ECON 010 – Principles of Macroeconomics
Drake University, Fall 2024
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BOAL'S ECON 010

SLIDESHOW HANDOUTS

FALL 2024

PART 1

Competitive
Supply and Demand

Big ideas: People and countries can benefit from trade, even if they are capable of producing every product they need. When they trade with money in competitive markets, we can predict the outcome if we know their demand and supply curves.

Famous quote: "That [the principle of comparative advantage] is not trivial is attested by the thousands of important intelligent men who have never been able to grasp the doctrine for themselves or to believe it after it was explained to them."
--Paul Samuelson, "The Way of an Economist" (1969) [Nobel Prize 1970]

Another famous quote: "We might as reasonably dispute whether it is the upper or the under blade of a pair of scissors that cuts a piece of paper, as whether the [price] is governed by utility [to demanders] or cost of production [to suppliers]." [The price is governed by *both*!]
--Alfred Marshall, *Principles of Economics* (1898)

WELCOME TO "PRINCIPLES OF MACROECONOMICS"
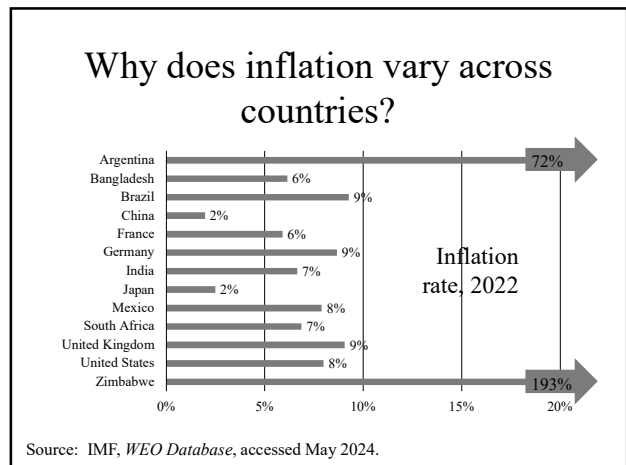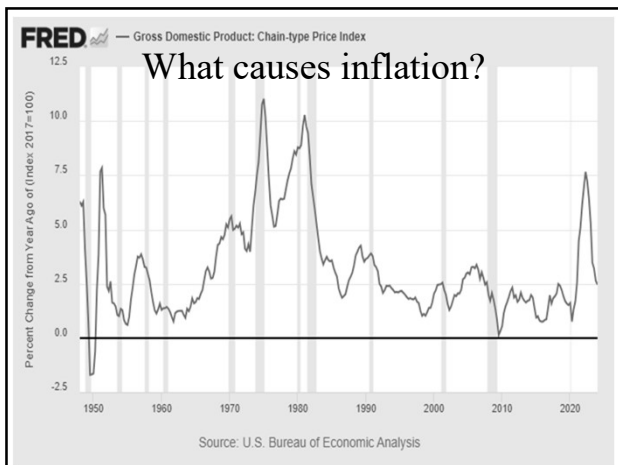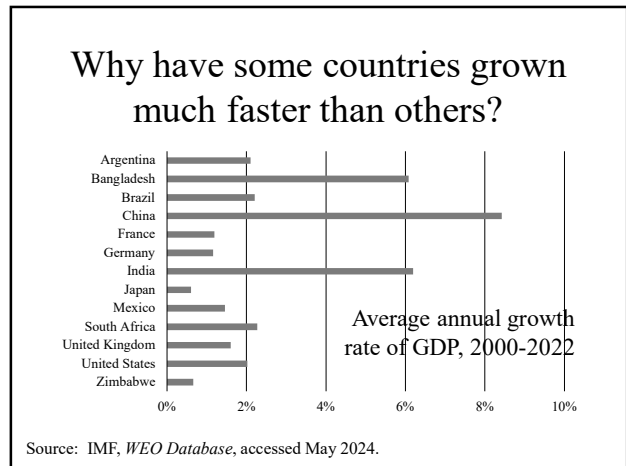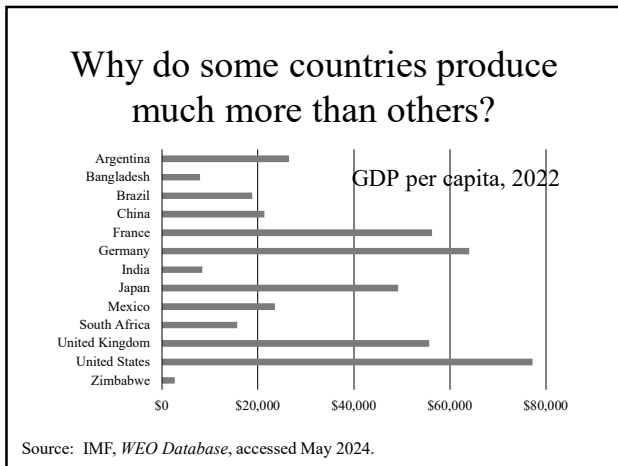## Page 1

WELCOME TO "PRINCIPLES OF MACROECONOMICS"

- What kinds of questions are investigated in this course?

How are people's productive activities coordinated?

- We rely on a huge number of people to grow food we eat, to produce goods we buy, to provide services we use, etc.
- Since no one is in charge, how are the activities of so many people coordinated?

Why do some countries produce much more than others?

GDP per capita, 2022

Source: IMF, *WEO Database*, accessed May 2024.

Why have some countries grown much faster than others?

Average annual growth rate of GDP, 2000-2022

Source: IMF, *WEO Database*, accessed May 2024.

What causes inflation?

Why does inflation vary across countries?

Inflation rate, 2022

Source: IMF, *WEO Database*, accessed May 2024.

WELCOME TO "PRINCIPLES OF MACROECONOMICS"
Page 2

What causes recessions and depressions?

25%

20%

15%

U.S. civilian
unemployment rate

10%

5%

0%

1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020

Sources: FRED; *Hist. Stat. of the U.S.*, 1975, Series D-86.

Conclusions

- "Principles of Macroeconomics" investigates how the economy works.
- Emphasis is on _____ picture: ups and downs of the economy as a whole.
- But to understand the big picture, we begin by examining individual players in the economy, and how their activities are coordinated in _____.

THE ECONOMIC APPROACH TO HUMAN BEHAVIOR
Page 1

THE ECONOMIC APPROACH TO HUMAN BEHAVIOR

- What basic assumption distinguishes economics from other social sciences?
- What are the implications of that assumption?

Rational behavior

- Economists usually assume that people behave "rationally." This means:
- *People do the* _____

  _____.

Rational behavior does not mean people are all alike

- People do the best they can, based on their *own* preferences and information, under the circumstances *they* face.
- People have different preferences, different information, and most importantly, different _____.

Behavior is affected by preferences and information

- Some people like vanilla. Other people like chocolate. Their _____ are different from each other.
- 70 years ago, many more people smoked cigarettes. Their _____ was different from people today.

Most importantly, behavior is affected by circumstances

- "Circumstances" means resources and tradeoffs.
- Resources include
  - _____
  - _____
- But resources only go so far.

Scarcity leads to tradeoffs

- If you do not have enough money to buy everything, you face a problem of

  _____.
- If you do not have enough time to do everything, you face a problem of

  _____.
- Choices must be made.

THE ECONOMIC APPROACH TO HUMAN BEHAVIOR
Page 2

Tradeoffs are measured by opportunity cost

- If your income is scarce (limited) then buying one thing means _____ buying another.
- If your time is scarce (limited) then doing one thing means _____ doing another.
- *Opportunity cost* = next best alternative that must be foregone when a choice is made.

Opportunity cost examples

- Suppose you have time to study or work out at the gym. Then the _____ of studying is that you miss a workout.
- Suppose the local government has enough money to build a playground or fix a street. Then the _____ of fixing the street is not having the playground.

Choosing *whether* to do something

- Rational behavior requires comparing the benefits and opportunity costs of any action.
- People choose to buy a car, or take a job, or go on a vacation if its total benefit _____ its total cost (including opportunity cost).

Example: *whether* to buy a car or not?
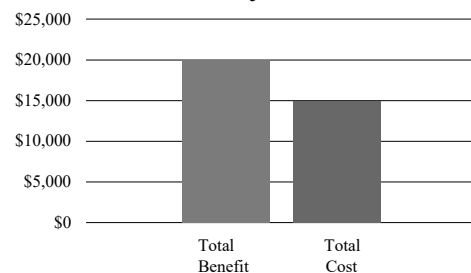
Choosing *how much* to do something

- Rational behavior requires comparing the opportunity cost of the _____ unit (the "marginal cost") with the benefit of the _____ unit (the "marginal benefit").
- People buy ice cream, go to the movies, play video games until the marginal cost of the last unit _____ the marginal benefit of the last unit.
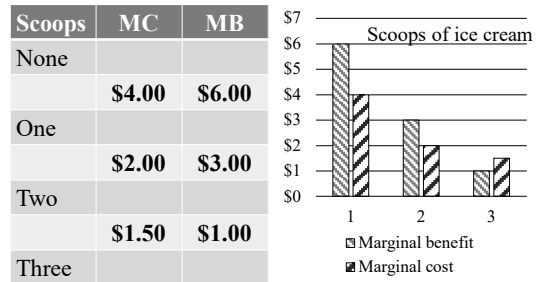
Example: marginal cost of ice cream

Scoops	Total cost	Marginal cost per scoop
No ice cream	$0.00	
One scoop	$4.00	
Two scoops	$6.00	
Three scoops	$7.50	

THE ECONOMIC APPROACH TO HUMAN BEHAVIOR
Page 3

Example: marginal benefit of ice cream

Scoops	Total benefit (willing to pay)	Marginal benefit per scoop
No ice cream	$0.00	
One scoop	$6.00	
Two scoops	$9.00	
Three scoops	$10.00	

Example: *how much* ice cream?

Scoops	MC	MB
None		
	$4.00	$6.00
One		
	$2.00	$3.00
Two		
	$1.50	$1.00
Three		

Scoops of ice cream

$7
$6
$5
$4
$3
$2
$1
$0

1   2   3

□ Marginal benefit
▨ Marginal cost

Incentives

- If costs or benefits change, then people often make new choices.
- If the ice cream shop raises prices, you might choose only 1 scoop instead of 2.
- If a job pays more, you might be more likely to take it.
- *Incentives* = changes in costs and benefits that influence _____.

Interaction

- One person's choice can affect other people's incentives.
- If Apple adds more features to its iPhone, that can create an incentive for Samsung to add features to its phone.
- If McDonalds cuts the price of its burger, that can create an incentive for Burger King to cut its price.

Equilibrium

- Where will it all end?
- *Equilibrium* = situation where no one has any incentive to change further.
- If neither McDonalds nor Burger King want to change their prices, then they are in _____.

Conclusions

- Economists assume people are _____: they do the best they can with what they have.
- They do things up to the point where _____ cost begins to exceed _____ benefit.
- One person's choices can change other people's *incentives*.
- _____ is reached when no one has any incentive to change further.

ECONOMICS AS A SCIENCE
Page 1

ECONOMICS AS A SCIENCE

- How is economics similar to natural science?
- What is the difference between micro- and macro-economics?

Is economics a science?

- In both economics and natural science, one must distinguish *positive* and *normative* statements.
- Both economics and natural science advance by developing *models* and gathering *evidence*.

What is a positive statement?

- *Positive statement* = statement of fact, of how the world works.
- Often contains words like _____ .
- Can be true or false, depending on logic and evidence.

Examples of positive statements

Economics
- "Prices _____ lower in competitive markets than in monopolistic markets."
- "Free international trade _____ help producers in some industries and hurt producers in other industries."

Other sciences
- "Without changes in policy, global temperatures _____ rise about 2 degrees."
- "If people are not vaccinated, a flu pandemic _____ cost many lives.

What is a normative statement?

- *Normative statement* = value judgment or policy prescription.
- Often contains words like _____ .
- Can be true or false, depending partly on a person's values and priorities.

Examples of normative statements

Economics
- "The government _____ promote competition and break up monopolies."
- "All countries _____ to encourage free international trade."

Other sciences
- "Energy taxes and incentives _____ be changed to slow global warming."
- "The government _____ to distribute flu vaccines for free."

ECONOMICS AS A SCIENCE
Page 2

Contrast

- Positive statement: "Taxes tend to slow economic growth and equalize income."
- Normative statement: "Taxes should be _____."
- Whether you say "raised" or "lowered" depends partly on your _____.

Economic science versus economic policy

- Economic science consists of _____ statements.
- Economic policy formulation consists of _____ statements, but is rooted in economic science.

Models and evidence

- Economic science studies the economy two ways:
  - Develops _____ = logical descriptions that match the real world approximately.
  - Gathers _____ = information that shows how closely models fit the facts.
- Good models fit the available evidence well, and can help predict the future.

Representing models

- To be useful and understandable, models must be _____ of reality.
- Models can be represented using
  - words.
  - numerical tables (or "schedules").
  - graphs.
  - equations.

Example: A model of expenditures for housing

- "People spend 25% of their income on housing."

Income	Housing Exp.
$ 20,000	$
$ 60,000	$
$100,000	$

Housing expenditures (vertical axis)
Income (horizontal axis)
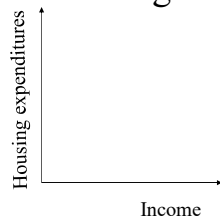
$H = \underline{\quad} \times I$

Branches of economics: <u>micro</u>economics

- Studies how prices and quantities of particular goods and services are determined in _____.
- Dates from Adam Smith (1776).
- Many key ideas developed by late 19th century.

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ECONOMICS AS A SCIENCE
Page 3

Branches of economics: <u>macro</u>economics

- Studies how the _____ price level and _____ output of goods and services are determined in an entire country or the world as a whole.
- Dates from J.M. Keynes (1936).
- Recently has been growing closer to microeconomics, emphasizing rational behavior.

Conclusions

- In economics and other fields, one must distinguish between *positive* ("is") and *normative* ("ought") statements.
- Economic science (_____ economics) develops models and gathers evidence.
- _____ economics studies particular markets while _____ economics studies the economy as a whole.

MATH REVIEW: BASIC CONCEPTS AND SKILLS
Page 1

MATH REVIEW: BASIC CONCEPTS AND SKILLS

- Economics is a quantitative subject.
- What basic quantitative concepts and skills are important?

No scary math requirements!

- All you need to know you probably learned by tenth grade.

Priority order of mathematical operation

(1) Anything in Parentheses.

(2) Exponents.

(3) Multiplication (x, dot, * or nothing) and Division (÷ or /).

(4) Addition and Subtraction.

(5) Left to right.

Priority order: examples

$1 + 2 * 3 = $ _____

$2 \times 3^2 \quad = $ _____

$7 - 3 + 2 = $ _____

Rounding

- How to round a number to n significant digits, ignoring leading zeros:
  - Look at the (n+1)st digit.
  - If it is 5 or larger, round up, raising the nth digit by one.
  - If it is 4 or smaller, round down, leaving the nth digit as is.

Rounding: examples

- Round 3.1415927 to four significant digits.
- Answer: _____
- Round $5/11 = 0.454545454545...$ to 2 significant digits.
- Answer: _____

MATH REVIEW: BASIC CONCEPTS AND SKILLS
Page 2

Caution about rounding

- Often an answer requires a sequence of calculations.
- Rounding errors can grow with each step, so avoid rounding intermediate answers!
- Instead, _____ intermediate answers in your calculator's memory.
- Round only _____ the last calculation.

Caution about rounding: example

Suppose we must evaluate $\frac{100}{\frac{1}{3}-\frac{1}{4}}$.

- Nearest tenth: $\frac{100}{\frac{1}{3}-\frac{1}{4}} \approx \frac{100}{0.3-0.3} =$
- Nearest hundredth: $\frac{100}{\frac{1}{3}-\frac{1}{4}} \approx \frac{100}{0.33-0.25} =$
- Nearest thousandth: $\frac{100}{\frac{1}{3}-\frac{1}{4}} \approx \frac{100}{0.333-0.250} =$

Caution about rounding: example (cont'd)

- Correct answer: $\frac{100}{\frac{1}{3}-\frac{1}{4}} =$ _____ .
- Moral: don't round intermediate calculations!
- Round only after last calculation!

Caution about rounding: example (cont'd)

- Correct answer: $\frac{100}{\frac{1}{3}-\frac{1}{4}} =$ ___1200___ .
- Moral: don't round intermediate calculations!
- Round only after last calculation!

Positive and negative relationships between variables

- *Positive relationship:* when one variable rises or falls, the other variable moves in the _____ direction.
- *Negative relationship:* when one variable rises or falls, the other variable moves in the _____ direction.

Positive and negative relationships: examples

- Line A shows a _____ relation between X and Y: "Y is decreasing in X."
- Curve B shows a _____ relation between X and Y: "Y is increasing in X."
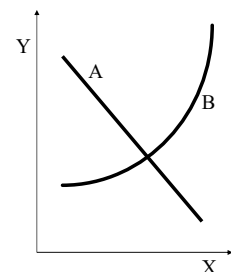
MATH REVIEW: BASIC CONCEPTS AND SKILLS
Page 3

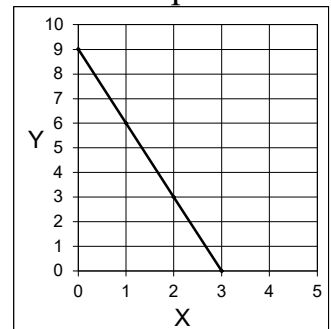### Slopes and intercepts from graphs of lines

- Intercepts shown by intersection with axes.
- Slopes calculated as *rise divided by run* ($\Delta Y / \Delta X$) over any interval.
- Downward-sloping line has _____ slope.
- Upward-sloping line has _____ slope.
- Size (absolute value) of slope shows steepness.

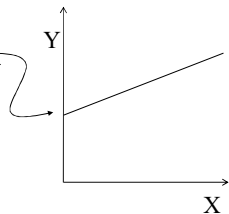### Slopes and intercepts from graphs of lines: example

X-intercept = _____

Y-intercept = _____

Slope = $\Delta Y/\Delta X$

= _____

Slopes and intercepts from equations of lines

- Slope-intercept form for a line: $Y = a + bX$
- Slope = _____
- Y-intercept = _____

Slopes and intercepts from equations of lines: examples
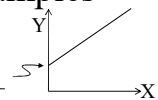
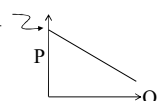- $Y = 3 + 2X$
  - slope = _____   Y-int = _____
- $Q = 5 - 3X$
  - slope = _____   Q-int = _____
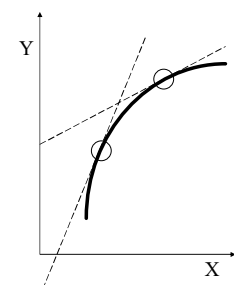- $P = 10 - 2Q$
  - slope = _____   P-int = _____
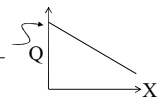
Practical meaning of slope

- Suppose line relating Y to X has slope $\Delta Y/\Delta X = 2$.
- Then if X increases by one unit ($\Delta X=1$), Y _____ units.
- If X increases by five units ($\Delta X=5$), Y _____ units.
- If X decreases by five units ($\Delta X=-5$), Y _____ units.

Slopes of curves

- At any point on the curve, slope = slope of tangent line.
- Curves can have changing slope.
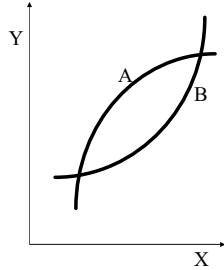- Slope can either increase or decrease.

MATH REVIEW: BASIC CONCEPTS AND SKILLS
Page 4

Slopes of curves: examples

- Curve A shows
  _____ slope.
- Curve B shows
  _____ slope.

Conclusions

- Math needed:
  - simple algebra and rounding.
  - positive and negative relationships.
  - slopes and intercepts.
  - increasing and decreasing _____.

MATH REVIEW: AVERAGES VERSUS MARGINS
Page 1

MATH REVIEW:
AVERAGES VERSUS MARGINS

- What is the difference between an
  average and a marginal value?

Deciding how much

- Many economic decisions take the form,
  "How much do I want?"
- To analyze these decisions, it is useful to
  calculate averages and marginal values.
- Average values are familiar to most people.
- But _____ values are usually
  more important for decision-making.

Average value: definition

- Average value
  = total value / number of units.
- Example: If you pay $2.00 for a set of 10
  pencils, average cost per pencil = $ _____.

Example: ice cream

Scoops	Total cost	Average cost per scoop
No ice cream	$0.00	
One scoop	$4.00	
Two scoops	$6.00	
Three scoops	$7.50	

Marginal value: definition

- Marginal value
  = change in value / change in number of units
  = Δ value / Δ quantity.
- Example: Suppose a pack of 10 pencils costs
  $2.00, and a pack of 15 pencils costs $2.75.
- Then the marginal cost per pencil, for last five
  pencils = ($2.75-$2.00) / (15-10) = $ _____

Example: ice cream

Scoops	Total cost	Avg cost per scoop	Marginal cost per scoop
No ice cream	$0.00	-	
One scoop	$4.00	$4.00	
Two scoops	$6.00	$3.00	
Three scoops	$7.50	$2.50	

MATH REVIEW: AVERAGES VERSUS MARGINS
Page 2

Example: ice cream

- Suppose you are deciding whether to buy two scoops or three scoops of ice cream.
- If you chose three scoops, the average cost per scoop = $ _____.
- The marginal cost of the third scoop
  = $ _____.
- How much are you paying for the third scoop?

Conclusions

- Average value
  = total value / number of units.
- Marginal value
  = _____ in value / _____ in number of units
  = Δ value / Δ quantity.
- The marginal cost of something is the additional amount you pay for the last unit.

MATH REVIEW: PERCENT CHANGES
Page 1

MATH REVIEW:
PERCENT CHANGES

- Percent changes are widely used in economics.
- What key concepts for percent changes are important?

Percent changes

- Suppose a variable X
  - has the initial value (or base) X_0 ,
  - then changes to the value X_1.
- Then
  - change in $X = \Delta X = X_1 - X_0$.
  - % change $= \Delta X / X_0 = (X_1 - X_0) / X_0$.

