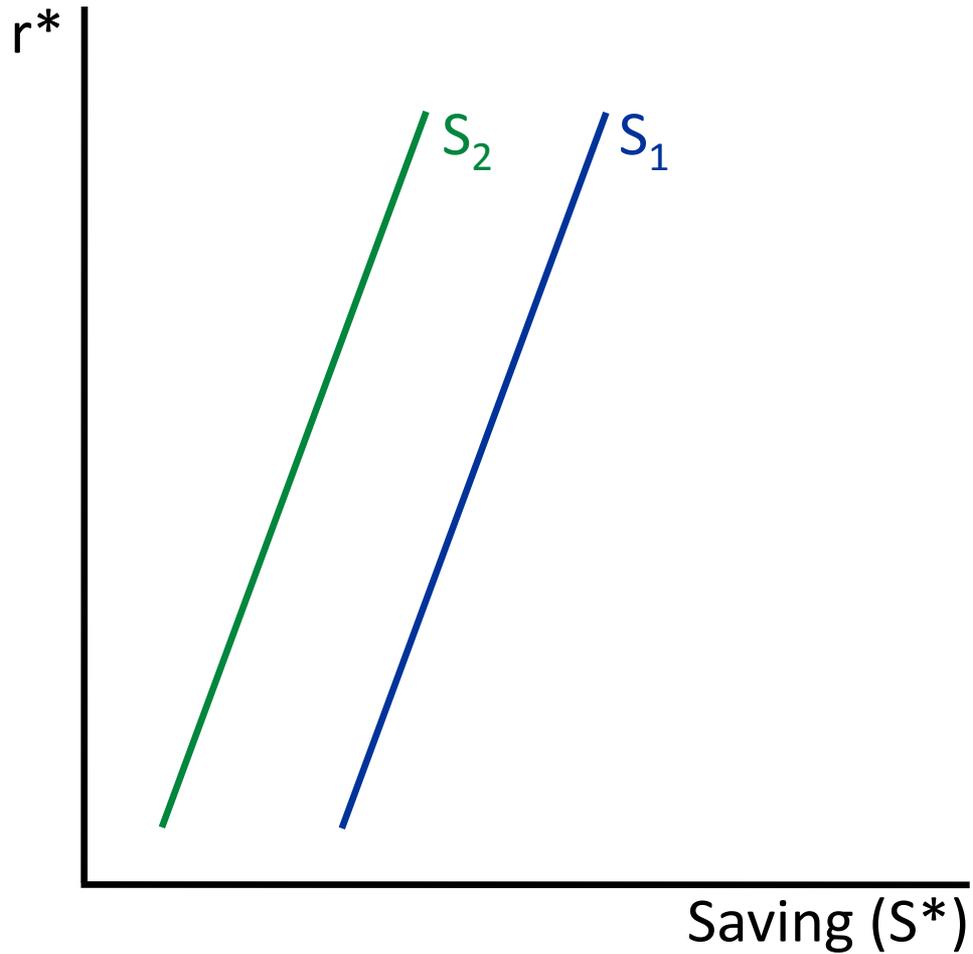
A Note on How We Model the Government

- Recall: We take G^* as given.
- This means that we assume it doesn't respond to other variables.
- So, for example, when we consider the effects of a change in T^* , we assume G^* doesn't change.
- Aside: This is just a specific example of *ceteris paribus* from early in the semester.

Private and Public Saving and a Tax Cut

- We assume that when $Y^* - T^*$ rises, C^* is higher at a given r , but by less than the amount of the rise in $Y^* - T^*$.
- Recall:
$$S^* = \underbrace{(Y^* - T^* - C^*)}_{\text{Private Saving}} + \underbrace{(T^* - G^*)}_{\text{Public Saving}}$$
- Suppose there is a tax cut. At a given r :
 - $T^* - G^*$ falls by the full amount of the tax cut.
 - $Y^* - T^* - C^*$ rises, but by less than the amount of the tax cut (because C^* rises).
 - So S^* falls at a given r .