  = _____

Percent changes: example

- Suppose the population of a country is 80 million one year and 82 million the next year.
- Change in population = ΔPOP
  = _____ million.
- Percent change in population = $\Delta POP / POP_0$
  = 2/80 = _____ % .

Growing by a given percentage

- Suppose a country's total income is $2 trillion one year.
- If the country's income grows by 5% the next year, what is its new total income?
- Answer: $2 trillion × (1 + 5%)
  = $2 trillion × (1 + 0.05)
  = $_____ trillion.

Percent changes of products: approximation formula

- Suppose $Z = X \times Y$.
- Then % change in Z =
    % change in X *plus* % change in Y.
- Example: If X increases by 3% and Y increases by 2%, Z will ___crease by __%.
- Example: If X increases by 3% and Y decreases by 4%, then Z will ___crease by __%.

Percent changes of products: applications

- Suppose price increases by 3% and quantity decreases by 2%.
  Then revenue (= price times quantity) will _____ by _____ %.

- Suppose the number of firms decreases by 2% but the average number of employees at each firm increases by 5%.
  Then total employment will _____ by _____ %.

MATH REVIEW: PERCENT CHANGES
Page 2

Percent changes of ratios: approximation formula

- Suppose $Z = X / Y$.
- Then % change in Z =
  % change in X *minus* % change in Y.
- Example: If X increases by 3% and Y increases by 2%, Z will __crease by __%.
- Example: If X increases by 1% and Y increases by 4%, then Z will __crease by __%.

Percent changes of ratios: applications

- Suppose total income increases by 3% and population increases by 1%.
  Then income per capita will
  _____ by _____ %.

- Suppose total output increases by 4% but the number of firms increases by only 1%.
  Then average output per firm will
  _____ by _____ %.

Conclusions

- The percent change in a quantity equals the change divided by the base.
- The percent change in a product is roughly the _____ of the percent changes.
- The percent change in a ratio is roughly the _____ of the percent changes.

PRODUCTION FUNCTIONS
Page 1

PRODUCTION FUNCTIONS

- What do economists mean by "production"?
- What do they mean by "diminishing returns"?

What is production?

- *Production* = transformation of inputs (or resources) into outputs.
- Production takes place in factories, offices, households, etc.
- Kinds of outputs:
  - goods like _____.
  - services like _____.

Inputs (or resources) for production

- Labor = _____
- Capital = _____
  _____
- Land = _____
- Materials (or intermediate inputs) = goods produced elsewhere, and used up here to produce something else.

What is a production function?

- *Production function* = relationship between the quantity of inputs and the quantity of outputs.
- Can be represented by:
  - schedule or table.
  - math formula (e.g..: $output = \sqrt{input}$).
  - graph.

Simple example of production function

Hours worked	Bushels raked
1 hour	9 bushels
2 hours	16 bushels
3 hours	21 bushels
4 hours	24 bushels

- Graph is sometimes called _____ product curve.
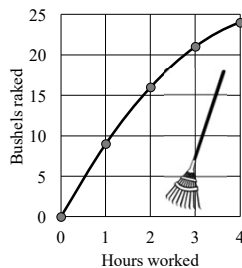
Average product

- *Average product* = output / input.
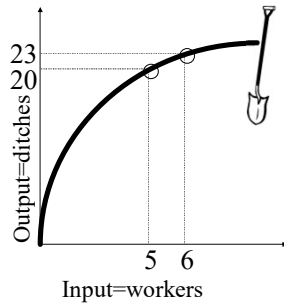- Example: If 5 workers together can dig 20 ditches per day, their AP = _____ ditches per worker.
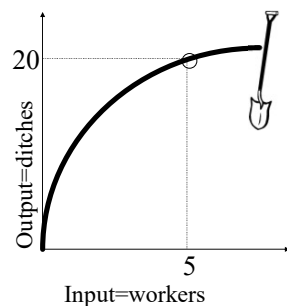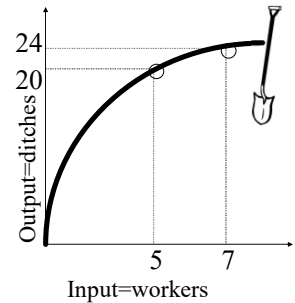

PRODUCTION FUNCTIONS
Page 2

Marginal product

- *Marginal product* = increase in output caused by the "last" unit of input.
- Example: Suppose adding 1 more worker raises output from 20 ditches to 23 ditches.
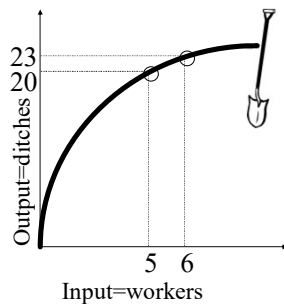- MP of 6th worker = __ ditches per worker.

(graph: Output=ditches on vertical axis with values 23, 20; Input=workers on horizontal axis with values 5, 6)

Marginal product = change in output / change in input

- MP = Δ output / Δ input.
- Example: Suppose going from 5 to 7 workers raises output from 20 to 24 ditches.
- MP in this range = _____.

(graph: Output=ditches on vertical axis with values 24, 20; Input=workers on horizontal axis with values 5, 7)

Marginal product = slope of production function

- MP = Δ output / Δ input = slope of secant.
- For very small changes in input, MP = slope of line tangent to production function.
- (Calculus: derivative.)

(graph: Output=ditches on vertical axis with values 23, 20; Input=workers on horizontal axis with values 5, 6)

Raking example (cont'd)

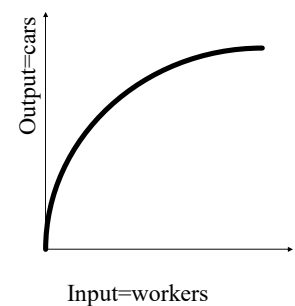| Hours worked	Bushels raked	AP	MP
0	0		
1	9		
2	16		
3	21		
4	24		

Diminishing returns to an input

- In many real-world production processes, additional units of input yield progressively smaller additional units of output.
- *Diminishing returns to an input* = situation where marginal product _____ as input increases.
- Implies graph of production function gets _____ steep as input increases.
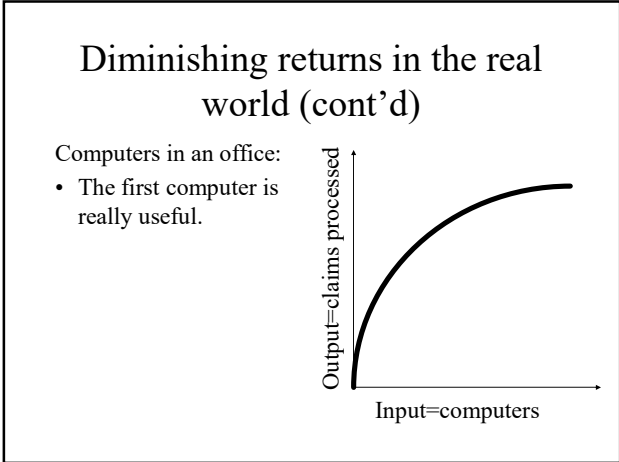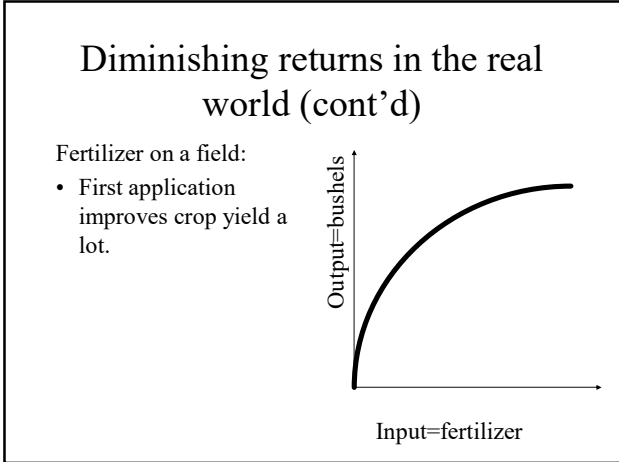
Diminishing returns in the real world

Workers on an assembly line:

- First few workers produce a lot of cars.

(graph: Output=cars on vertical axis; Input=workers on horizontal axis)

PRODUCTION FUNCTIONS
Page 3

Diminishing returns in the real world (cont'd)

Fertilizer on a field:
- First application improves crop yield a lot.

Output=bushels

Input=fertilizer

Diminishing returns in the real world (cont'd)

Computers in an office:
- The first computer is really useful.

Output=claims processed

Input=computers

Conclusions

- A production function shows a relationship between inputs and output.
- _____ = total output divided by total input.
- _____ = the contribution of the last unit of input to output.
  - usually declines as more units of the input are added: "_____."

PRODUCTION POSSIBILITIES
Page 1

PRODUCTION POSSIBILITIES

- Why is there a trade-off between different kinds of output?
- How does production relate to the concept of opportunity costs?

Production possibilities

- When the same inputs can be applied to producing different outputs, we have a whole range of *production possibilities* from which to choose.
- Real-world examples:

Tradeoffs

- With a fixed stock of available inputs, we face a *tradeoff* in how these inputs can be used.
- If we use all available inputs, then producing more of one kind of output requires producing less of another.
- Problem of *scarcity* arises.

PP curves

- Can express this tradeoff graphically as a "*production possibilities curve.*"
- Axes are different kinds of output.
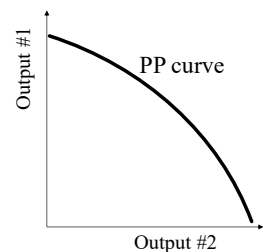
Example 1: raking v. mowing

- Suppose the same person
  - could alternatively mow lawns, at 2 lawns per hour (no diminishing returns).
  - has 4 hours of time available for work.
- Then: hours spent mowing = 4 - hours spent raking.
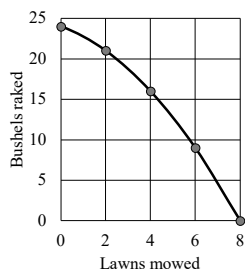

Example 1: raking v. mowing (cont'd)

Raking leaves		Mowing lawns	
Hours	Bushels	Hours	Lawns
0	0	4	
1	9	3	
2	16	2	
3	21	1	
4	24	0	

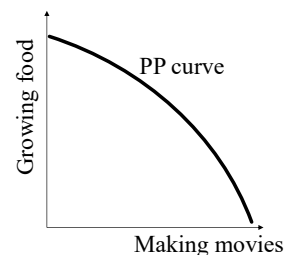## PRODUCTION POSSIBILITIES
Page 2

Example 1: graph of PP curve

- Where did this graph come from?
- Vertical axis is 2nd column on previous slide.
- Horizontal axis is 4th column on previous slide

Efficiency in production

- Points on graph represent combinations of outputs.
- Any point is either:
  - infeasible (impossible).
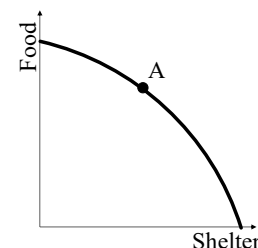 - technically efficient.
  - inefficient.

Opportunity cost

- *Opportunity cost of a good* = amount of something that must be given up in order to get something else.
- Usually expressed as a _____ number.

Example 2: Using slope of PP curve to compute opportunity cost

- Suppose we are given that the slope of a production possibility curve at efficient point A is -2:

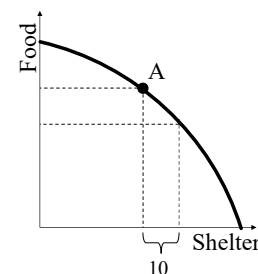$$\frac{\Delta \text{Food}}{\Delta \text{Shelter}} = -2$$

Example 2: Using slope of PP curve to compute opportunity cost (cont'd)

- Now suppose we wanted to increase production of shelter by 10 units.
- Clearly, we would have to _____ production of food, but by how much?
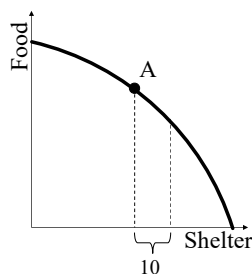
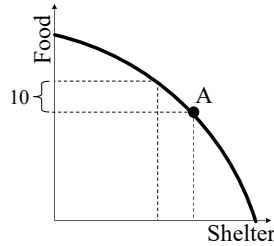### Example 2: Using slope of PP curve to compute opportunity cost (cont'd)

- Substitute ∆ Shelter = 10 into slope formula:

$$-2 = \frac{\Delta \text{Food}}{\Delta \text{Shelter}} = \frac{\Delta \text{Food}}{10}$$

- Solve to get ∆ Food = _____.
- Food production would have to decrease by _____ units.

PRODUCTION POSSIBILITIES
Page 3

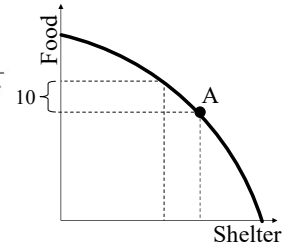### Example 2: Using slope of PP curve to compute opportunity cost (cont'd)

- Conversely suppose we wanted to increase production of food by 10 units.
- Clearly, we would have to _____ production of shelter, but by how much?

### Example 2: Using slope of PP curve to compute opportunity cost of food

- Substitute Δ Food = 10 into slope formula:
$$-2 = \frac{\Delta \text{Food}}{\Delta \text{Shelter}} = \frac{10}{\Delta \text{Shelter}}$$
- Solve to get Δ Shelter = _____.
- Shelter production would have to decrease by ___ units.

Example 3: opportunity cost of one more unit

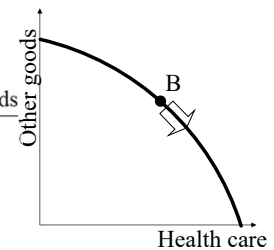$$\frac{\Delta \text{Other goods}}{\Delta \text{Health care}} = -5$$

- Suppose we are given slope of a production possibility curve at efficient point B is -5.
- What is opp. cost of one more unit of health care at point B?
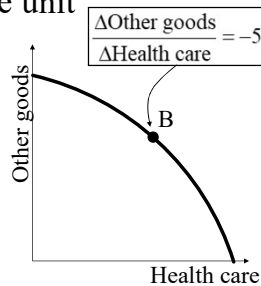
Example 3: opportunity cost of one more unit of health care
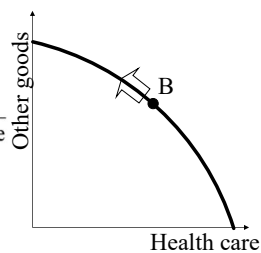
- Substitute Δ Health care = 1 into slope formula:
$$-5 = \frac{\Delta \text{Other goods}}{\Delta \text{Health care}} = \frac{\Delta \text{Other goods}}{1}$$
- Δ Other goods = _____
- So opp. cost of a unit of health care is _____ units other goods.

Example 3: opportunity cost of one more unit of other goods

- Substitute Δ Other goods = 1 into slope formula:
$$-5 = \frac{\Delta \text{Other goods}}{\Delta \text{Health care}} = \frac{1}{\Delta \text{Health care}}$$
- Δ Health care = _____.
- So opp. cost of a unit of other goods is _____ units health care.

Slope = opportunity cost of one more unit

- Thus, |slope| = opp. cost of one more unit of whatever good is on _____ axis.
- In this graph, |slope| of PP curve is opp. cost of one more unit of _____.
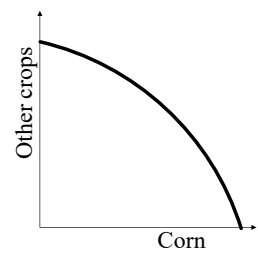
PRODUCTION POSSIBILITIES
Page 4

What does reciprocal of slope tell us?

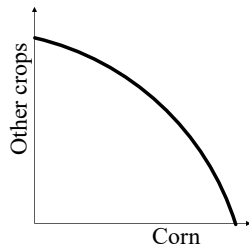- Conversely, |1/slope| = opp. cost of one more unit of whatever good is on _____ axis.
- In this graph, |1/slope| of PP curve is opp. cost of one more unit of _____.

Other crops / Corn

Decreasing |slope| implies decreasing opportunity cost

- If PP curve is "bowed in," opp. cost of one more unit is _____ as more is produced.
- There are gains from _____.
- Possible cause: setup costs.

Studying biology / PP curve / Studying history
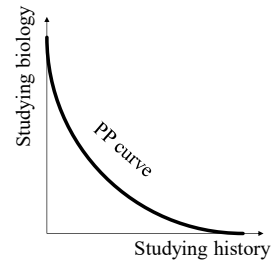
Increasing |slope| implies increasing opportunity cost

- If PP curve is "bowed out," opp. cost of one more unit is _____ as more is produced.
- There are gains from _____.
- Possible cause: special resources useful for only kind of output.


Food / PP curve / Health care
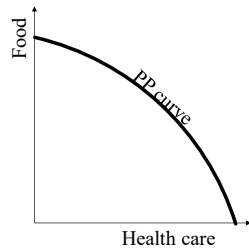
Increasing or decreasing opportunity costs in the real world?

- Decreasing opportunity costs are typical of an *individual person's* PP curve.
  - Example:
- Increasing opportunity costs are typical of a *region or nation's* PP curve.
  - Example:

Example 1: raking v. mowing again

- Does opportunity cost appear to increase or decrease in this example?

Bushels raked / Lawns mowed
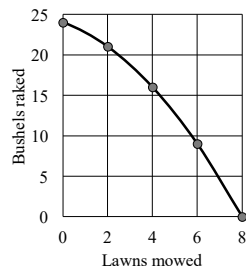
Computing opportunity cost per unit along intervals of PP curve

| Production possibility curve		Opportunity cost of…	
Bushels raked	Lawns mowed	…a bushel raked	…a lawn mowed
0 bushels	8 lawns		
9 bushels	6 lawns		
16 bushels	4 lawns		
21 bushels	2 lawns		
24 bushels	0 lawns		

PRODUCTION POSSIBILITIES
Page 5

Economic growth

- Economic growth occurs because either:
  - people learn how to produce more output with the same inputs (technological progress).
  - the stock of available inputs increases.

Economic growth and the PP curve

- With economic growth, the PP curve expands over time.
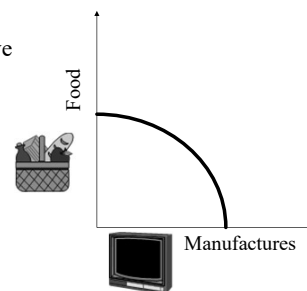
Capital accumulation and economic growth

- Growth in the future depends partly on choices made now.
- If more resources are devoted to producing capital goods (rather than consumption goods) growth will be faster.
  - Why? _____
    _____

Capital accumulation and economic growth

- In this diagram, which choice will cause faster economic growth?
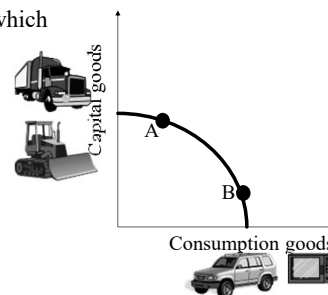
Conclusions

- When the same inputs can be used to produce different kinds of outputs, producible combinations of outputs can be graphed as a _____ *curve.*
- The opportunity cost of one more unit of the output on the horizontal axis is the _____ of the PP curve.
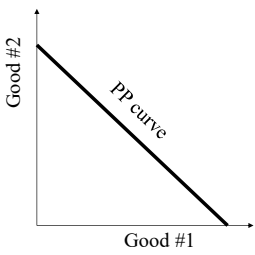- *Increasing opportunity cost* occurs if the PP curve is "bowed _____."

COMPARATIVE ADVANTAGE
Page 1

COMPARATIVE
ADVANTAGE

• When does one producer have a
comparative advantage over
another?

Opportunity cost (review)

• *Opportunity cost of a
good* = amount of
other good that must
be given up in order to
get one more unit of
the first good.
• = |slope| of PP curve
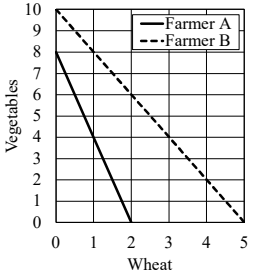with the first good on
the horizontal axis.

Comparative advantage:
definition

• Suppose two producers have *different*
opportunity costs.
  • Producers could be people, regions, countries,
  etc.
• The producer with the lower opportunity
cost is said to have a *comparative
advantage* in that particular good.

Example 1: Farmers A and B
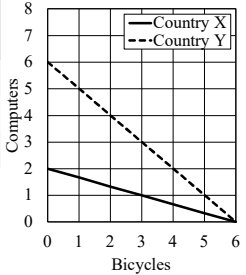
Opportunity cost of growing 1 unit of…		
	Wheat	Vegetables
A	units veg.	units wheat
B	units veg.	units wheat

Who has comparative
advantage in wheat? _____
Who has comparative
advantage in vegetables? _____

Example 2: Countries X and Y

Opportunity cost of making a…		
	Bicycle	Computer
X	computers	bicycles
Y	computers	bicycles

Who has comparative
advantage in bicycles? _____
Who has comparative
advantage in computers? _____

Absolute advantage versus
comparative advantage

• Farmer B can produce more wheat or more
vegetables than Farmer A.
• So Farmer B has an *absolute* advantage in
both crops.
• But Farmer B has a *comparative* advantage
in only one crop (_____).
• Farmer A has a comparative advantage in
the other (_____).

COMPARATIVE ADVANTAGE
Page 2

Absolute advantage versus comparative advantage

- Farmer B can produce more wheat or more vegetables than Farmer A.
- So Farmer B has an *absolute* advantage in both crops.
- But Farmer B has a *comparative* advantage in only one crop (_____wheat_____).
- Farmer A has a comparative advantage in the other (_____vegetables_____).

Absolute advantage versus comparative advantage (cont'd)

- Country Y can produce more computers or more bicycles than Country X.
- So Country Y has an *absolute* advantage in both goods.
- But Country Y has a *comparative* advantage in only one good (_____).
- Country X has a comparative advantage in the other (_____).

No one can have a comparative advantage in every activity: graphical proof
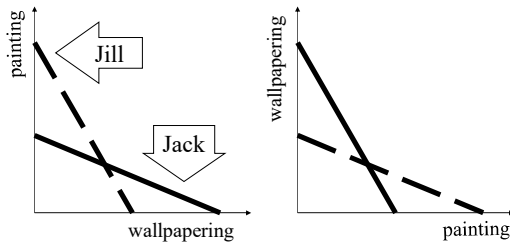
Jack has CA in wallpapering *implies*

Algebraic proof

$$\begin{array}{ccc} Jack's\ opp.cost & < & Jill's\ opp.cost \\ of\ wallpapering & & of\ wallpapering \end{array}$$

$$\left|\frac{\Delta\ walls\ painted}{\Delta\ walls\ papered}\right|_{Jack} < \left|\frac{\Delta\ walls\ painted}{\Delta\ walls\ papered}\right|_{Jill}$$

$$\left|\frac{\Delta\ walls\ papered}{\Delta\ walls\ painted}\right|_{Jack} > \left|\frac{\Delta\ walls\ papered}{\Delta\ walls\ painted}\right|_{Jill}$$

$$\begin{array}{ccc} Jack's\ opp.cost & > & Jill's\ opp.cost \\ of\ painting & & of\ painting \end{array}$$

Conclusions

- A producer has a _____ advantage over another producer in some activity if the first producer has lower opportunity cost.
- A producer (no matter how productive) can _____ have a comparative advantage in every activity.

GAINS FROM TRADE
Page 1

GAINS FROM TRADE

- Why are goods and services traded?
- When can both parties gain from trade?

Voluntary trade

- People trade goods and services voluntarily only if both parties expect to be better off as a result.
- Both parties must expect to enjoy *gains from trade.*

Why might gains from trade occur?

- Each party might have something that the other party wants more. Example:
- Each party might produce something that the other party wants more. Example:
- The two parties both produce both goods and desire the goods equally but they have *different opportunity costs.*
  - Focus of this presentation.

Produce or trade?

- *Key principle:* You should not produce a good for yourself if you can get it at lower cost by trading.
- Here, "lower cost" means lower opportunity cost.
- Trading allows you to get _____ your own production-possibility curve.

When does trading work?

- If two producers have _____ opportunity costs, then each will prefer to
  - specialize in producing the good in which it has a comparative advantage.
  - trade for the other good.
- Then _____ producers can get OUTSIDE their own production possibility curves.

Example 1 revisited

- Farmer A has comp. adv. in _____.
- Farmer B has comp. adv. in _____.
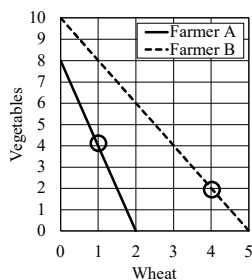- Suppose farmers produce circled quantities.
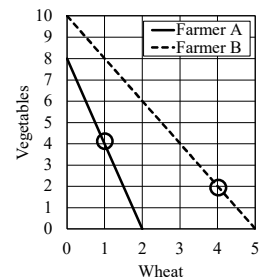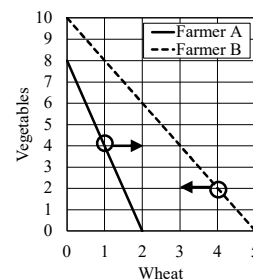
GAINS FROM TRADE
Page 2

Example 1: specialization

- Suppose Farmer B offers 1 unit of wheat to Farmer A.
- Can Farmer A give some vegetables in return, and BOTH farmers come out ahead?

Example 1: trade

- Farmer A comes out ahead if A gives B less than _____ units of vegetables.
- Farmer B comes out ahead if B receives more than _____ units of vegetables.

Example 1: BOTH are better off

- Both farmers come out ahead if Farmer A gives Farmer B between 2 and 4 units of vegetables.
- Example: Farmer A gives ____ units of vegetables.
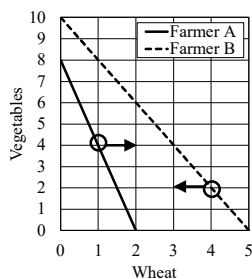
Example 2 revisited

- Country X has comp. adv. in _____.
- Country Y has comp. adv. in _____.
- Suppose countries produce circled quantities.
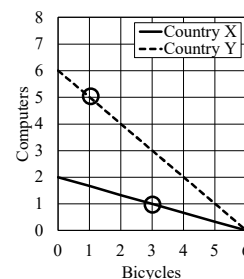
Example 2: specialization

- Suppose Country Y exports 1 computer to Country X.
- Can Country X export some bicycles back to Country Y, and BOTH countries come out ahead?
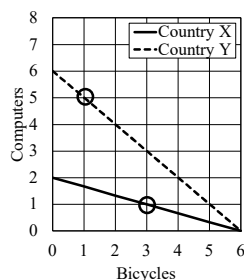
Example 2: trade

- Country X comes out ahead if X gives Y less than _____ bicycles.
- Country Y comes out ahead if Y receives more than _____ bicycle.
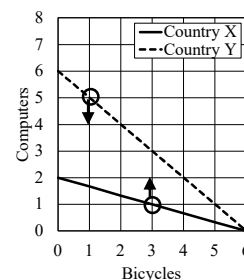
GAINS FROM TRADE
Page 3

Example 2: BOTH are better off

- Both countries come out ahead if Country X exports between 1 and 3 bicycles back to Country Y.
- Example: Country X exports _____ bicycles.
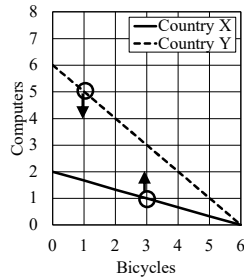
Conclusions

- Two producers with different opportunity costs can always _____ enjoy *gains from trade.*
- Each producer must
  - specialize in producing the good in which it has a _____ *advantage.*
  - trade that good for the other good.

INSTITUTIONS THAT SUPPORT TRADE
Page 1

INSTITUTIONS THAT SUPPORT TRADE

- Does trading happen automatically?
- What institutions help maximize the gains from trade?

Supporting trade

- Trade does not happen automatically.
- In some times and places, it is easier to _____ what you want.
  - (Or to get the government to take it from someone and give it to you!)
- In some times and places, it is very difficult to _____ someone to trade with.

Property rights

- *Property rights* = social arrangements governing ownership, use, and disposal of goods and services.
- Kinds of property:
  - _____ property
  - _____ property
  - _____ property

Why property rights matter

Without property rights,
- People can take possession of whatever they have the ability to obtain ("stealing" or "tribute").
- Resources are diverted from production into stealing and protecting property from being stolen.

Money

- Modes of trading:
  - barter
  - monetary exchange
- *Money* = a particular good that everyone agrees to accept as payment = *medium of exchange*.

Why money matters

- Disadvantage of barter: To obtain desired goods via barter requires either:
  - double coincidence of wants, or
  - (potentially long) sequence of transactions.
- Monetary exchange avoids these problems.

INSTITUTIONS THAT SUPPORT TRADE
Page 2

Markets

- *Market*s = institutions that link buyers and sellers, enabling them to get information and do business.
- In a well-functioning market:
  - anyone can trade with _____ else.
  - prices at which people are buying and selling are _____ to everyone.

The "law of one price"

- No buyer wants to pay _____ than necessary.
- No seller wants to be paid _____ than necessary.
- Therefore prices (for the exact same good) tend to *converge* to a single number.
- A market with substantial "price dispersion" is _____ functioning well.

Why markets matter

- Markets simplify the negotiations required for trade. All one needs to know is:
  - the going *price* of the good.
- Market participants decide whether to buy or sell by comparing their own opportunity cost with the price.
  - If opportunity cost > price, buy.
  - If opportunity cost < price, sell.

Two kinds of markets

Spending (or revenue)

Goods and services

Households

Firms

Inputs

Income
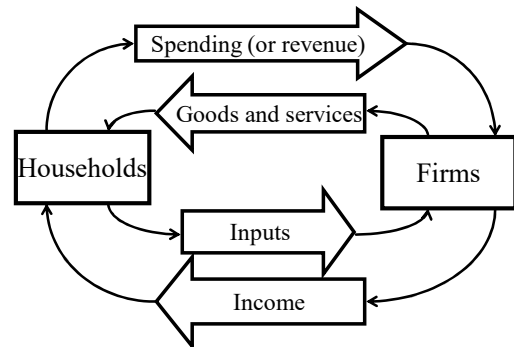
Conclusions

- _____*rights* facilitate trade and reduce the resources devoted to stealing or guarding against stealing.
- Trading is vastly simplified if everyone agrees to accept a particular good as payment. That good is called _____.
- A well-functioning *market* tends to follow the _____.

DEMAND
Page 1

DEMAND

- How do consumers respond to changes in a good's price?

Buying and selling

- When money is used, every trade involves a
  - _____, who gives up money in exchange for a good or service
  - _____, who gives up a good or service in exchange for money.

Response to price
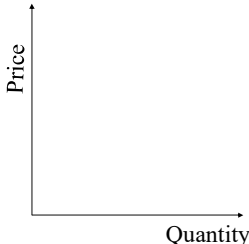
- If the market is functioning well, it will follow the law of _____.
- How will buyers and sellers respond to this price?

Demand relation (or demand curve)

- *Demand relation* = relation between the price of a good and the quantity that buyers wish to buy.
- Can be represented by:
  - schedule or table.
  - mathematical formula.
  - graph.

The "Law of Demand"

- Price and quantity demanded are negatively related, *ceteris paribus*.
- Ceteris paribus means " _____ _____."

Simple example of demand relation: demand for coconuts

Price	Quantity
$10	0
$9	100
$8	200
$7	300
$6	400
$5	500
$4	600
$3	700
$2	800
$1	900
$0	1000

DEMAND
Page 2

Reasons for Law of Demand

(1) Substitution effect: As price of one good rises, consumers substitute other goods that become relatively cheaper.
- Example: If price of beef rises, consumers switch to _____.
- Example: If price of orange juice rises, consumers switch to _____.

Reasons for Law of Demand

(2) Income effect: Even if no substitutes are available, a rise in price implies consumer cannot afford as much as before. Purchasing power of income falls, so buy less of everything, including this good.
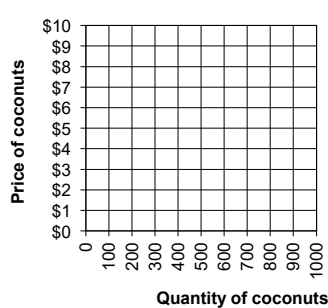- Example: If apartments rents go up, consumers cut back on everything, move to _____.

Other factors influencing the quantity demanded

- Prices of related goods.
- Income of consumers.
- Expected future prices of same good.
- Population and demographic structure.
- Product quality.
- Preferences.

Change in demand = shift in demand curve

- When these other factors change, we say there is a *change in demand*. The demand curve *shifts.*
- By contrast, when price of good itself changes, no change in demand and no shift in curve.
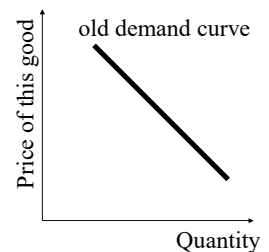
Effect of *prices of related goods* on quantity demanded

- Can be positive or negative.
- *Substitute* = good whose price has a _____ effect on quantity demanded of first good.
- *Complement* = good whose price has a _____ effect on quantity demanded of first good.

Hamburgers and hotdogs are _____

- If the price of hamburgers increases, people eat _____ hot dogs, even if the price of hot dogs does not change.

DEMAND
Page 3

Mustard and hotdogs are _____

- If the price of hot dogs increases, people eat _____ mustard, even if the price of mustard does not change.

Demand for mustard

Price of mustard

Quantity of mustard
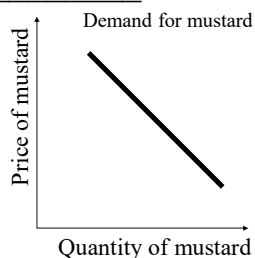
SUVs and gasoline are _____

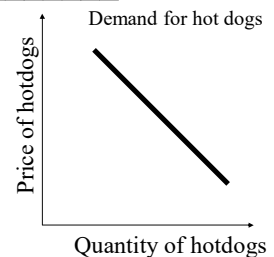- If the price of gasoline increases, people buy _____ SUVs, even if the price of SUVs does not change.

Demand for SUVs

Price of SUVs

Quantity of SUVs
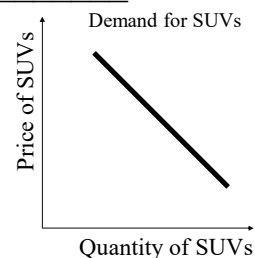
Effect of *income* on quantity demanded

- Can be positive or negative.
- *Normal good* = good whose demand _____ as income increases.
- *Inferior good* = good whose demand _____ as income increases.

Most goods are _____ goods

- As people's incomes rise, they buy _____ cars, appliances, clothing, food, energy, etc., even if the prices of those goods do not change.

Demand for cars

Price of cars

Quantity of cars
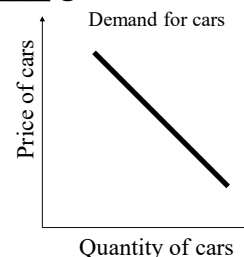
A few goods are _____ goods

- As people's incomes rise, they buy _____ bus rides, second-hand clothes, and macaroni-and-cheese dinners, even if the prices of those goods do not change.

Demand for bus rides

Price of bus rides

Quantity of bus rides
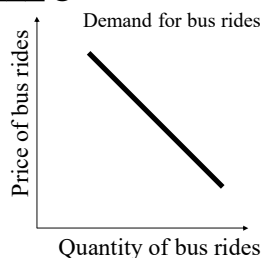
Effect of *expected future prices* on quantity demanded

- Have a positive effect on the quantity demanded.
- If prices are expected to fall, people buy less now.
- If prices are expected to rise, people buy more now.
- Examples: _____

DEMAND
Page 4

Effect of population and age structure

- Population size has a positive effect.
  - Examples: _____
- Effect of age structure differs across goods.
  - Examples: _____

Effect of other variables on quantity demanded

- Quality has positive effect (in general).
  - Examples: _____
- Preferences and tastes affect quantity demanded.
  - Examples: _____

Conclusions

- The *Law of Demand* states that price and the quantity demanded by consumers are _____ related, *ceteris paribus.*
- It holds because any price change has a _____ *effect* and an _____ *effect*.
- Other things can change the quantity demanded, shifting the *demand curve*, including the _____ of related goods and the _____ of consumers.

SUPPLY
Page 1

SUPPLY

- How do producers respond to changes in a good's price?

Supply relation (or supply curve)

- *Supply relation* = relation between the price of a good and the quantity that sellers wish to sell.
- Can be represented by:
  - schedule or table.
  - mathematical formula.
  - graph.

The "Law of Supply"

- Price and quantity supplied are positively related, *ceteris paribus.*
- Ceteris paribus means " _____ _____."

Price

Quantity

Simple example of supply relation: supply of coconuts

Price	Quantity
$1	0
$2	200
$3	400
$4	600
$5	800
$6	1000
$7	1200

Price of coconuts

$10 $9 $8 $7 $6 $5 $4 $3 $2 $1 $0

0 100 200 300 400 500 600 700 800 900 1000

Quantity of coconuts

Reasons for Law of Supply

- Increasing opportunity cost generates the law of supply.
  - As more of the good is produced, the cost of producing an additional unit usually _____.
  - A _____ price must be offered to induce suppliers to sell more.

### Other factors influencing the quantity supplied

- Prices of inputs.
- Technology.
- Government regulations.
- Expected future prices of same good.
- Number of suppliers.

SUPPLY
Page 2

Change in supply = shift in supply curve

- When these other factors change, we say there is a *change in supply*. The supply curve *shifts*.
- By contrast, when price of good itself changes, no change in supply and no shift in curve.

Price of this good | old supply curve
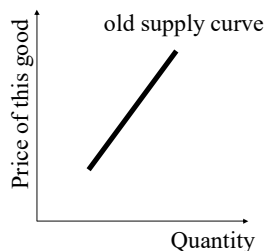
Quantity

Effect of *prices of inputs* on quantity supplied

- Have a negative effect on quantity supplied.
- Reason: Because an increase in input prices increases the cost of producing the good.

Example: increase in wages of fast-food workers shifts supply of fast food to the _____

- Fast-food workers are an input to making fast food.

Price of fast food | Supply of fast food

Quantity of fast food
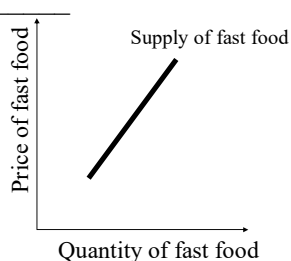
Example: decrease in price of petroleum shifts supply of gasoline to the _____

- Petroleum is an input to making gasoline.

Price of gasoline | Supply of gasoline

Quantity of gasoline
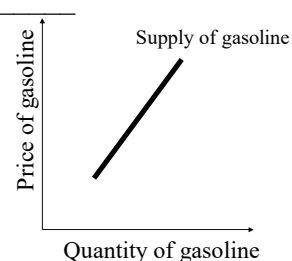
Effect of *technology* on quantity supplied

- New production technology has a positive effect on quantity supplied.
- Reason: Improved production methods _____ the cost of production, by allowing producers to do more with less.
- Examples:

Example: development of "lean" production methods shifts supply of manufactured goods to the _____

- "Lean" production methods use fewer workers, less factory space, and less energy.

Price of manufactures | Supply

Quantity of manufactures
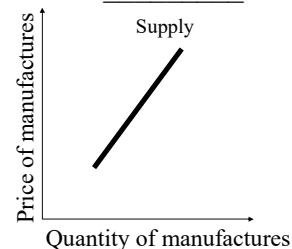
SUPPLY
Page 3

Effect of *government regulations* on quantity supplied

- Have a negative effect on quantity supplied to the extent that they increase the cost of production.
- Most government regulations *do* increase the cost of production—otherwise they would be adopted voluntarily!

Example: environmental regulations shift supply of electricity to the _____

- Environmental regulations require electricity generators to put "scrubbers" on smokestacks.
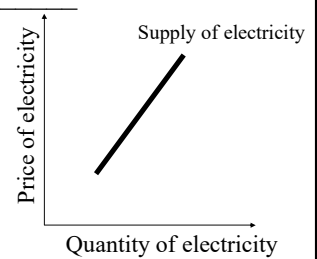
Effect of *expected future prices* on quantity supplied

- Have a negative effect on the quantity supplied.
  - If prices are expected to fall in the future, suppliers sell _____ now.
  - If prices are expected to rise in the future, suppliers sell _____ now.
- Examples:

Effect of *number of producers* on quantity supplied

- Has a positive effect on the quantity supplied.
- Reason: With more producers, output is greater.

Conclusions

- The *Law of Supply* states that price and the quantity supplied are _____ related, all other things held constant.
- It holds because as more of a good is produced, the cost of producing an additional unit usually _____.
- Other things can change the quantity supplied, shifting the *supply curve*, including the prices of inputs and the available production _____.
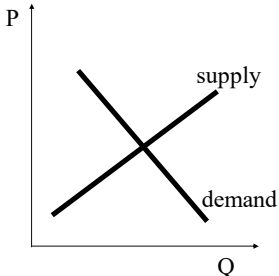
MARKET EQUILIBRIUM
Page 1

MARKET EQUILIBRIUM

- What determines market price and quantity?

Demand and supply together

- Demanders and suppliers simultaneously make decisions about how much they want to buy or sell, in response to the market price.
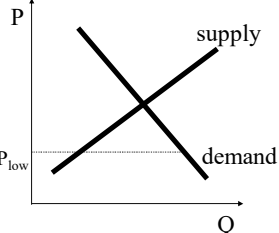
What if quantity demanded does not equal quantity supplied?

- Let:
  Q_D = quantity demanded.
  Q_S = quantity supplied.
- At any given price, Q_D might not equal Q_S.
- But in that case, price will tend to
  _____.
  - Not an equilibrium!

Excess demand = shortage
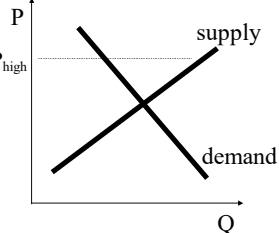
- At low prices, $Q_D > Q_S$.
- "Excess demand" or shortage.
- Some consumers are excluded.
- Excluded consumers *bid up* the price.
- Price tends to _____.

Example 1: market for coconuts
If price = $2, excess _____ = _____ units.
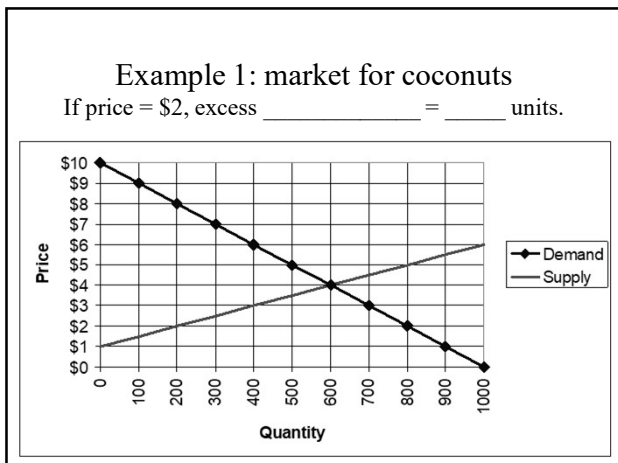
Excess supply = surplus

- At high prices, $Q_D < Q_S$.
- "Excess supply" or surplus.
- Some producers are excluded.
- Excluded producers *cut* the price.
- Price tends to _____.

MARKET EQUILIBRIUM
Page 2

Example 1: market for coconuts

If price = $5, excess _____ = _____ units.

Market equilibrium

- The only stable price is where demand and supply curves intersect:
- P* = equilibrium price
- Q* = equilibrium quantity.