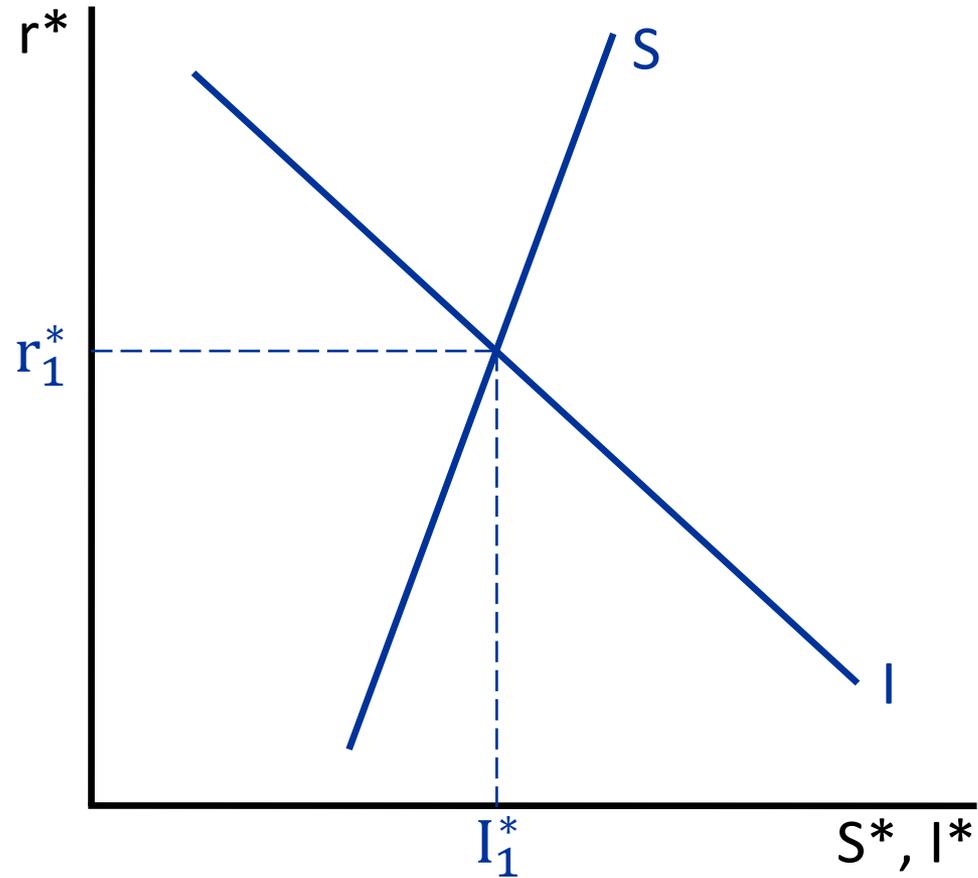
Example: A Tax Cut



Recall: $S^* = Y^* - C^* - G^*$

V. THE DETERMINANTS OF INVESTMENT