Revenue = spending

- Revenue to sellers
  = spending by buyers
  = P* × Q*
  = area of rectangle

Example 1: market equilibrium
P*= ____, Q*= _____ , Revenue= _____.
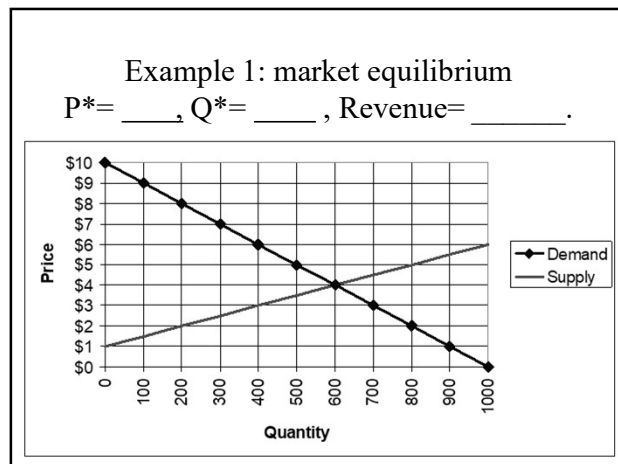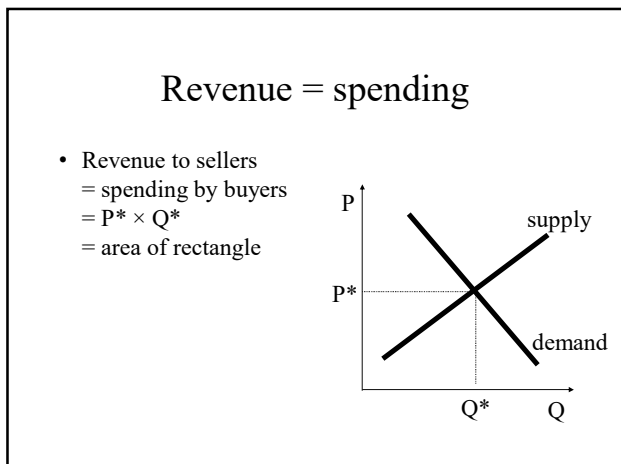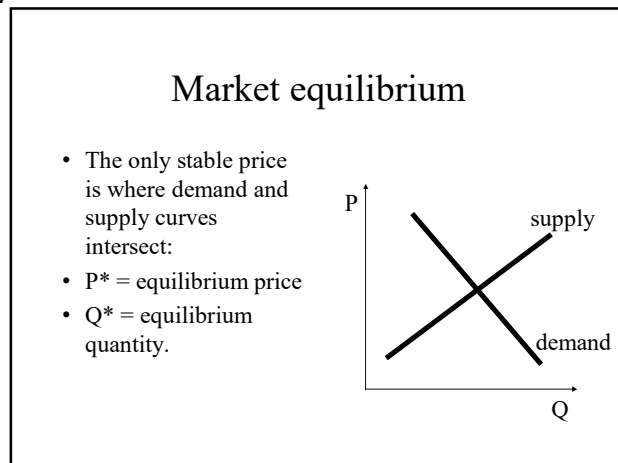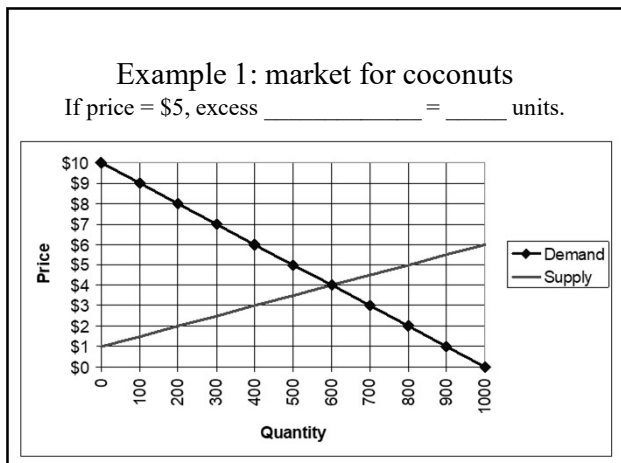
Example 2: market for steel

If price = $20, excess _____ = _____ tons.

Price per ton	Quantity demanded (tons)	Quantity supplied (tons)
$10	800	200
$20	700	250
$30	600	300
$40	500	350
$50	400	400
$60	300	450
$70	200	500

Example 2: market for steel

If price = $70, excess _____ = _____ tons.

Price per ton	Quantity demanded (tons)	Quantity supplied (tons)
$10	800	200
$20	700	250
$30	600	300
$40	500	350
$50	400	400
$60	300	450
$70	200	500

MARKET EQUILIBRIUM
Page 3

Example 2: market for steel

Equilibrium price = $_____ .

Price per ton	Quantity demanded (tons)	Quantity supplied (tons)
$10	800	200
$20	700	250
$30	600	300
$40	500	350
$50	400	400
$60	300	450
$70	200	500

Example 3: market for orange juice

- Suppose demand is given by
  $Q_D = 400 - 20 P$
- And supply is given by
  $Q_S = -50 + 30 P$
- Equilibrium means $Q_D = Q_S$,
  $400 - 20 P = -50 + 30 P$
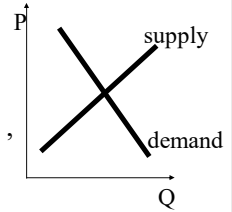
How soon do markets reach equilibrium?

- It may *take time* for markets to adjust to a new equilibrium.
- Usually, the better the communication between buyers and sellers,
  - the _____ the duration of any excess supply or excess demand.
  - the _____ the market reaches the new equilibrium.

Do markets always reach equilibrium eventually?

- *Government policies* may deliberately prevent price from reaching equilibrium.
- Examples:

Conclusions

- *Equilibrium price and quantity* are determined by the intersection of supply and demand curves.
- Any other price is likely to be unstable because it will create either
  a shortage (*excess _____*)
  or a surplus (*excess _____*) .

SHIFTS IN DEMAND AND SUPPLY CURVES
Page 1

SHIFTS IN DEMAND AND SUPPLY CURVES

- What happens if demand or supply shift?
- What happens if both curves shift?

Shifts in curves

- If the supply or demand curves shift, the equilibrium price and quantity change in predictable ways.
- Changes are predictable because
  - demand always slopes _____
  - and supply slopes _____ .

Effect of rightward shift in demand

- Suppose something shifts demand to the right, such as:
  - increase in price of substitute
  - decrease in price of complement.
  - increase in income.

P* & Q* both _____ .
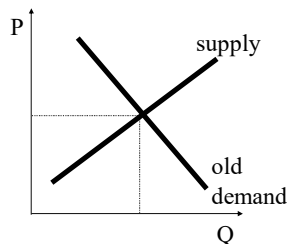
Effect of leftward shift in demand

- Suppose something shifts demand to the left, such as:
  - decrease in price of substitute
  - increase in price of complement.
  - decrease in income.

P* & Q* both _____ .
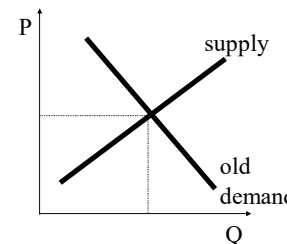
Effect of rightward shift in supply

- Suppose something shifts supply to the right, such as:
  - input price decreases.
  - discovery of new production method.
  - decrease in govt. regulation.

P* _____ ,
Q* _____ .
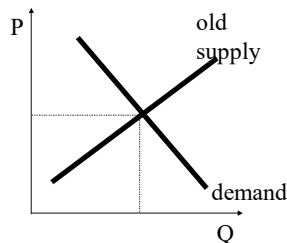
Effect of leftward shift in supply

- Suppose something shifts supply to the left, such as:
  - increase in input price.
  - increase in govt. regulation.

P* _____ ,
Q* _____ .
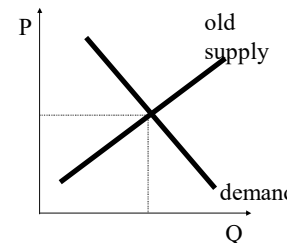
SHIFTS IN DEMAND AND SUPPLY CURVES
Page 2

Example: World automobile market

- Suppose incomes of consumers fall (perhaps due to a recession).
- Implications:
  - P* _____
  - Q* _____
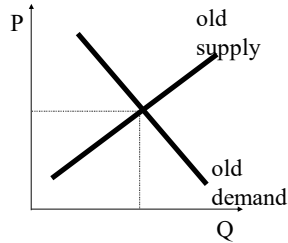
Example: Agricultural market

- Suppose there is a crop failure due to bad weather or disease.
- Implications:
  - P* _____
  - Q* _____
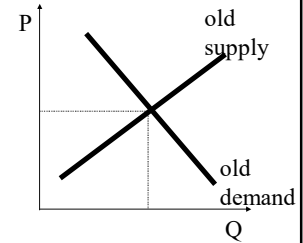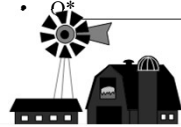
Example: Market for illegal drugs

- Suppose tougher law enforcement raises the likelihood of arrest for persons transporting drugs into the U.S.
- Implications:
  - P* _____
  - Q* _____
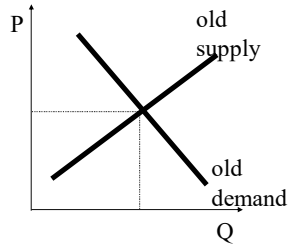
Example: Market for inner-city apartments

- Suppose an urban revitalization program increases the attractiveness of inner-city residential neighborhoods.
- Implications:
  - P* _____
  - Q* _____
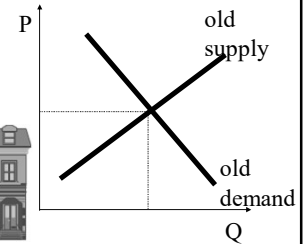
Simultaneous shifts in demand and supply in same direction

- If both curves shift to right, then:
- Q* will surely _____.
- But P* could either increase or decrease, depending on shapes of curves, and which curve shifts more.
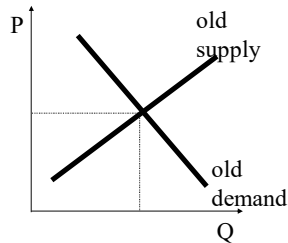
Simultaneous shifts in demand and supply in opposite directions

- If demand shifts to right while supply shifts to left, then:
- P* will surely _____.
- But Q* could either increase or decrease, depending on shapes of curves, and which curve shifts more.
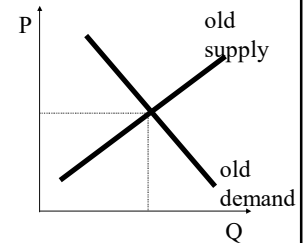
SHIFTS IN DEMAND AND SUPPLY CURVES
Page 3

Example: Market for computers

1. Due to technological breakthroughs, the price of computer chips falls sharply.
2. Simultaneously, the price of software falls.
- Implications:
  - P* _____
  - Q* _____

P — old supply — old demand — Q
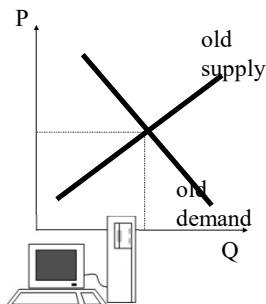
Example: Market for U.S.-made cars

1. Suppose the United Auto Workers win a major wage increase.
2. Simultaneously, the price of foreign-made cars decreases.
- Implications:
  - P* _____
  - Q* _____

P — old supply — old demand — Q
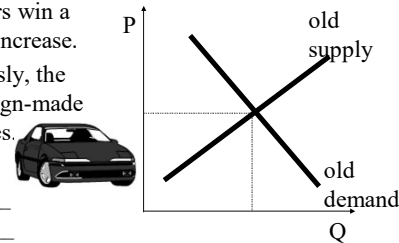
Example: Market for coal

1. Suppose a new law requires strip-mining companies to spend more money for land restoration.
2. Simultaneously, a war in the Middle East raises the price of petroleum.
- P* _____ Q* ____

P — old supply — old demand — Q
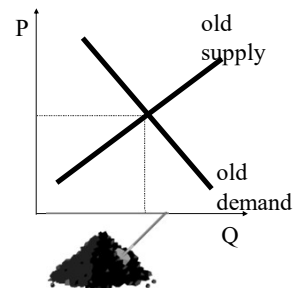
Conclusions

How to predict effects of shifts in curves:
(1) Draw demand-and-supply diagram.
(2) Determine which _____ is shifting, and which _____.
(3) Read off changes in quantity and price from diagram.
(4) If both curves shift, remember that one variable (price or quantity) _____ be predicted without more info.

PRICE CONTROLS
Page 1

PRICE CONTROLS

- What happens when a market is subject to price controls?
- Who wins and who loses?

What are price controls?

- *Price floor* = *minimum price* = price below which a good may not legally be traded.
- *Price ceiling* = *maximum price* = price above which a good may not legally be traded.

Binding versus nonbinding price controls

- Not all price control laws have an effect on the market.
- A price control is *binding* if it actually prevents the price from reaching market equilibrium.
- A *nonbinding* price control has _____ effect.

Nonbinding price controls

- A price ceiling above the market equilibrium price is not binding.
- A price floor below the market equilibrium price is not binding.
- Henceforth, we consider only *binding* price controls.
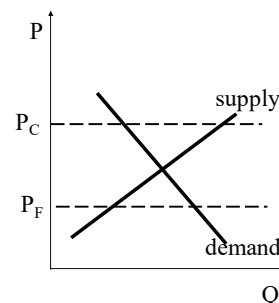
How a price floor works

- A price floor creates permanent excess _____.
- Some suppliers are not able to sell all they want at the legal minimum price.
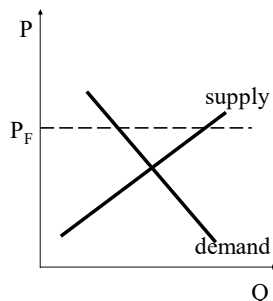
Effect of price floor on quantity traded

- Quantity actually traded is _____ than equilibrium quantity.
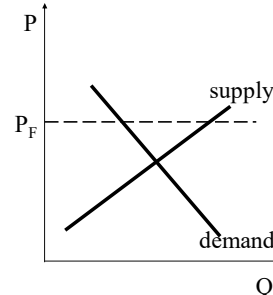
PRICE CONTROLS
Page 2

Example of a price floor

- Suppose in this market, a price floor of $4 is imposed.
- Excess supply = _____ million gallons.
- Quantity actually traded = _____ million gallons.
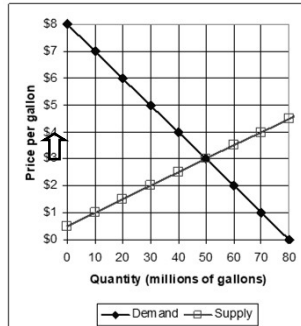
Who gains and who loses from a price floor?

- Buyers all _____ because they pay a higher price than they would otherwise.
- Sellers who get into the market _____ because they receive a higher price than they would otherwise.
- However, some sellers are excluded (or at least sell less than they would otherwise). They _____.

Example of price floor: agricultural price supports

- *Agricultural price supports* are not legal minimum prices, but rather price targets set by the government.
- To keep prices high, the government must either:
  - increase demand (by buying and destroying output).
  - reduce supply (by paying farmers to grow less and/or excluding foreign suppliers).

Example of price floor: minimum wages

- *Minimum wage laws* are simple legal minimum prices, not enforced by supply or demand intervention.
- If binding, they contribute to unemployment.
- However, U.S. min. wage laws are probably binding on only a small fraction of the labor force—mostly young unskilled workers.

U.S. federal minimum wage
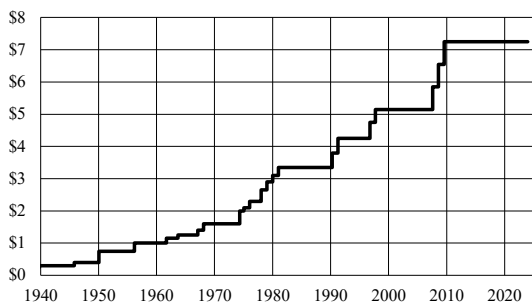
SOURCE: https://www.dol.gov/general/topic/wages/minimumwage

Federal minimum wage as percent of average manufacturing wage
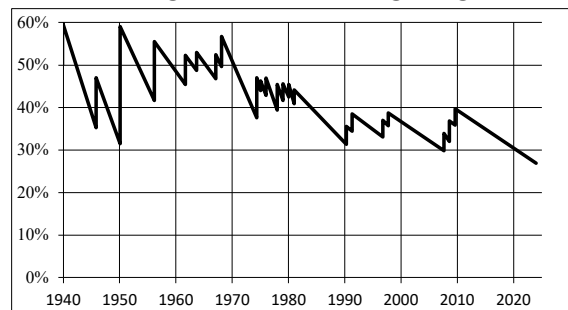
SOURCE: www.bls.gov, data series CEU3000000008

PRICE CONTROLS
Page 3

Other examples of price floors

- Airlines and trucking before federal deregulation in 1980.
- Prices were kept well above equilibrium by federal regulatory agencies.
- Excess supply was controlled by regulating entry of new firms, as well as regulating prices.

How a price ceiling works

- A price ceiling creates permanent excess _____.
- Some demanders are not able to buy all they want at the legal maximum price.
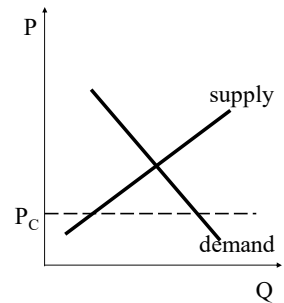
Effect of price ceiling on quantity traded

- Quantity actually traded is _____ than equilibrium quantity.
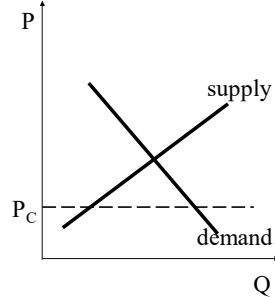
Example of a price ceiling

- Suppose in this market, a price ceiling of $1 is imposed.
- Excess demand = _____ million gallons.
- Quantity actually traded = _____ million gallons.
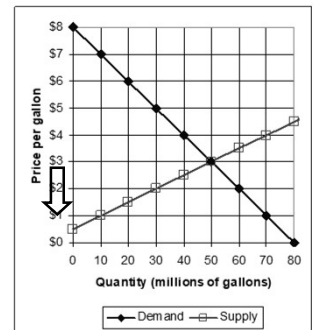
Who gains and who loses from a price ceiling?

- Sellers all _____ because they receive a lower price than they would otherwise.
- Buyers who get into the market _____ because they pay a lower price than they would otherwise.
- However, some buyers are excluded (or at least buy less than they would otherwise). They _____.

Example of price ceiling: usury laws

- *Usury laws* restrict the rate of interest that can be charged on loans.
- Once widespread in U.S.
- Binding if market interest rate > ceiling.
- Generate "credit crunches" if binding— becomes very difficult to borrow.
- Still binding on persons with little credit or collateral. Why?

PRICE CONTROLS
Page 4

More examples of price ceiling

- General price controls imposed by President Nixon from August 1971 to April 1974 to restrain inflation.
- Price controls on petroleum lasted till January 1981 (lifted by President Reagan).

Example of price ceiling: rent control

- *Rent control ordinances* restrict rents that can be charged for apartments.
- Some cities have rent controls that are not probably not binding.
- New York City has strong, binding, rent control ordinance dating from World War II.

Rent control reduces quantity of housing more in the long run than short run

- Short-run supply of housing is nearly perfectly inelastic.
- Response is slow.
- Long-run supply of housing is more elastic.
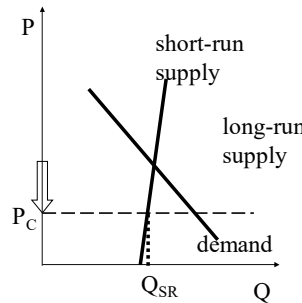
Other examples of price ceilings

- Food prices in some developing countries.
- Create excess _____ for food, unless demand is restrained by rationing or supply is boosted by subsidies.

Conclusions

- *Price controls* keep price away from its equilibrium level and _____ the quantity traded in a market.
- Buyers all _____ from a *price floor*, but sellers who can still get into the market win.
- Sellers all _____ from a *price ceiling*, but buyers who can still get into the market win.

PART 2

Measuring the Economy

Big ideas: The value of total output produced by a country is called gross domestic product (GDP). GDP per capita is correlated with but is not the same as well-being. To measure GDP growth over time, one must account for changes in prices.

Famous quote: "Economic welfare cannot be adequately measured unless the personal distribution of income is known. And no income measurement undertakes to estimate the reverse side of income, that is, the intensity and unpleasantness of effort going into the earning of income. The welfare of a nation can, therefore, scarcely be inferred from a measurement of national income."
--Simon Kuznets, "Uses and Abuses of National Income Measurements" (1937). [Nobel Prize 1971]

READING VALUES
Page 1

READING VALUES IN DOLLARS AND OTHER CURRENCIES

Decimal points

	American (.)	Some other countries (,)
"Three dollars and 45 cents"	$3.45	$3,45

Large numbers

	American English	British English
$1,000,000	$1 million	$1 million
$1,000,000,000	$1 billion	$1 thousand million
$1,000,000,000,000	$1 trillion	$1 billion

Currencies and symbols

Country used	Currency name	Currency unit	Abbre-viation	Symbol
France, Italy, Germany, etc.	Euro	euro	EUR	€
Japan	Yen	yen	JPY	¥
United Kingdom	Sterling	pound	GBP	£
China	Renminbi	yuan	CNY	¥

Quarters of a year

Quarter	Months
First (Q1, I)	
Second (Q2, II)	
Third (Q3, III)	
Fourth (Q4, IV)	

THE MACROECONOMIC RECORD: GDP AND EMPLOYMENT
Page 1

THE MACROECONOMIC RECORD: GDP AND EMPLOYMENT

- How do GDP and employment behave in the long run?
- How do they behave in the short run?

Tracking the macroeconomy

- Key measures of the macroeconomic performance:
  - GDP (output of goods and services)
  - Employment (number of workers with jobs)

Patterns in the macroeconomy

- Key features of GDP:
  - long-run _____ .
  - short-run _____ , also called "business cycles."
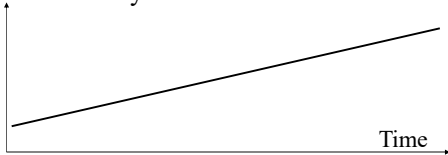
Time

GDP: rough definitions

- *Gross domestic product (GDP)* = total value of goods and services produced in the economy during a specified period of time.
- Also called "nominal GDP" for contrast with real GDP.
- *Real GDP* = GDP adjusted for _____ .

US GDP and real GDP since 1800:
long-run _____ and short-run _____
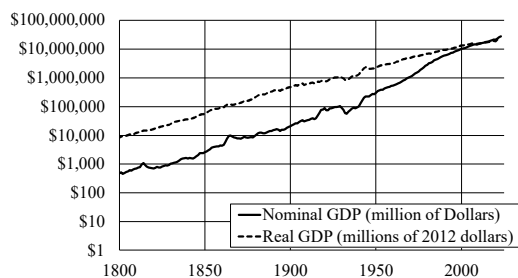
Source: Louis Johnston and Samuel H. Williamson, "What Was the U.S. GDP Then?" MeasuringWorth, 2024. URL: http://www.measuringworth.org/usgdp/

GDP per capita: definitions

- *GDP per capita* = GDP / population.
- *Real GDP per capita* = real GDP / population.
- Growth rate of real GDP per capita = growth rate of real GDP _____ growth rate of population.

THE MACROECONOMIC RECORD: GDP AND EMPLOYMENT
Page 2

US GDP and real GDP per capita since 1800: long-run _____ and short-run _____

Source: Louis Johnston and Samuel H. Williamson, "What Was the U.S. GDP Then?" MeasuringWorth, 2021. URL: http://www.measuringworth.org/usgdp/

Growth rates have changed over time

Source: BEA, FRED. Downloaded December 2021.
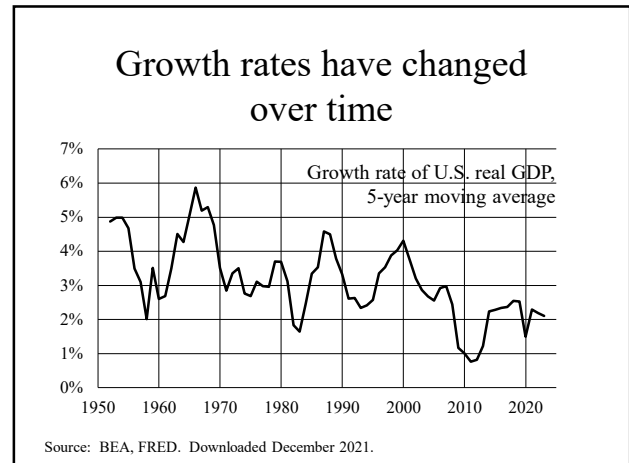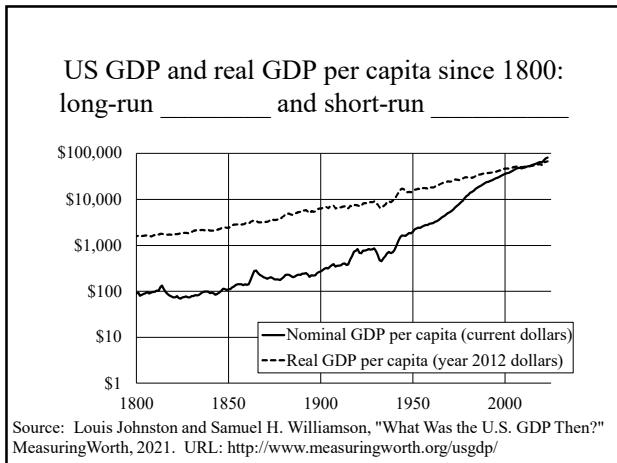
Small differences in growth rates add up over time

U.S. GDP per capita is about $80 thousand now. How big will it be in 50 years?

Assumed annual growth rate	Formula	Answer
0.5 %	$\$80 \times 1.005^{50}$	
1%	$\$80 \times 1.01^{50}$	
3%	$\$80 \times 1.03^{50}$	
5%	$\$80 \times 1.05^{50}$	

Short-run fluctuations in GDP

- Every few years, real GDP stops growing, falls, and then increases rapidly again, producing a _____ cycle.
- Business cycles are irregular: each is unique in length, severity, etc.
- _____ = period of falling real GDP.
- Most recent recession was _____.

Turning points in a business cycle

- _____ = highest point, when real GDP stops growing.
- _____ = lowest point, when real GDP starts growing again.

Turning points in a business cycle
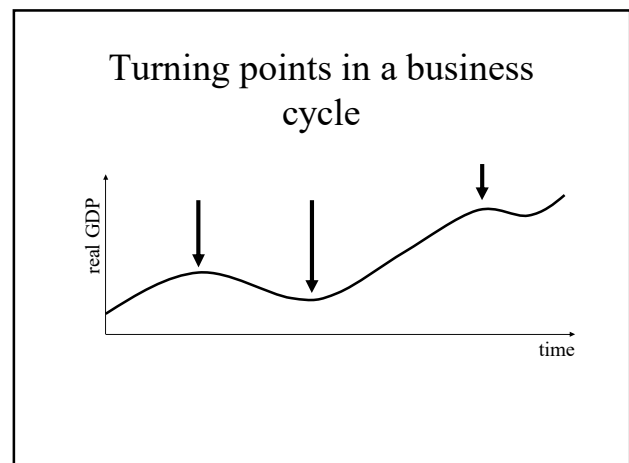
THE MACROECONOMIC RECORD: GDP AND EMPLOYMENT
Page 3

Periods of a business cycle

- _____ = period of real GDP growth just before it stops growing.
- _____ = period of falling real GDP.
- _____ = period of real GDP growth just after trough.
- _____ = entire period of real GDP growth, from trough to the next peak.

Periods of a business cycle
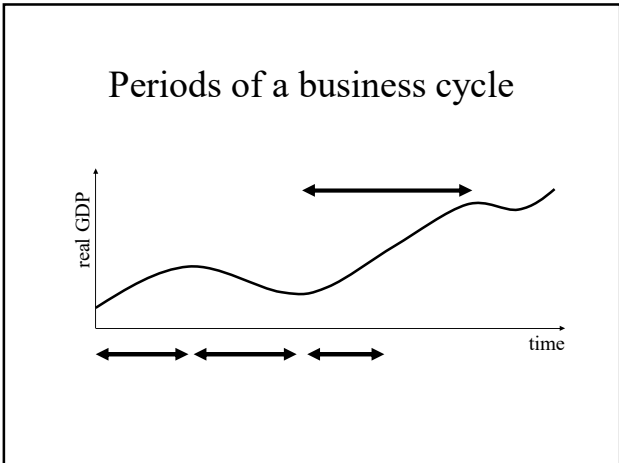
Employment: definitions

- *Employment* = number of people who have jobs.
- *Unemployment* = number of people who do not have jobs but are looking for work.
- *Labor force*
  = employment + unemployment.
- *Unemployment rate*
  = unemployment / labor force.
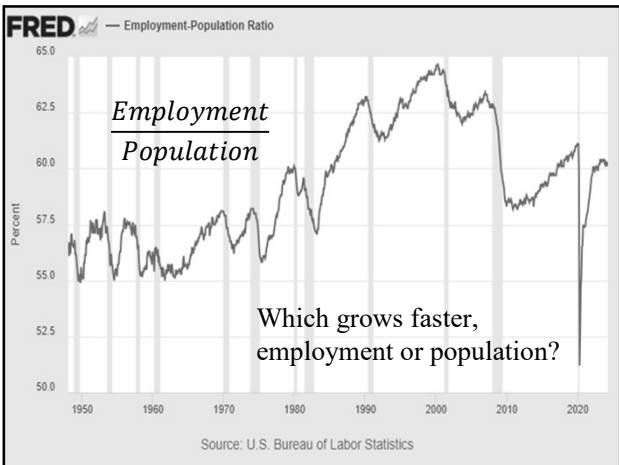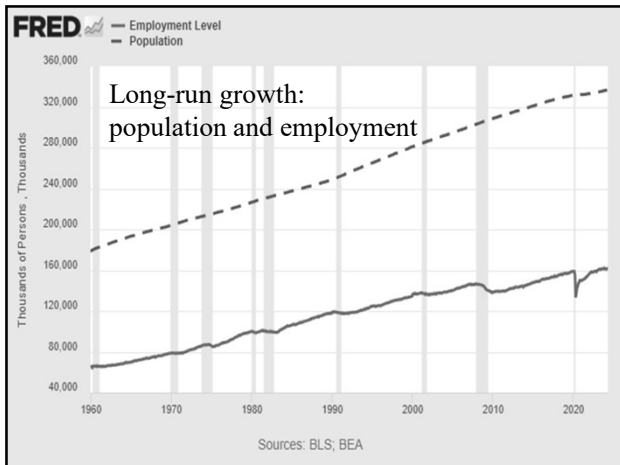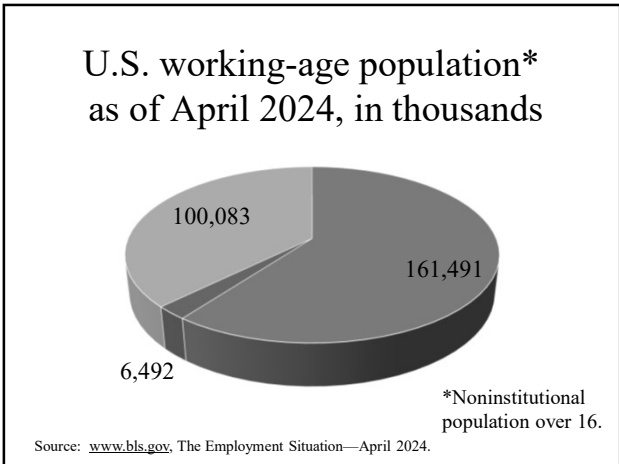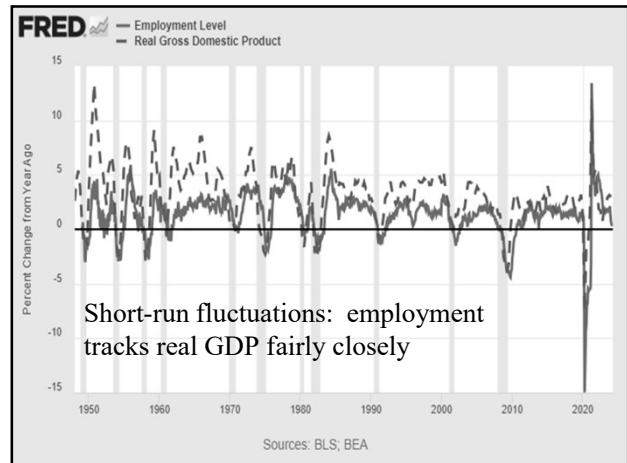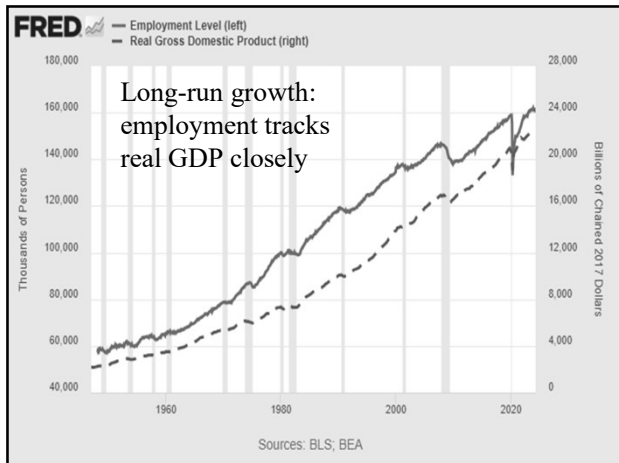
U.S. working-age population* as of April 2024, in thousands

100,083

161,491

6,492

*Noninstitutional population over 16.

Source: www.bls.gov, The Employment Situation—April 2024.

Long-run growth: population and employment

$\frac{Employment}{Population}$

Which grows faster, employment or population?

THE MACROECONOMIC RECORD: GDP AND EMPLOYMENT
Page 4

Long-run growth: employment tracks real GDP closely

Sources: BLS; BEA

Short-run fluctuations: employment tracks real GDP fairly closely

Sources: BLS; BEA

Short run fluctuations in employment

- Employment rises in booms, falls in recessions (as people become unemployed).
- Labor force (employment + unemployment) also shrinks slightly in recessions.
  - Why? Some people who lose their jobs get discouraged and stop _____.

Short run fluctuations in employment

- Employment rises in booms, falls in recessions (as people become unemployed).
- Labor force (employment + unemployment) also shrinks slightly in recessions.
  - Why? Some people who lose their jobs get discouraged and stop looking for work_____.

Unemployment *rate* = unemployment / _____
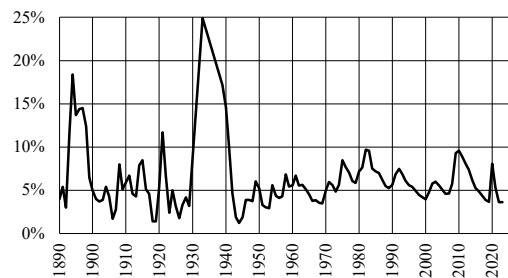
Productivity: definition

- Productivity
  = real GDP divided by employment
- *Growth rate* of productivity
  = *growth rate* of real GDP
  _____ *growth rate* of employment.
- Over the last few decades:
  - Productivity has grown about 1% annually.
  - GDP *per hour of work* has grown even faster because hours per worker have _____.

THE MACROECONOMIC RECORD: GDP AND EMPLOYMENT
Page 5

U.S. productivity: long-run growth and short-run fluctuations

Source: U.S. Bureau of Labor Statistics

Conclusions

- GDP and employment show both
  - long run _____
  - short run _____ ("business cycles").
- Periods when real GDP is falling are called _____.
- Employment _____ and unemployment _____ during booms. The opposite happens during recessions.

THE GREAT DEPRESSION
Page 1

THE GREAT DEPRESSION

- What is the macroeconomic record of the Great Depression?

Depression: definition

- A severe recession.
- Great Depression took place in _____.
  - Most severe recession of 20th century.
  - World-wide phenomenon.
- Let's compare Great Depression with the "Great Recession" of 2007-2009.

Depression: definition

- A severe recession.
- Great Depression took place in ___1930s___.
  - Most severe recession of 20th century.
  - World-wide phenomenon.
- Let's compare Great Depression with the "Great Recession" of 2007-2009.

U.S. real GDP (billions of 2012 dollars)
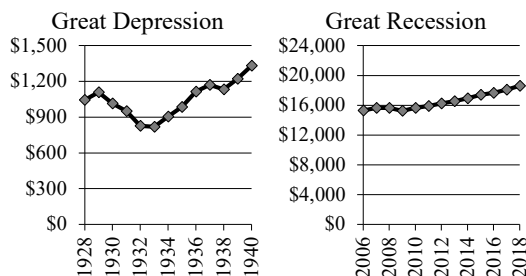
U.S. employment (millions)
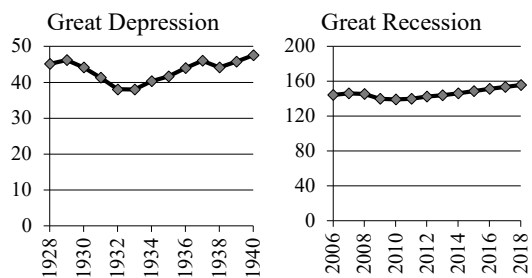
U.S. unemployment rate
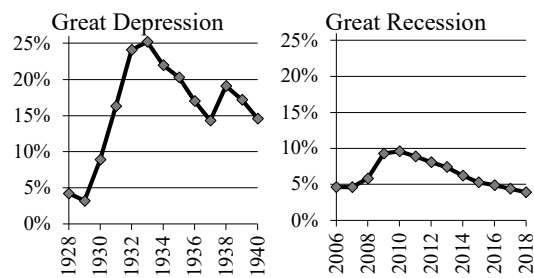
THE GREAT DEPRESSION
Page 2

What's behind these numbers?

- Great Depression caused massive hardship for huge numbers of people.
- Many people could not find jobs for years.
- Many businesses, including banks, failed.

U.S. bank failures
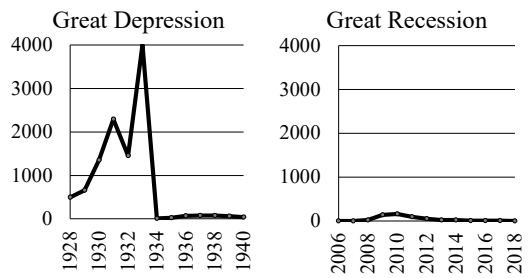
Unemployed men sitting in public square in the Minneapolis "Gateway" district

Waiting for food in the Forrest City, Arkansas, refugee camp

Unemployed miner with food from surplus commodities corporation

Squatters' houses in "Jersey Meadows," on city dump

© 2024 William M. Boal

THE GREAT DEPRESSION
Page 3

Conclusions

- During the early years of the Great Depression, GDP fell by almost _____, and the unemployment rate rose to almost _____.
- The result was massive, long-lasting hardship for many people.
- The Great Depression was far more severe and long-lasting than any recession since—even the 2007-2009 "Great Recession."

THE MACROECONOMIC RECORD: INFLATION AND INTEREST RATES
Page 1

THE MACROECONOMIC RECORD: INFLATION AND INTEREST RATES

- How do inflation and interest rates behave in the long run?
- How do they behave in the short run?

Inflation: definitions

- *Inflation* = a rise in the general level of prices.
- *Inflation rate* = growth rate (or percent increase) in the price level from one year to the next.
- Recall: Percent increase = _____ .

Measuring the price level

- *Price index* = any measure of the general price level, set to equal _____ in some specified base year.
- *Consumer Price Index (CPI)* = a measure of the average price consumers pay for goods and services.
- In the U.S., the CPI is computed by the Bureau of Labor Statistics.

U.S. CPI: Base year = _____ .
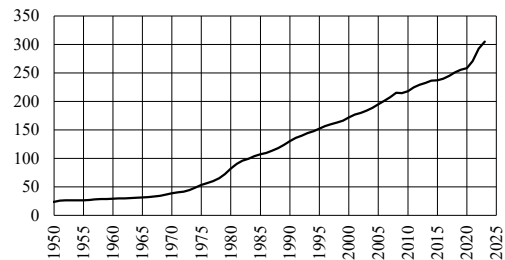
Computing the inflation rate: example

Year	CPI	Inflation rate
2018	251.1	
2019	255.7	$\frac{255.7 - 251.1}{251.1} = $ %
2020	258.8	$\frac{258.8 - 255.7}{255.7} = $ %

Inflation rate has changed over time
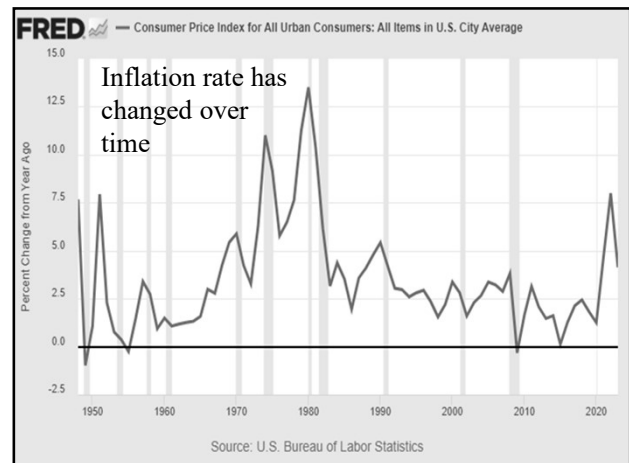
THE MACROECONOMIC RECORD: INFLATION AND INTEREST RATES
Page 2

Long run inflation

- The price level has risen (positive inflation) for most of the last hundred years.
- However, the rate of inflation has varied a lot from one decade to the next.
- The inflation rate was especially high in the _____.

Short run fluctuations in inflation

- The rate of inflation tends to
  - increase in _____.
  - decrease during and immediately after _____.
- *Accelerating inflation* = an increase in inflation rate.
- *Disinflation* = decrease in inflation rate.

Deflation

- *Deflation* = drop in price level = negative inflation.
- Different from *disinflation* = inflation slowdown.
- Substantial deflation is very unusual in the world today.
- Historical examples:
  1929-33 (price level dropped by _____%)
  1920-21 (price level dropped by _____%)

Interest rate: definition

- Interest rate = % amount that lenders charge borrowers. Thus interest rate is the price of "renting money."
- Basis points = hundredths of a percentage point.
- So if an interest rate increased from 2.00% to 2.25%, it increased by _____ basis points.

Many different interest rates

- Interest rates vary depending on who is borrowing and who is lending.
- Examples:
  - _____
  - _____
  - _____
  - _____

But most interest rates move up and down together
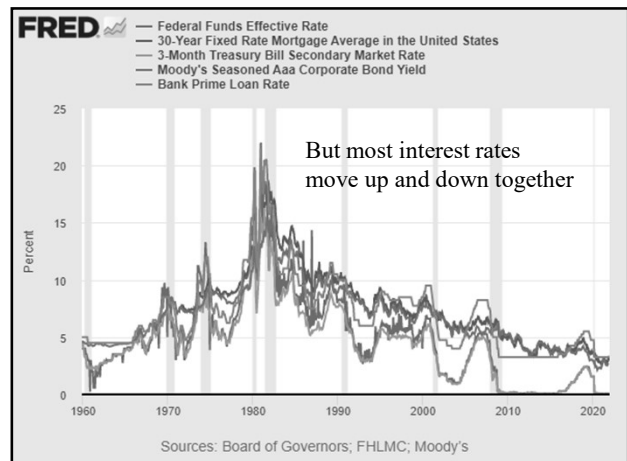
THE MACROECONOMIC RECORD: INFLATION AND INTEREST RATES
Page 3

Long run trends in interest rates: the impact of inflation

- Long run trends in interest rates tend to track long run trends in inflation.
- When there is inflation, part of the value of a loan will be eaten up by inflation before the money is returned.
- To compensate, lenders will require a higher rate of interest.