AND THE REAL INTEREST RATE IN THE LONG RUN

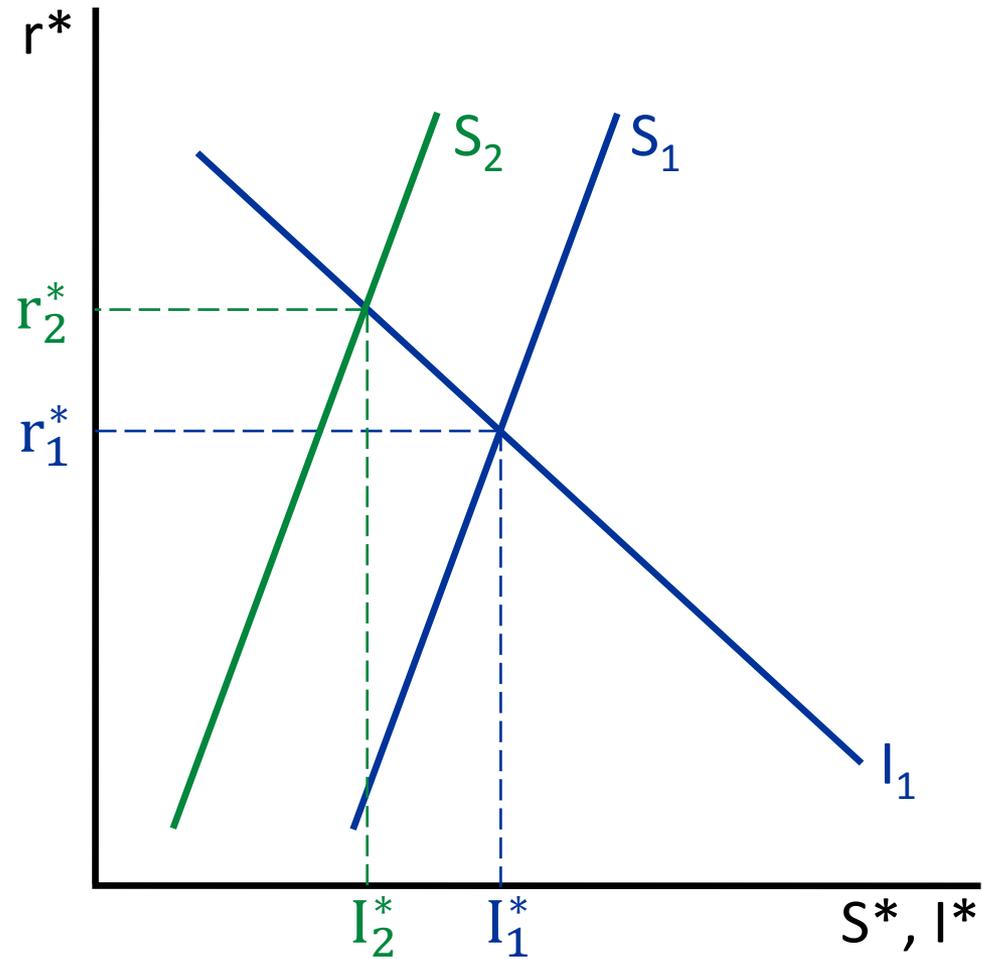
The Long-Run Saving and Investment Diagram