Interest rates tend to track inflation in the long run
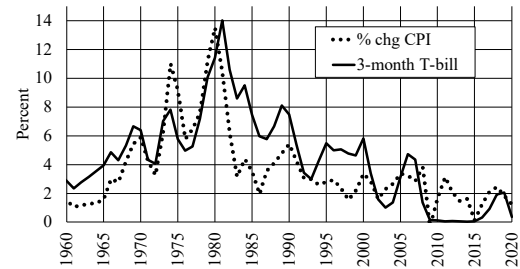
Nominal versus real interest rates

- *Nominal interest rate* = interest rate as explicitly stated in loan documents, credit card applications, etc.
- *Real interest rate* = nominal rate minus expected rate of _____ .
- *Example:* Suppose nominal interest rate is 10% and inflation is expected to be 3%. Then the real interest rate = _____ .

Short run fluctuations in interest rates

- Interest rates tend to:
  - rise during booms.
  - fall during recessions.
- This is true of both nominal and real interest rates.

Conclusions

- The *rate of inflation* fluctuates over time.
- The *rate of inflation* _____ during booms and _____ during and immediately after recessions.
- *Interest rates* also fluctuate over time, influenced by inflation and business cycles.
- The *real interest rate* = interest rate minus the expected rate of _____ .

MACROECONOMIC THEORY AND POLICY
Page 1

MACROECONOMIC THEORY AND POLICY

- What is macroeconomic theory about?
- How does macroeconomic theory try to improve government policy?

Goals of macroeconomic theory

- To explain (and perhaps predict) movements in the macroeconomy (GDP, employment, inflation, interest rates).
- To find the best government policies for promoting economic growth and avoiding recessions and slumps.

Two branches of theory

- Theory of _____ seeks to
  - explain long run trends.
  - find policies to promote growth.
- Theory of _____ seeks to
  - explain (and perhaps predict) short run fluctuations around long run trends.
  - find policies to avoid recessions and slumps.

Government policies that affect the macroeconomy

- *Fiscal policy* = taxing, spending and borrowing.
- *Monetary policy* = control over the supply of money.

Potential GDP: definition

- Growth theory and business cycle theory can be distinguished using the concept of potential GDP.
- *Potential GDP* = long run trend of real GDP.
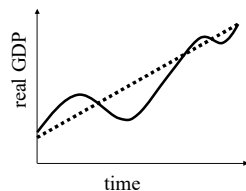
Potential GDP

- is _____ directly observed. We must estimate it somehow.
- is average or normal GDP, not maximum GDP.
- might grow at different rates in different time periods.

MACROECONOMIC THEORY AND POLICY
Page 2

Estimate of potential GDP using Excel's "trendline-exponential" option

Estimate of potential GDP by Congressional Budget Office

Sources: CBO; BEA
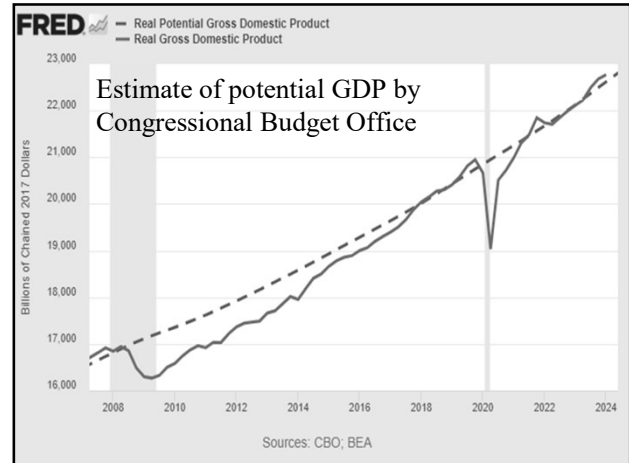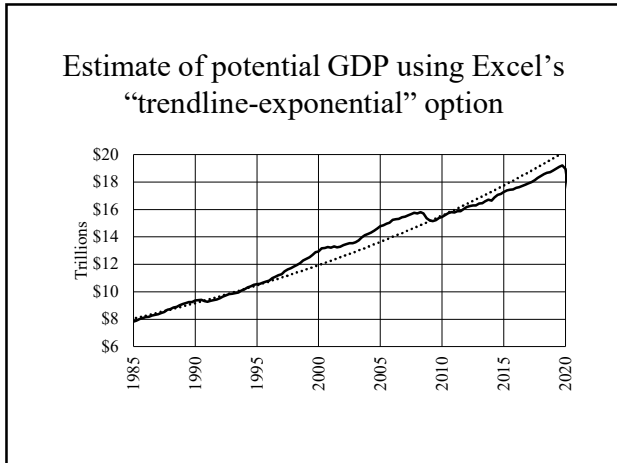
Growth theory

- Began with Robert Solow (1924-2023) (Nobel Prize, 1987).
- Focuses on trends in _____ GDP.
- Postulates that potential GDP is determined by "aggregate supply."
- *Aggregate supply* = total productive capacity of economy.

The aggregate production function

- Aggregate supply depends on the total available resources for production, through the *aggregate production function*:
- Potential GDP = f (L, K, T), where
  L = _____ = total hours of all workers.
  K = _____ = factories, equipment, etc.
  T = _____ = available know-how.

Growth theory and government policy

Fiscal policy can affect

- **L:** how many people are willing to work, and how many hours.
- **K:** how much businesses are willing to borrow to purchase new capital.
- **T:** what resources are devoted to developing new know-how through education and research.

Growth theory and government policy (cont'd)

- Monetary policy can affect the rate of inflation, at least in the long run.
- Keeping inflation low and stable is likely to be good for economic growth.

MACROECONOMIC THEORY AND POLICY
Page 3

Business cycle theory

- Began with John Maynard Keynes (1883-1946).
- Focuses on _____ around potential GDP.
- Postulates that business cycles are caused by fluctuations in aggregate demand.

Aggregate demand

Sum of demands by
- consumers wanting to buy consumption goods.
- businesses wanting to buy capital goods.
- government wanting to buy aircraft, roads, education services, etc.
- foreigners wanting to buy goods exported from the U.S.

Aggregate demand fluctuations

- What if aggregate demand > potential GDP?
- Economy experiences _____.
- Inflation accelerates.
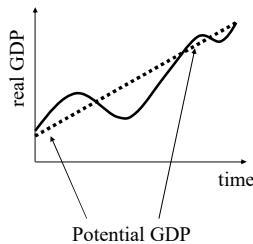
Potential GDP

Aggregate demand fluctuations

- What if aggregate demand < potential GDP?
- Economy experiences _____.
- Inflation rate decreases (disinflation).
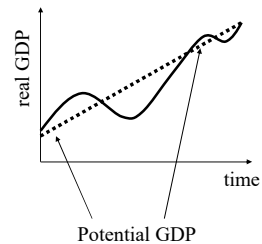
Potential GDP

Output gap: definition

- During a slump, actual GDP falls below potential GDP.
- Output gap = actual GDP - potential GDP.
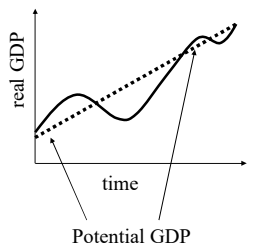
Potential GDP

Example: output gap in second quarter 2009

- Actual real GDP was about $ 15.2 trillion.
- Potential GDP was about $16.0 trillion.
- Then the output gap was $15.2 - 16.0 = -$_____ trillion, or about _____% of potential GDP.
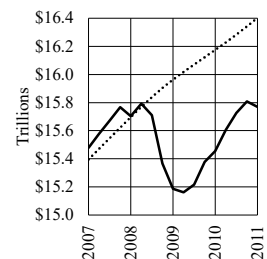
MACROECONOMIC THEORY AND POLICY
Page 4

Does aggregate supply fluctuate over business cycles, too?

- Aggregate supply (= potential GDP) may fluctuate in the short run.
- Examples:
    - _____.
    - _____.
- "Real business cycle school" of macroeconomic theory emphasizes fluctuations in aggregate supply.

Business cycle theory and government policy

Fiscal policy and monetary policy can affect business cycles.

- _____ policy can minimize recessions and speed recoveries.
- _____ policy can cause or prolong recessions.

Conclusions

- Macroeconomic theory tries to explain and predict movements in the macroeconomy.
- *Growth theory* seeks to explain long run _____ in *potential GDP*, and suggest *fiscal and monetary policies* to increase growth.
- *Business cycle theory* seeks to explain _____ around *potential GDP*, and suggest *fiscal and monetary policies* to avoid recessions and slumps.

WHAT IS GDP?
Page 1

WHAT IS GDP?

- What is included in GDP?
- How can GDP be measured?
- Does GDP measure national well-being?

Gross domestic product (GDP): definition

- GDP is the most commonly-used measure of the size of an economy.
- *Gross domestic product* = the value of all final goods and services newly *produced* in a country during a period of time (typically one year or one quarter).
- Sometimes abbreviated as "Y" in equations.

What GDP includes:

- only final goods.
- only goods produced this year.
- only goods produced within the U.S.
- only goods produced for sale.

What GDP includes: only final goods

- Consumption goods: food, clothing, appliances, entertainment, etc.
- Capital goods: buildings, equipment, computers, vehicles.
- Coal, crude oil.
- Lumber, roofing materials, sheetrock (unless sold directly to do-it-yourself consumers).
- Computer chips, car engines (unless sold directly to consumers).

What GDP includes: only goods produced this year

- Cars produced this year, even if not actually sold till next year.
- Houses built this year, whether sold this year or not.
- Cars produced last year and still sitting on dealer lots.
- Houses built many years ago and resold this year.

What GDP includes: only goods produced within the U.S.

- Corn, hogs, beans grown in the U.S. for export.
- Hondas, Toyotas, and Nissans built in U.S. manufacturing plants.
- Clothing made in China and sold in U.S.
- Hamburgers sold by McDonalds in other countries.
- Cars built in Japan and imported to U.S.

WHAT IS GDP?
Page 2

What GDP includes: only goods produced for sale

- Public or private trash collection.
- Paid childcare services.
- Take-out food from restaurants.
- Professional house-painting.

- Volunteer neighbor-hood clean-up drives.
- Free childcare by friends or relatives.
- Meals prepared at home.
- Do-it-yourself house-painting.

Included in GDP or not?

- New cars? _____
- Used cars? _____
- Raw wheat? _____
- Flour produced for consumers? _____
- Flour produced for a bakery? _____

- Health care services? _____
- Legal services to consumers? _____
- Electricity delivered to office buildings? _____
- Highway construction? _____

Adding apples and oranges

- GDP includes a variety of different kinds of goods.
- Before adding them up, the amount produced of each good is first multiplied by its price.
- Thus GDP sums the _____ of goods and services produced.

Three approaches to measuring GDP

(1) *Spending approach:* how much is *spent* on final goods and services.

(2) *Production approach:* how much is actually *produced* in factories, offices, farms, etc. Also called "value-added" approach.

(3) *Income approach:* how much is *paid* to people producing goods and services.

Comparing the three approaches

- All three approaches should give same answer, except for statistical discrepancies.
- All three approaches reported in "National Income and Product Accounts" of the U.S. Bureau of _____.

Practical limitations of GDP

- GDP calculations are subject to errors and revisions.
  - Reason: some data arrive slowly.
- Underground economy is not measured.
  - Examples:
- Improvements in product quality are not well measured.
  - Examples:

WHAT IS GDP?
Page 3

Conceptual limitations of GDP

- Output is measured by its market value.
- If it's not paid for, it's not measured.
- Items omitted include:

Other conceptual limitations of GDP

- GDP does *not* measure changes in environmental quality, life expectancy, literacy rates, etc.
- GDP does *not* measure fairness of income distribution.
- Thus, GDP is only a rough measure of national well-being.

But GDP per capita is correlated with other measures of well-being

Countries of the world, 2019

Life expectancy at birth (years)
GDP per capita   Thousands
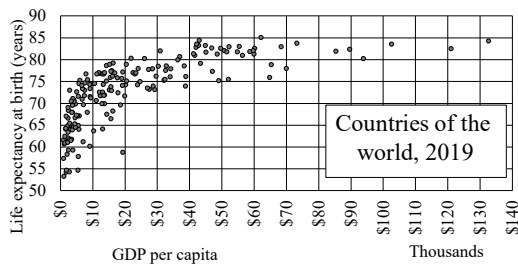
Source: databank.worldbank.org, accessed December 2021.

Conclusions

- GDP is the total value of *final goods and services* produced in an economy.
- GDP can be measured by summing either:
  (1) total _____ on final goods,
  (2) _____ at each production stage,
  (3) total _____ of producers.
- GDP is only a rough measure of national well-being.

THE SPENDING APPROACH TO GDP
Page 1

THE SPENDING APPROACH TO GDP

- How can GDP be computed from spending?
- What spending must be included?
- What spending must be excluded?

Three approaches to measuring GDP

(1) *Spending approach:* how much is *spent* on final goods and services.

(2) *Production approach:* how much is actually *produced* in factories, offices, farms, etc.

(3) *Income approach:* how much is paid to people producing goods and services.

Categories of spending

- Spending approach sums four categories of spending on final goods:
    - C = consumption
    - I = investment
    - G = government purchases
    - X = net exports
- Let Y = GDP. Then Y = C + I + G + X.

Consumption

- *Consumption (C)* = purchases of final goods and services by individuals.
- Called "personal consumption expenditures" by Bureau of Economic Analysis (BEA).
- Consumption = about 2/3 of GDP.

What is included in consumption?

- New durable goods, like: _____
  _____
- New nondurable goods, like: _____
  _____
- Services, like: _____
  _____

What is excluded from consumption?

- Purchases of used goods, like:
  _____
  _____
    - Reason excluded: GDP includes only *newly produced* goods.
- New housing
    - Reason excluded: counted under investment instead.

THE SPENDING APPROACH TO GDP
Page 2

U.S. consumption in 2023

	(billions)
Durable goods	$2,198.8
Nondurable goods	$3,992.7
Services	$12,379.2
Total consumption	

Source: Bureau of Economic Analysis, table 1.1.5, April 25, 2024.
(Components may not sum exactly to total due to rounding.)

Investment

- *Investment (I)* = purchases of final goods by businesses.
- That is, purchases of newly-produced economic or physical _____.
- Called "gross private domestic investment" by BEA.

What is included in investment?

- Nonresidential fixed investment, like:

  _____

  _____

- Residential fixed investment, like:

  _____

- Change in inventories:

  _____

What is **ex**cluded from investment?

- Intermediate goods, like: _____

  _____

  _____

- Reason excluded: GDP includes only *final* goods. If intermediate goods were included separately, they would be double-counted.

Economic investment versus financial investment

- Economic investment means purchases of _____-produced economic or physical capital.
- Financial investment means purchases of _____ assets, including
  - stocks and bonds.
  - old buildings or vehicles.
  - gold, art, baseball cards.
  - land.

Gross investment versus net investment

- _____ investment includes all purchases of newly-produced economic or physical capital.
- _____ investment excludes purchases to replace worn-out or obsolete economic or physical capital.
- The amount of worn-out or obsolete capital, in dollars, is called "depreciation" or "capital consumption."

THE SPENDING APPROACH TO GDP
Page 3

Gross investment versus net investment: example

- Suppose Drake buys $100,000 in new computers this year.
- Meanwhile, Drake's existing computers decline in value by $20,000 because they wear out or become obsolete (cannot run the latest software).
- Then Drake's gross investment in computers this year = $_____.
- Drake's net investment = $_____.

U.S. investment in 2023

	(billions)
Nonresidential fixed investment	$3,716.1
Residential fixed investment	$1,074.2
Change in inventories	$53.6
Total investment	

Source: Bureau of Economic Analysis, table 1.1.5, April 25, 2024.
(Components may not sum exactly to total due to rounding.)

Government purchases

- *Government purchases (G)* = purchases of final goods and services by federal, state, and local governments.
- Called "government consumption expenditures and gross investment" by BEA.

What counts as government purchases?

- Included:
  - Spending on goods, like:_____
  - Spending on services, like:_____
  - Govt production, like: _____
- Excluded:
  - Transfer payments, like: _____
  - Interest on debt.

U.S. government purchases in 2023

	(billions)
Federal	
National defense	$994.7
Nondefense	$777.0
State and local	$2,973.4
Total gov't purchases	

Source: Bureau of Economic Analysis, table 1.1.5, April 25, 2024.
(Components may not sum exactly to total due to rounding.)

What Americans buy: gross domestic purchases

- Gross domestic purchases = C + I + G.
- This would equal GDP, *if* there were no international trade (buying and selling across borders) .
- But GDP by definition includes goods _____ in the U.S., no matter who purchased them.

THE SPENDING APPROACH TO GDP
Page 4

Why gross domestic purchases does not equal GDP

- Some goods and services purchased in U.S. are not produced here.
  - Examples: _____
  - Must be subtracted.
- Some goods and services produced in U.S. are not purchased here.
  - Examples: _____
  - Must be added.

Net exports

- *Net exports (X)* = difference between exports and imports.
- X = exports - imports.
- Also called the "international trade balance."
- We must add net exports to gross domestic purchases to get GDP.

What counts in net exports?

U.S. exports
- goods like:_____
- services like:_____

U.S. imports
- goods like:_____
- services like:_____

U.S. net exports in 2023

	(billions)
Exports	$3,027.2
Imports	$3,825.9
Net exports	

Negative net exports = "trade deficit."

Source: Bureau of Economic Analysis, table 1.1.5, April 25, 2024.
(Components may not sum exactly to total due to rounding.)

U.S. net exports in 2023

	(billions)
Exports	$3,027.2
Imports	$3,825.9
Net exports	$-798.7

Negative net exports = "trade deficit."

Source: Bureau of Economic Analysis, table 1.1.5, April 25, 2024.
(Components may not sum exactly to total due to rounding.)

Spending approach: four categories of U.S. GDP in 2023
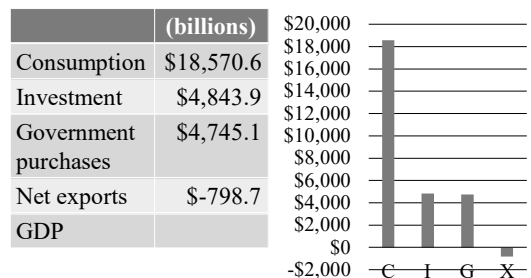
	(billions)
Consumption	$18,570.6
Investment	$4,843.9
Government purchases	$4,745.1
Net exports	$-798.7
GDP	

Source: Bureau of Economic Analysis, table 1.1.5, April 25, 2024.
(Components may not sum exactly to total due to rounding.)

THE SPENDING APPROACH TO GDP
Page 5

Summary of relationships

       Consumption spending
+   Investment spending
+   Government purchases
       Gross Domestic Purchases

Summary of relationships

       Consumption spending
+   Investment spending
+   Government purchases
       Gross Domestic Purchases
+   Net exports (positive or negative)

Conclusions

- The spending approach computes GDP from purchases of final goods by consumers, businesses, and government.
- These sum to _____.
- But Gross Domestic **Product** (GDP) includes goods and services **produced** in the _____, so exports must be added and imports must be subtracted.
- So *GDP* = _____.

STOCKS AND FLOWS
Page 1

STOCKS AND FLOWS

•What exactly is the relationship between *investment* and *capital*?

What is a stock? What is a flow?

- It is useful to distinguish data that represent stocks versus data that represent flows.
- _____ are total quantities measured at a point in time.
- _____ are quantities measured as rates per unit of time.

Example 1: A bathtub

- The rate at which water is coming in through the faucet is a _____.
- Measured in gallons *per minute*.
- The water level in the tub is a _____.
- Measured in total gallons.
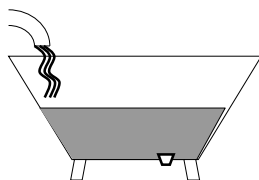
Example 1: A bathtub (cont'd)

- The rate at which water is going out through the drain is also a _____.
- Measured in gallons *per minute*.
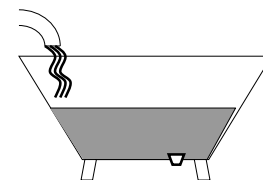
Example 1: A bathtub (cont'd)

- The stock of water in the bathtub at 7:10,
- _____ the amount of water flowing in from 7:10 to 7:15,
- _____ the amount of water flowing out from 7:10 to 7:15,
- _____ the stock of water in the bathtub at 7:15.
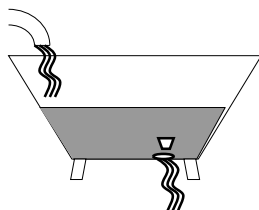
Example 2: Your bank account

- The amount of money in your bank account at any point in time is a _____.
- The amount of money deposited in your account in a month is a _____.
- The amount of money taken out of your account in a month (payments and withdrawals) is also a _____.

STOCKS AND FLOWS
Page 2

Example 2: Your bank account (cont'd)

- The stock of money in your account on the first day of the month
- _____ the flow of money into your account during the month,
- _____ the flow of money out of your account during the month,
- _____ the stock of money in your account on the first day of the next month.

Example 3: Investment versus economic (or physical) capital

- Economic capital = factories, machinery, equipment, vehicles, computers, software, houses and apartments.
- Formally called "private fixed assets" in BEA's national accounts.
- The total amount of economic capital in the economy is a _____.

Example 3: Investment versus economic capital (cont'd)

- Investment = spending on *new* economic capital: factories, machinery, equipment, vehicles, computers, and software.
- Formally called "gross private fixed investment" in BEA's national accounts.
- The amount of investment during any period is a _____.

Example 3: Investment versus economic capital (cont'd)

- Depreciation = wearing out or obsolescence of *old* economic capital.
- Formally called "consumption of private fixed capital" in BEA's national accounts.
- The amount of depreciation during any period is a _____.

Example 3: Investment versus economic capital (cont'd)

- The stock of economic capital on the first day of the year
- _____ the flow of depreciation during the year,
- _____ the flow of gross investment during the year,
- _____ the stock of economic capital on the first day of the next year.

Capital and investment in 2022

		(billions)
	Private fixed assets at end of 2021	$59,280
	Depreciation of private fixed capital in 2022	$3,578
	Gross private fixed investment in 2022	$4,548
	Private fixed assets at end of 2022	$60,250*

Source: Bureau of Economic Analysis, Fixed Assets Accounts Tables 1.1, 1.3, and 1.5. Accessed May 2024.
* Excludes increases in value of assets from changes in their prices.

STOCKS AND FLOWS
Page 3

Capital and investment in 2022

		(billions)
	Private fixed assets at end of 2021	$59,280
MINUS	Depreciation of private fixed capital in 2022	$3,578
PLUS	Gross private fixed investment in 2022	$4,548
EQUALS	Private fixed assets at end of 2022	$60,250*

Source: Bureau of Economic Analysis, Fixed Assets Accounts Tables 1.1, 1.3, and 1.5. Accessed December 2021.
* Excludes increases in value of assets from changes in their prices.

Conclusions

- _____ are total quantities measured at a point in time.
- _____ are quantities measured as rates per unit of time.
- The amount of economic capital in the economy at a point in time is a _____.
- Investment in new capital and depreciation of old capital are _____.

THE PRODUCTION APPROACH TO GDP
Page 1

THE PRODUCTION
(OR VALUE-ADDED)
APPROACH TO GDP

- What is "value added"?
- How can GDP be computed from total value added?

Three approaches to measuring GDP

(1) *Spending approach:* how much is *spent* on final goods and services.

(2) *Production approach:* how much is actually *produced* in factories, offices, farms, etc.

(3) *Income approach:* how much is paid to people producing goods and services.

Stages of production

- Most final goods go through many stages of production.
- Example: farms and food processors sell _____ goods.
- Supermarket sells _____ goods.

Farm

Food Processor

Supermarket

Value added: definition

- *Difference between revenue and payments for intermediate goods at each stage of production.*
- Value is added to parts by finishing, assembling, and packaging them.
- *Value added* measures the amount of production happening at each stage.

Value added: example

- Suppose Super-Duper supermarket has revenues of $9 million and spends $7 million on food that it purchases from Acme Brands, a food processor.
- Then *value added by Super-Duper* = $_____ million.
- Note that only intermediate goods are subtracted, *not* labor cost or rent or equipment (such as refrigerators and cash registers).

Value added: example (cont'd)

- So Acme Brands, the food processor, received $_____ million in revenue.
- Suppose Acme spent $3 million for raw food from Sunshine Farms.
- Then *value added by Acme Brands* = $_____ million.
- Again, only intermediate goods are subtracted, *not* labor cost or rent or equipment (such as ovens and canning machinery).

THE PRODUCTION APPROACH TO GDP
Page 2

Value added: example (cont'd)

- So Sunshine Farms received $_____ million revenue.
- Suppose for simplicity that Sunshine farms spends no money on intermediate goods (OK, not very realistic).
- Then *value added by Sunshine Farms* = $_____ million.

Total value-added = sales of final good

Start with	$_____ million	Value added by Sunshine Farms
Plus	$_____ million	Value added by Acme Brands
Plus	$_____ million	Value added by Supermarket
Equals	$_____ million	Sales of final good: food

Value added and the production approach to GDP

- Total revenue received for final goods is the _____ of value-added at different stages production.
- So instead of measuring GDP by final sales, we can alternatively measure GDP as _____ value-added by all business firms in the U.S.

Where value added goes

- What happens to the $2 million of value added by the supermarket?
- Payments to:
  - workers
  - business owners
  - lenders
  - landlords
  - government (taxes, etc.)

Summary

$$
\begin{array}{rl}
 & \text{Value added by industry A} \\
+ & \text{Value added by industry B} \\
+ & \text{Value added by industry C} \\
+ & \dots \\
+ & \underline{\text{Value added by industry Z}}
\end{array}
$$

Value added by industry in 2022 (billions)

Agriculture, forestry, fishing, & hunting	$ 271	Finance, insurance, real estate, rental, & leasing	$ 5330
Mining	$ 457	Professional and business services	$ 3314
Utilities	$ 438	Educational services, health care, & social assistance	$ 2150
Construction	$ 1090	Arts, entertainment, recreation, accommodation, & food services	$ 1082
Manufacturing	$ 2650	Other services, except government	$ 544
Wholesale trade	$ 1547	Government	$2937
Retail trade	$ 1621		
Transportation & warehousing	$ 921		
Information	$ 1393	Total GDP	$

Source: Bureau of Economic Analysis, table "U.Value Added by Industry," May 2024.

THE PRODUCTION APPROACH TO GDP
Page 3

> ## Conclusions
>
> - *Value added* is the difference between a business's sales revenue and its payments for _____ goods.
> - GDP is the _____ of value added at all stages production throughout the economy.
> - Value added becomes _____ for workers, business owners, lenders, landlords, and payments to the government.

THE INCOME APPROACH TO GDP
Page 1

THE INCOME APPROACH TO GDP

- How can GDP be computed from people's total income?

Three approaches to measuring GDP

(1) *Spending approach:* how much is *spent* on final goods and services.

(2) *Production approach:* how much is actually *produced* in factories, offices, farms, etc.

(3) *Income approach:* how much is paid to people producing goods and services.

Income must approximately equal spending
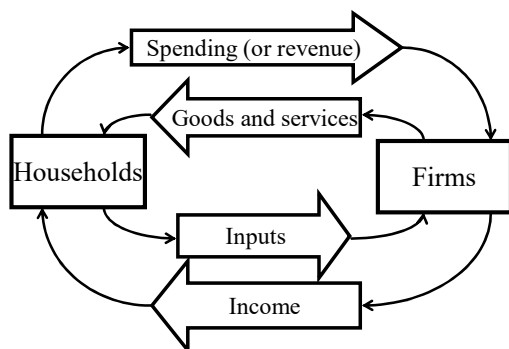
Income must also approximately equal total value added

- Value added = sum of:
  - total income enjoyed by producers in U.S.
  - other costs of production.
- Thus GDP = income + other costs of production = "*aggregate income*."
- An alternative way of computing GDP.

Income

- *Income* = labor and capital income of all citizens and permanent residents of U.S.
- _____ *income:* compensation of employees—wages, salaries, benefits.
- _____ *income:* proprietor's profits, corporate profits, interest payments, rental payments.

U.S. labor and capital income in 2020

	(billions)
Labor income	$11,572.2
Capital income	$5,224.2
Total labor and capital income	

Source: Bureau of Economic Analysis, News Release Nov. 24, 2021, table 7. (Components do not sum exactly to total due to rounding.)

THE INCOME APPROACH TO GDP
Page 2

U.S. income shares in 2023

Source: Bureau of Economic Analysis, table 1.12, May 2024.
(Components do not sum exactly to total due to rounding.)
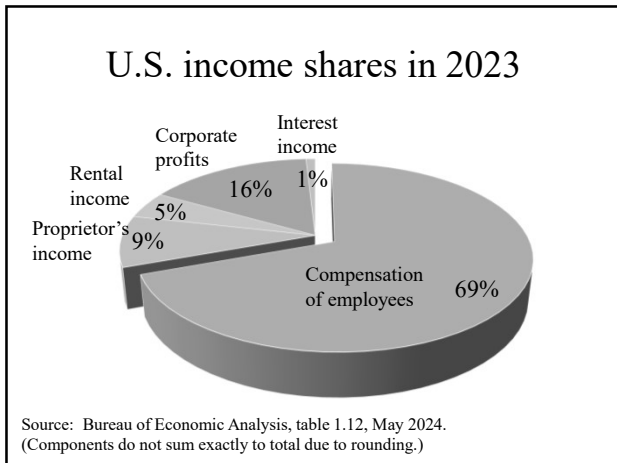
Why income does not exactly equal GDP

1. Income excludes other costs of production, like indirect business taxes and depreciation, which are part of GDP.
   - Firms subtract these items when they compute their profits.
2. Income includes income of Americans producing abroad and excludes income of foreigners producing here.

What are indirect business taxes?

- *Indirect business taxes* = taxes levied on goods when they are sold.
- Example: gasoline taxes, tariffs on imports.
- Part of the value of goods sold is income to the government, not producers.
- Firms subtract indirect business taxes when they compute their profits.

From income to net national product

- Income + indirect business taxes
  = _____ .
- National income + statistical discrepancy
  = _____ .
- Statistical discrepancies exist because the data are not perfect.

What is depreciation?

- *Depreciation* = amount by which buildings and equipment decline in value, due to wear-and-tear, obsolescence, etc.
- Equals amount of investment required to maintain existing productive capacity.
  - Also called "capital consumption."
- Recall that _____
  = gross investment - depreciation.

Why does depreciation matter for computing GDP?

- Firms are allowed to subtract depreciation when they compute their profits.
- So depreciation is _____ included in capital income and therefore not included in net national product.
- But GDP by definition includes _____ (not just net) investment.

THE INCOME APPROACH TO GDP
Page 3

Why does depreciation matter for computing GDP?

- Firms are allowed to subtract depreciation when they compute their profits.
- So depreciation is _____not_____ included in capital income and therefore not included in net national product.
- But GDP by definition includes _____gross_____ (not just net) investment.

From net national product to gross national product

- So depreciation must be added back in to labor and capital income.
- Net national product + depreciation = _____ .

From gross national product to gross domestic product

- To get income of all producers *in U.S.*:
  - Add income of foreigners who produce goods and services in U.S., and
  - Subtract income of U.S. citizens who produce goods and services abroad.
- Gross national product + net income of foreigners =

  _____ .

U.S. income and GDP in 2023

	(billions)
Total labor and capital income	$20,512.6
Plus: indirect business taxes*	$1,936.4
Equals: national income	
Plus: statistical discrepancy	$490.2
Equals: net national product	
Plus: depreciation	$4,585.8
Equals: gross national product	
Plus: net income of foreigners	$-164.2
Equals: **gross domestic product**	

* And other minor items. Components do not sum exactly to totals due to rounding.

Conclusions

- The income approach computes GDP from the sum of *labor and capital* _____ of U.S. citizens.
- To this must be added *indirect business taxes*, *depreciation*, and the *net income of foreigners,* and so that GDP measures final goods and services _____ in the U.S.

INCOME AND SAVING
Page 1

INCOME AND SAVING

- What is "national saving" and who does it?
- What is the connection between saving, investment, and net exports?


Investment requires saving

- To create any new business, the owners must draw on their own or other people's savings.
- A country with large saving has the ability to undertake investment internally or in other countries.
- A country without large saving might be able to borrow from other countries.

Saving by households

- An individual person or household saves when they consume less than their income.
- Saving can be negative: "dissaving".
- How can a person dissave?

Typical life-cycle pattern of personal saving
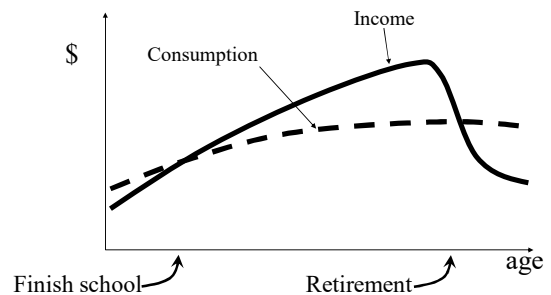
Saving by businesses

- Businesses save when they do not pay out all their profits to their owners, but instead keep some as "retained earnings."
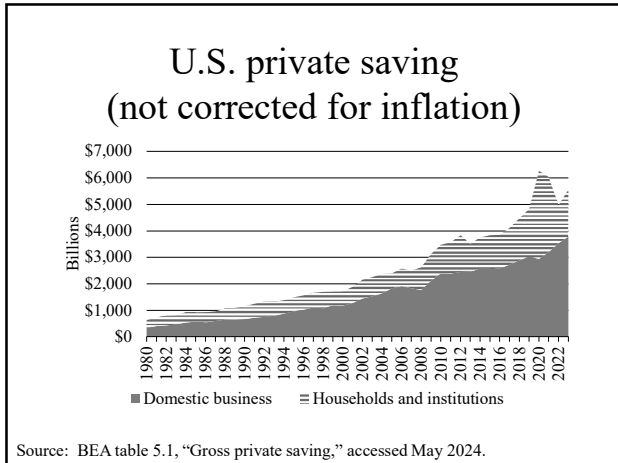- Some large corporations are profitable but almost never pay dividends.

See examples at https://www.dividend.com/investor-resources/sp-500-companies-that-dont-pay-dividends/

Private saving

- Includes saving by both households and businesses.
- Called "gross private saving" by the BEA.

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INCOME AND SAVING
Page 2

U.S. private saving (not corrected for inflation)

Source: BEA table 5.1, "Gross private saving," accessed May 2024.

An equation for private saving

- *Private saving*
  = personal saving + business saving.
  = total income + transfers - taxes - consumption.
- Let T = taxes - transfers.
- Thus private saving = _____ .

What are "transfer payments"?

- Payments by the government to individuals that do not involve the purchase of a good or service.
- Transfer payments include

Government saving

- Governments save when they spend less than their income (taxes).
- Budget surplus: taxes > spending.
- Budget deficit: taxes < spending.

An equation for government saving

- *Government spending* = government purchases (G) + transfer payments.
- Again, let T = taxes - transfers.
- *Government saving*
  = taxes – spending
  = taxes – transfers – gov't purchases
  = _____

An equation for government saving

- *Government spending* = government purchases (G) + transfer payments.
- Again, let T = taxes - transfers.
- *Government saving*
  = taxes – spending
  = taxes – transfers – gov't purchases
  = T - G____ .

INCOME AND SAVING
Page 3

Government saving (cont'd)

- Note that government purchases (G) are treated like consumption in defining government savings.
- Saving by U.S. federal government has almost always been _____ except briefly in late 1990s.
- Negative in most other countries, too.

Government saving (not corrected for inflation)
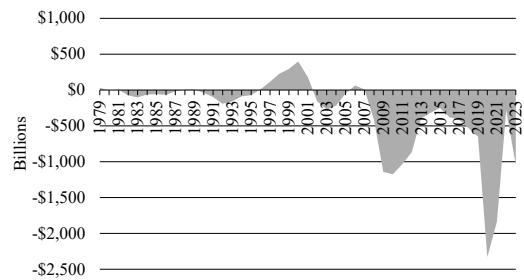
Source: BEA table 5.1, "Gross government saving," accessed May 2024.

Government saving (not corrected for inflation)
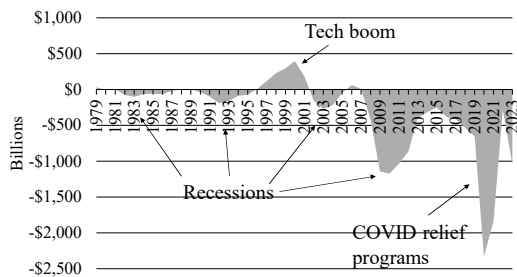
Source: BEA table 5.1, "Gross government saving," accessed May 2024.

National saving

- *National saving (S)* = net saving by a country.
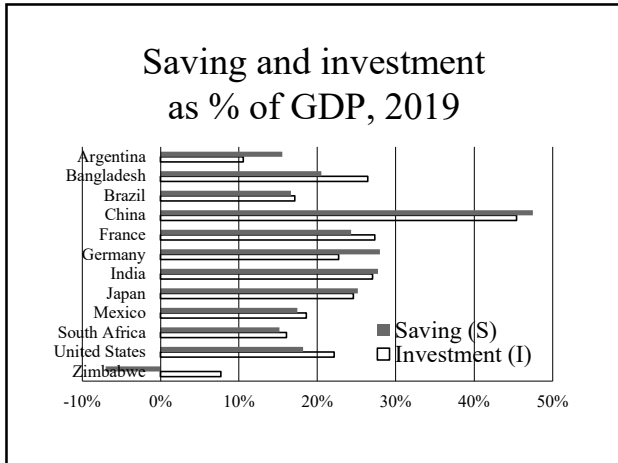 = private saving + government saving.
  = (Y - T - C) + (T - G).
  = _____ .

An important identity

- Saving, investment, and net exports are related by definition:
  S = Y - C - G
    = (C + I + G + X) - C - G
    = _____ .
- In words, *whatever output people and their government do not consume must be either investment or _____ .*

Saving, investment, and net exports

- Can rewrite equation as: S - I = X.
- If a country saves more than it invests, it must necessarily export _____ than it imports.
- If a country saves less than it invests, it must necessarily export _____ than it imports.

INCOME AND SAVING
Page 4

Saving and investment as % of GDP, 2019

Saving (S)
Investment (I)

Conclusions

- *National saving* consists of *private saving,* and *government saving*.
- By definition, national saving equals GDP minus consumption and government purchases: = _____.
- Therefore, national saving minus investment equals net exports: _____.

REAL GDP VERSUS NOMINAL GDP
Page 1

REAL GDP VERSUS NOMINAL GDP

- How can we separate changes in output from changes in prices?

Changes in output

- Imagine that an economy produces only one final good, say, pizzas.
- In year 2020, 100 pizzas are produced and sold at a price of $10.
  - GDP = _____.
- In year 2021, 105 pizzas are produced and sold at a price of $12.
  - GDP = _____.

Measuring changes in output

- So GDP increased by _____.
- But did output increase by this amount?
- No. The increase in GDP reflected both the increase in output and the increase in _____ (inflation).
- The increase in output was only _____.

Real* and nominal GDP

- _____ *GDP* = value of output of goods and services, corrected for inflation.
- _____ *GDP* = GDP without correcting for inflation. Same as GDP as defined earlier in this course.

*The word "real" comes from the Latin "res," meaning "thing."

Changes in production with more than one good

- Imagine an economy where two goods are produced, say, apples and pocket calculators.
- We have data on quantities of both goods for two years.
- We want to measure the overall change in output quantities: real GDP.

How much has real GDP increased?

	Apples	Calculators
2020	100 lbs	25
2021	102 lbs	28
% increase		

- We could average the two %s.
- But apples and calculators are not equally important. We need to know *prices*.

REAL GDP VERSUS NOMINAL GDP
Page 2

First compute nominal GDP = price × quantity in same year

	Apples		Calculators	
	Quantity	Price	Quantity	Price
2020	100	$2	25	$12
2021	102	$6	28	$16

	At constant 2020 prices	At constant 2021 prices
Value of 2020 output quantities		
Value of 2021 output quantities		

Growth rate of nominal GDP

- So nominal GDP grew by
$$\frac{1060 - 500}{500} = \underline{\hspace{1cm}}$$

	At constant 2020 prices	At constant 2021 prices
Value of 2020 output quantities	$500	
Value of 2021 output quantities		$1060

Second, compute price × quantity in different years

	Apples		Calculators	
	Quantity	Price	Quantity	Price
2020	100	$2	25	$12
2021	102	$6	28	$16

	At constant 2020 prices	At constant 2021 prices
Value of 2020 output quantities	$500	
Value of 2021 output quantities		$1060

Third, compute growth rates of GDP in constant prices

- At 2020 prices: $\frac{540-500}{500} =$
- At 2021 prices: $\frac{1060-1000}{1000} =$

	At constant 2020 prices	At constant 2021 prices
Value of 2020 output quantities	$500	$1000
Value of 2021 output quantities	$540	$1060

Growth rate of real GDP

- Should we use the growth rate in constant 2020 prices (8%) or the growth rate in constant 2021 prices (6%)?
- Method used by BEA takes the _____ of the two growth rates in constant prices.
- $\frac{8\%+6\%}{2} =$

How to compute real GDP itself

- First, compute growth rate of real GDP as above.
- Then, pick a "base year." Set real GDP = nominal GDP in base year.
- Third, use growth rates to compute real GDP for every year afterwards:
real GDP_{t+1} = real $GDP_t \times (1 + $ growth rate$)$.

REAL GDP VERSUS NOMINAL GDP
Page 3

How to compute real GDP itself: example

- Let 2020 be the base year for this example.
- Then for 2020 only, real GDP = nominal GDP = $_____ (calculated earlier).
- Growth rate of real GDP from 2020 to 2021 was _____ .
- Therefore real GDP in 2021 = $500 × (1+0.07) = _____ .

Use growth rates to compute real GDP

- Suppose we computed the growth rate of real GDP from 2021 to 2022 to be 10%.
- Then real GDP for 2022 = (real GDP in 2021) × (1+ 0.10) = $535 × (1.10) = _____ .
- Similarly, would use growth rate from 2022 to 2023 to compute real GDP in 2023.

"Chaining" values of real GDP

- Like chaining daisies, each value of real GDP is "chained" onto previous one using growth rate.
- Result sometimes called "GDP in chained dollars."

Year	Growth rate	Real GDP
2020		$500
2021	7%	
2022	10%	

U.S. real and nominal GDP Base year = _____
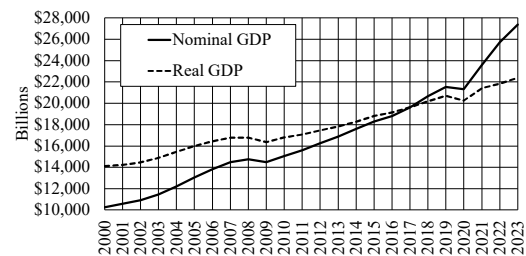
Source: BEA tables 1.1.5 and 1.1.6, accessed May 2024.

Summary: nominal GDP

- *Nominal GDP* = GDP as defined earlier in the course = quantities × prices from the *same year*.
- Also called "GDP in current dollars."
- Changes in nominal GDP reflect changes in both output _____ and _____ .

Summary: real GDP

- *Real GDP* = GDP adjusted for inflation.
- Also called "GDP in constant dollars" or "GDP in chained [*base year*] dollars."
- Changes in real GDP reflect only changes in _____ .

REAL GDP VERSUS NOMINAL GDP
Page 4

Conclusions

Real GDP is GDP, adjusted for _____ .
Compute it as follows:
- First, compute % growth of value of production using both new and old prices.
- The growth rate of real GDP is the _____ of the two answers.
- Second, pick a *base year*. Use growth rates to compute real GDP in later years.

MEASURING INFLATION
Page 1

MEASURING INFLATION

- With prices of various goods rising at different rates, how can we measure the rate of inflation?

Changes in prices

- Imagine that an economy produces only one final good, say, pizzas.
- In year 2020, the price was $10.
- In year 2021, the price was $12.
- Then rate of inflation is just the percent increase in price: $\frac{12-10}{10} =$

Inflation with more than one good

	Apples	Calculators
2020	$2	$12
2021	$4	$16
% increase		

- We could average the two %s.
- But apples and calculators are not equally important. Their quantities should matter.