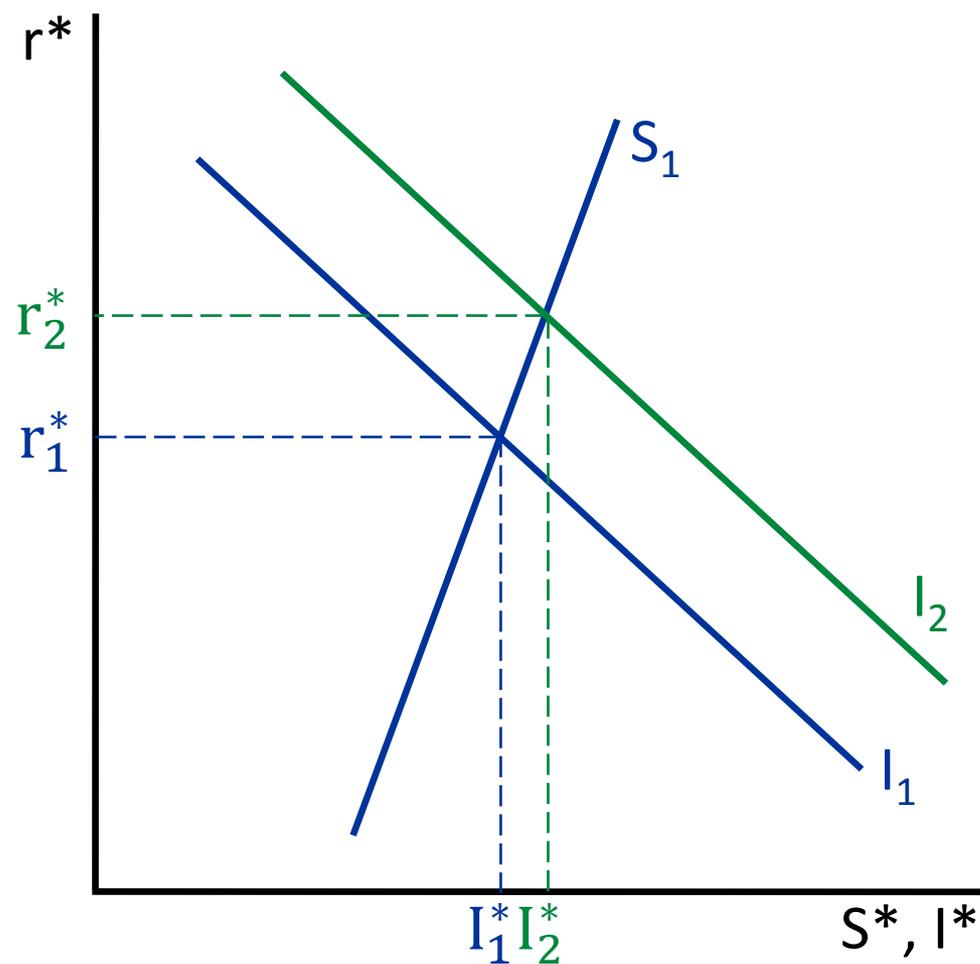
Recent U.S. Fiscal Developments

- Since last June, the projected deficit for fiscal year 2019 has risen from \$700 billion (3% of GDP) to \$1.2 trillion (6% of GDP).
- The change is entirely the result of changes in policy, not in the health of the economy: roughly \$300 billion from the tax bill, and roughly \$200 billion from the budget agreement.
- Most observers think that output is currently close to potential ($Y \approx Y^*$).

A Tax Cut and “Crowding Out”



A New Technology That Raises Future MRP_K 's



VI. STOCK PRICES

Physical Capital versus Financial Capital

- **Physical capital** refers to aids to the production process that were made in the past: machines, buildings, trucks, computers.
- **Financial capital** refers to the funds used to purchase, rent or build physical capital.

Two Ways to Raise Financial Capital

- **Issue bonds:** borrow funds in return for a promise to repay later with interest.
- **Issue stocks:** sell people a share of the company. In return, they are entitled to a share of future profits (that is what a dividend is).

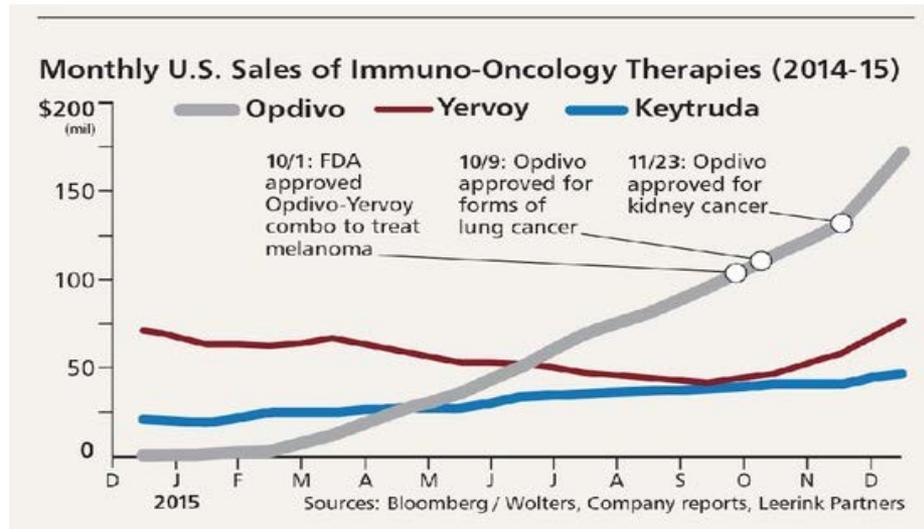
What should someone be willing to pay for a
stock?

Stock price =
PV(Stream of Expected Future Dividends)

What moves stock prices?

- A change in the interest rate.
 - Lower interest rates, all else equal, are likely to be associated with higher stock prices.
- A change in expected future dividends.
 - If something makes people expect higher future dividends, that should be associated with a higher stock price.
 - The higher expected dividends could apply to a particular firm or to firms in general.

Bristol Myers Squibb Stock Price and Drug Approval



Source: Barron's and CNN Money.

Facebook Stock Price and News of Privacy Breach

Market summary > Facebook, Inc. Common Stock
NASDAQ: FB - Mar 19, 7:59 PM EDT



172.56 USD **↓12.53 (6.77%)**

After-hours: 170.00 **↑1.48%**

1 day

5 day

1 month

3 month

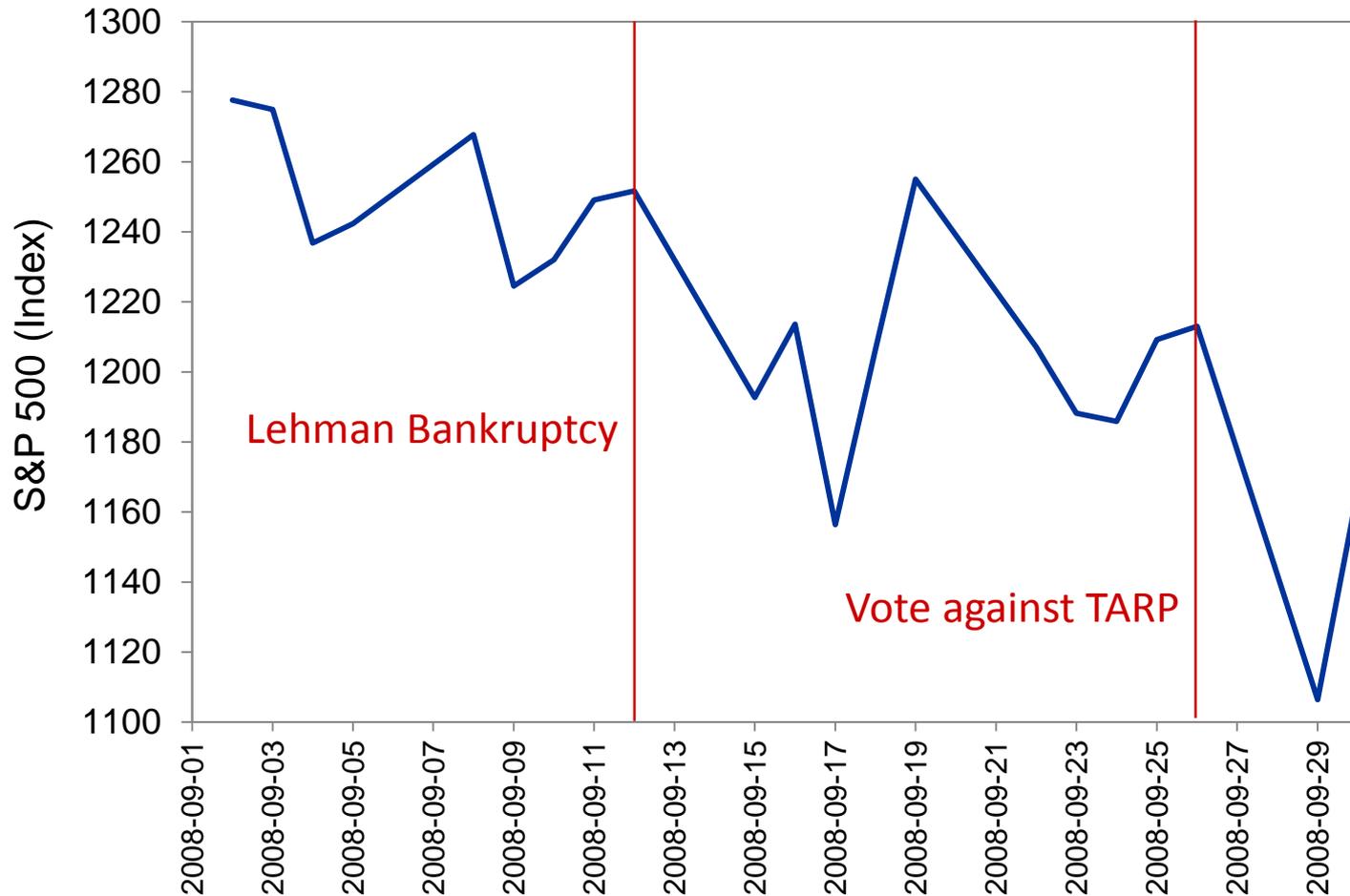
1 year

5 year

max



S&P 500 and News about the Financial Crisis



Source: FRED, Federal Reserve Bank of St. Louis.

Recent Overall Stock Price Movements



Source: FRED.

Efficient Markets Hypothesis

- It is difficult to make money off news in the stock market because information is processed very quickly.

Three Types of Risk

- Idiosyncratic (or diversifiable) risk:
 - Risk that is unrelated to the overall behavior of the economy.
- Systematic (or nondiversifiable) risk:
 - Risk that is correlated with the overall behavior of the economy.
- Asymmetric-information risk:
 - Risk arising from one party having information that the other doesn't.
 - Asymmetric-information risk may be affected by the nature of the contract.