The "price level"

- In reality, the economy consists of many goods, whose prices change at different rates.
- Inflation = percent change in the *overall price level.*
- So to measure inflation, must first measure the overall price level.

Price index: general definition

- *A measure of the price level of many goods.*
- Not a simple average of prices: weighs different goods in proportion to their importance.
- Scaled to equal _____ in the index's *base year*.

GDP price index: definition

- *A measure of the price level of all final goods produced in the economy.*
- Computed by the U.S. Bureau of Economic analysis as:

  GDP PI =

MEASURING INFLATION
Page 2

GDP price index: definition

- *A measure of the price level of all final goods produced in the economy.*
- Computed by the U.S. Bureau of Economic analysis as:

$$\text{GDP PI} = \frac{\textbf{Nominal GDP}}{\textbf{Real GDP}} \times \textbf{100}$$

GDP price index for U.S.

	Nominal GDP (billions)	Real GDP (billions)	GDP price index
2016	$18,805	$19,142	
2017	$19,612	$19,612	
2018	$20,657	$20,194	
2019	$21,521	$20,692	

- Here, _____ is the *base year* because nominal GDP = real GDP in that year.

Source: BEA, tables 1.1.5 and 1.1.6, May 2024.

Computing inflation from a price index

	GDP price index	Inflation rate (percent change)
2021	110.2	
2022	118.0	$\frac{118.0 - 110.2}{110.2} =$
2023	122.3	$\frac{122.3 - 118.0}{118.0} =$

Source: BEA, tables 1.1.5 and 1.1.6, May 2024.

Another way to compute inflation

- Inflation = percent change in price index.
- Now GDP PI = $\frac{Nominal\ GDP}{Real\ GDP} \times 100$.
- If percent changes are small, we can use the approximation rule for ratios,

$$\begin{array}{ccc} \%\ change & \%\ change\ in & \%\ change \\ in\ GDP\ PI & \approx\quad nominal\ GDP & in\ real\ GDP \end{array}$$

Computing inflation from growth rates: example

- Suppose the annual growth rate of nominal GDP is 5 percent and the growth rate of real GDP is 3 percent.
- Then the rate of inflation, measured by the GDP price index, is _____ percent.

Computing inflation from a growth rates: U.S. data

	Growth rate nominal GDP	Growth rate real GDP	Inflation rate
2018	5.3%	3.0%	
2019	4.2%	2.5%	
2020	-0.9%	-2.2%	

Source: BEA, tables 1.1.5 and 1.1.6, May 2024.

MEASURING INFLATION
Page 3

What if we do not have data on quantities?

- To compute real GDP, we used quantities and prices for each year.
- Sometimes we know prices for each year, but not quantities.
- Example: The Consumer Price Index must be calculated every month *without* information about the most recent quantities consumers are purchasing.

Fixed-weight price index: definition

$$= \frac{\begin{bmatrix} cost\ of\ base\ year\ combination \\ of\ goods\ at\ this\ year's\ prices \end{bmatrix}}{\begin{bmatrix} cost\ of\ base\ year\ combination \\ of\ goods\ at\ base\ year\ prices \end{bmatrix}} \times 100$$

- Note that base-year combination of goods is used in both numerator and denominator.
- Value of index in base year is always_____.

Example of fixed-weight index

- Suppose we know that a combination of 2 pants and 3 shirts were purchased in 2019.
- We know prices (but not quantities) in later years.

	Pants price	Shirt price	Total cost of 2019 quantities
2019	$30	$20	
2020	$40	$20	
2021	$50	$25	

Example of fixed-weight index (cont'd)

	Total cost of 2019 combination	Price index (base year = 2019)
2019	$120	100.0
2020	$140	
2021	$175	

Computing inflation from a fixed-weight index

	Price index (base year =2019)	Inflation rate (percent change)
2019	100.0	
2020	116.7	(116.7-100.0)/100.0 = %
2021	145.8	(145.8-116.7)/116.7 = %

Some well-known fixed-weight price indexes

- *Consumer Price Index (CPI):* measures price level of goods consumers buy.
- *Producer Price Index (PPI):* measures price level of all goods produced.
- Both calculated by the U.S. Bureau of Labor Statistics.

MEASURING INFLATION
Page 4

Price indexes differ by *coverage*, as well as by method of calculation

What is covered by the index?	CPI	PPI	GDP PI
Consumer goods...			
produced in U.S.	Yes	Yes	Yes
imported	Yes	No	No
Plant and equipment	No	Yes	Yes
Intermediate goods	No	Yes	No
Government purchases	No	Some	Yes

U.S. price indexes since 1980: What are the base years?

Source: FRED, May 2024.

U.S. inflation rates since 1950
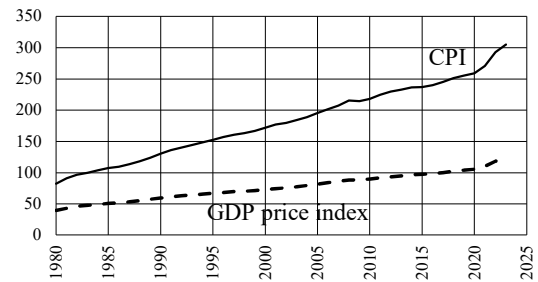
Converting an old price into today's dollars

- Just multiply the price by the ratio:
  price index today / price index in old year.
- Example: Original IBM PC cost about $1500 when introduced in 1981.
- Consumer price index was 90.9 in 1981, is about 320 now (base year = 1982-84).
- Price of IBM PC in today's dollars = $1500 × (320/90.9) = $_____ .

Conclusions

- To measure inflation, an index is needed to measure the overall *price level*.
- The *GDP price index* is the ratio of _____ GDP to _____ GDP ×100.
- A *fixed-weight* index measures the current cost of some fixed combination of goods relative to its cost in some base year.
- The *rate of inflation* is the annual _____ increase in the price index.

INTERNATIONAL COMPARISONS OF GDP

Page 1

INTERNATIONAL COMPARISONS OF GDP

- How can we compare GDP in different countries?

2017 GDP per capita in local currency

Source: World Bank, ICP 2017, https://www.worldbank.org/en/programs/icp.
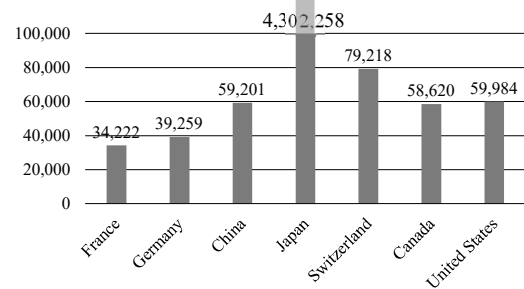
Comparing GDP across countries

- To compare GDP of different countries, must evaluate GDP of both countries in terms of the same currency.
- *Exchange rate* = rate at which values in one currency may be converted to another.

Markets for foreign exchange

- In foreign exchange markets, people trade dollars for other currencies, such as euros.
- Importers use dollars they receive from their customers to _____ euros, so they can pay their suppliers in Europe.
- Exporters use euros they receive from their customers to _____ dollars, so they can pay their employees.

The market exchange rate

- *Market exchange rate* = market price of one currency in terms of another.
- Example: In 2017, the market exchange rate for the dollar in terms of Japanese yen was about 112 yen per U.S. dollar.

Using the market exchange rate

- Let's compute GDP per capita in Japan using the market exchange rate.
- Divide: ¥4,302,258 by (¥112/$1) to get: $ _____.

INTERNATIONAL COMPARISONS OF GDP
Page 2

2017 GDP per capita in U.S. dollars at market exchange rates

Source: World Bank, ICP 2017, https://www.worldbank.org/en/programs/icp.
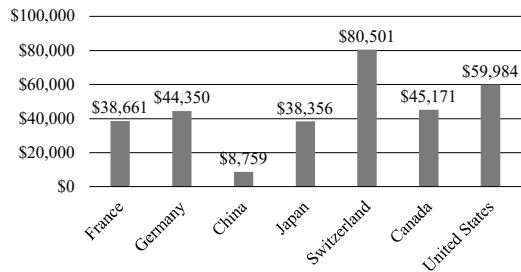
Another exchange rate

- *Purchasing power parity (PPP) exchange rate* = ratio of the cost of goods actually bought in the two countries.
- Often different from market exchange rate.
- If higher than market exchange rate, cost of living is "expensive" in that country.
- If lower, then cost of living is "cheap."

PPP exchange rate

- Example: How many Japanese yen would have the same *purchasing power* in Japan as one dollar has in the United States?
- A recent estimate showed that a basket of consumer goods that cost $100 in the U.S. would cost ¥10,538 in Japan.
- Therefore the PPP exchange rate = (¥10,538/$100) = (¥ _____ / $1).

Source: World Bank, ICP 2017, https://www.worldbank.org/en/programs/icp.

Using the PPP exchange rate

- To compare the standard of living in two countries, the PPP exchange rate is more useful than the market exchange rate.
- Now let's compute GDP per capita in Japan using the PPP exchange rate.
- Divide: ¥ 4,302,258   by (¥ 105.38/$1) to get: $ _____.

2017 GDP per capita in U.S. dollars at PPP exchange rates

Source: World Bank, ICP 2017, https://www.worldbank.org/en/programs/icp.
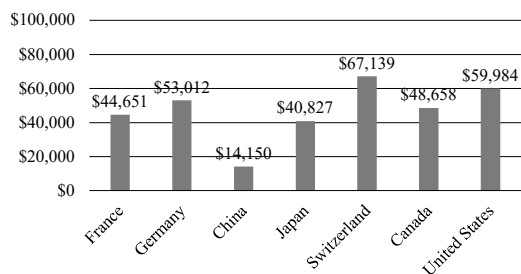
Hint on using exchange rates

- Exchange rates can be expressed as
  - foreign currency per dollar (as above) or
  - dollars per foreign currency.
- You can avoid errors if you *keep the currency symbols* in all calculations.
- Example: to convert ¥500 to dollars, divide by exchange rate in yen per dollar (¥/$), or multiply by exchange rate in dollars per yen ($/¥).
- If you used the exchange rate correctly, the ¥ symbols cancel and you are left with _____.

INTERNATIONAL COMPARISONS OF GDP
Page 3

Conclusions

- To compare GDP across countries, one must convert all numbers to the same currency using an exchange rate .
- The _____ exchange rate is the market price of once currency in terms of another.
- The _____ (PPP) exchange rate is the ratio of the cost of similar goods bought in the two countries.

PART 3

Long-Run Economic Growth and Inflation

Big ideas: The total productive capacity of a country (potential GDP) depends on available land, capital, labor, and technology. Very high inflation is caused by very high growth rate of the money supply.

Famous quote: "Is there some action a government of India could take that would lead the Indian economy to grow like Indonesia's or Egypt's? If so, *what*, exactly? If not, what is it about the 'nature of India' that makes it so. The consequences for human welfare involved in questions like these are simply staggering: Once one starts to think about them, it is hard to think about anything else."
-- Robert Lucas, "On the mechanics of economic development" (1988) [Nobel Prize 1995]

Another famous quote: "Inflation is always and everywhere a monetary phenomenon."
--Milton Friedman, *Inflation: Causes and Consequences* (1963) [Nobel Prize 1976]

THE AGGREGATE PRODUCTION FUNCTION
Page 1

THE AGGREGATE PRODUCTION FUNCTION

•What determines real GDP?

What drives the economy in the long run?

- This section of course is on long-run growth.
- *Potential GDP* = long run trend of real GDP = how much economy CAN produce.
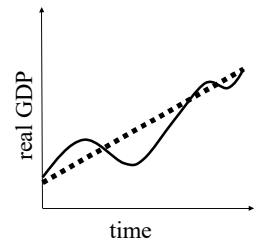
Recall concept of a production function

Production function = relationship between the quantity of inputs and the quantity of output. Inputs include

- Labor = _____
- Capital = _____
- Land = _____
- Materials (or intermediate inputs).

An aggregate production function

- Macroeconomics assumes that potential GDP depends on total available inputs in the entire economy:
  GDP = F (labor, capital, land).
- Materials (or intermediate inputs) are omitted because they are included in GDP (final output).

GDP = F (labor, capital, land)

- *Available* inputs (labor, capital, and land) determine potential GDP.
- Inputs *actually used* determine actual GDP—that is, fluctuations.
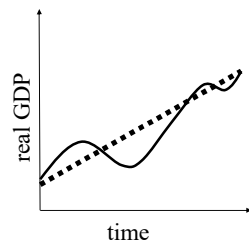
No inputs, no output

- Some people think spending determines GDP.
- Spending affects whether inputs (workers, machinery, etc.) are actually used.
- But if the inputs are not available, _____ can be produced.

THE AGGREGATE PRODUCTION FUNCTION
Page 2

Early economies:
GDP = F (labor, land)

- In the ancient world and the Middle Ages, capital was almost nonexistent.
- Land and labor were by far the most important inputs. Almost everyone worked in _____.
- Land was usually fixed, but labor could increase or decrease.

After the industrial revolution:
GDP = F (labor, capital, land)

- After the industrial revolution, which began in the 1800s in Britain, capital became increasingly important.
- Modern macroeconomic models often ignore land because it does not usually change: GDP = F (labor, capital).

Technology, too

- In economics, "technology" means "know-how."
- As technology advances, people learn to produce _____ output with the same inputs— they "work smarter."
- About 70 years ago, economists realized that technology was very important for economic growth: GDP = F (labor, capital, technology).

Conclusions

- Potential GDP depends on total available inputs (_____) in the entire economy.
- Actual GDP depends on inputs actually used.
- Capital is important in modern economies.
- Land is usually fixed, but technology advances, so the aggregate production function is written GDP = F (_____).

THE GROWTH MODEL OF THOMAS MALTHUS
Page 1

THE GROWTH MODEL OF THOMAS MALTHUS

- Are there limits to growth?
- Is economic growth accelerating or decelerating?

Economic growth

- Economic growth has fascinated economists since the time of Adam Smith.
- Many people have suggested that economic growth faces an upper limit.
- Thomas Malthus articulated this view in 1798.

Thomas Robert Malthus, *An Essay on the Principle of Population,* 1976 [1798], New York: Norton.

Early economies: GDP = F (labor, land)

- Thomas Malthus lived at the beginning of the industrial revolution, when capital was still almost nonexistent.
- Land and labor were by far the most important inputs. Almost everyone worked in _____.

Malthus's key assumptions

1. Available land is fixed. Labor is the only variable input. So write GDP = F (labor).
2. Labor is subject to _____ returns.
3. The level of output required to sustain the population is _____ to population size.

Graphing the aggregate production function

- Write aggregate production function as: GDP = F(L).
- Graph production function as upward-sloping curve.
- Diminishing returns to labor implies slope _____ as L increases.

GDP = Output

L = Labor input

Subsistence in the Malthusian model

- Suppose the subsistence level of output per person is fixed quantity a.
- Labor force is some fraction b of the total population: $L = b \times POP$.
$$POP = (1/b)\ L$$
- Total output required to sustain a given labor force is thus: $GDP = a \times POP$ = _____.

THE GROWTH MODEL OF THOMAS MALTHUS
Page 2

Graphing the subsistence line in the Malthusian model

- Subsistence line shows output required to sustain any given level of labor input.
- Graph of GDP=(a/b) L is an upward-sloping line through origin.
- Slope = _____.

GDP =Output

L = Labor input
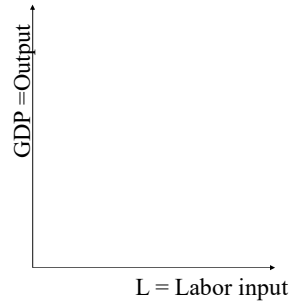
What if output is *above* the level required for subsistence?

- This occurs at any L where the aggregate production function is above the subsistence line.
- In that case, Malthus said population and L must _____.

GDP =Output

Subsistence line

Production function

L = Labor input
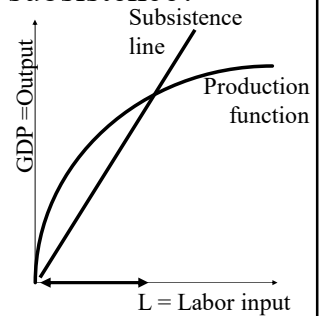
What if output is *below* the level required for subsistence?

- This occurs at any L where the aggregate production function is below the subsistence line.
- In that case, Malthus said population and L must _____.

GDP =Output

Subsistence line

Production function

L = Labor input
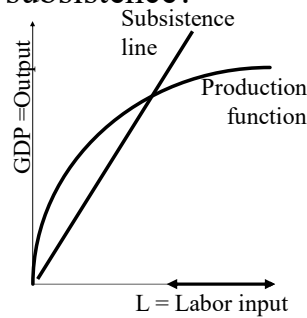
Malthus's dismal conclusion

- Output always converges to the subsistence level _____.
- Output per worker (productivity) converges to GDP/L = _____.
- "Iron Law of Wages"

GDP =Output

Subsistence line

Production function

L = Labor input
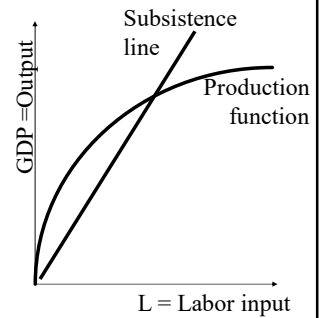
What if the production function shifted up?

- What if new land were brought under cultivation?
- Eventually, population would _____ and output per worker (productivity) would converge to _____.

GDP =Output

Subsistence line

Production function

L = Labor input
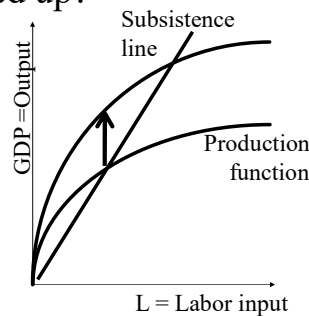
Quote from Malthus

"Must it not then be acknowledged ...

"That the increase of population is necessarily limited by the means of subsistence,

"That population does invariably increase when the means of subsistence increase. And that the superior power of population is repressed, and the actual population kept equal to the means of subsistence, by misery and vice."

Thomas Robert Malthus, *An Essay on the Principle of Population*, Norton Critical Edition, edited by Philip Appleman, 1976, p. 56 [originally published 1798].

THE GROWTH MODEL OF THOMAS MALTHUS
Page 3

Early economies

- Malthus's model fits the facts pretty well.
- Studies of ancient and medieval economies have shown that over centuries, output per worker and daily wages hardly changed.

Real GDP per capita, 2011 $

China
Egypt
India
United Kingdom

$4,000
$3,500
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0

1000 1100 1200 1300 1400 1500 1600 1700

Source: Maddison Project Database.

The industrial revolution

800
700
600
500
400
300
200
100
0

Real Wage (1860s = 100)

1200 1300 1400 1500 1600 1700 1800 1900 2000

FIG. 1.—Builders' real day wages, 1209–2004 (source: table A2)

Source: Clark, G. (2005). The Condition of the Working Class in England, 1209–2004. *The Journal of Political Economy*, 113(6), pp. 1307-1340.

After the industrial revolution

- GDP per capita fluctuates from year to year.
- But in the long run, GDP per capita tends to _____, not remain constant.
- Moreover, the growth rate of GDP per capita has been _____ over the last few hundred years.
- There do not seem to be limits to growth.

Contrary to Malthus, productivity growth has _____, not decreased, since the industrial revolution

Productivity growth of fastest-growing economies

3%
2%
1%
0%
-1%

Netherlands 1700-1785 | UK 1785-1820 | US 1820-1890 | US 1890-2000

Also contrary to Malthus, total fertility has _____ worldwide in recent years

7
6
5
4
3
2
1
0

☐ 1965-70
▨ 2015-20

Brazil   Italy   Mexico   S. Korea   U.S.

Source: U.N. Department of Economic and Social Affairs, World Population Prospects 2019.

Conclusions

- Malthus concluded that output per capita would always return to _____ level: the "*iron law of wages*."
- Malthus's model fits the facts for ancient and medieval economies.
- But since the industrial revolution, output per capita has _____ at an increasing rate and recently fertility has decreased.

OUTPUT AND CAPITAL
Page 1

OUTPUT AND CAPITAL

•Why is the capital stock important?

Potential GDP depends on inputs

- Total amount that the economy can produce depends on available inputs through the *aggregate production function*:
- Potential GDP = F (L, K, T), where
  L = _____ = total hours of all workers.
  K = _____ = factories, equipment, etc.
  T = _____ = available know-how.

Capital

- We will study L and T later, but first we study K, capital input.
- Capital in economics includes _____
  _____
  _____
  _____
- Sometimes called "physical capital" or "economic capital" to distinguish from financial capital (stocks, bonds, etc.).

Which workers will get more work done?

- Workers building roads with shovels.
- Workers building roads with backhoes.

Which workers will get more work done?

- Workers transporting goods with small vehicles.
- Workers transporting goods with big trucks.

Which workers will get more work done?

- Workers accessing information from paper files.
- Workers accessing information from computers.

OUTPUT AND CAPITAL
Page 2

Which workers will get more work done?

- Workers farming with horses or oxen.
- Workers farming with tractors.

More capital, more output

- Workers who can use machinery, equipment, vehicles, computers, and software can get *much more work* done.
- _____ goods help people produce more goods.
- Countries that have more capital per worker can produce more output per worker.

Investment in new capital increases potential GDP

- The faster the capital stock grows, the faster total output can grow.
- For example, total output grows faster if point _____ is chosen.
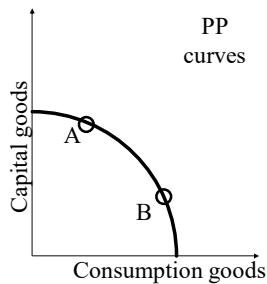
Conclusions

- Workers can produce more goods and services if they have more economic _____ to work with.
- An increase in the stock of capital raises the aggregate _____ function.
- If we choose to invest in new capital now, the economy's production possibility curve will shift out _____ in the future.

MEASURING INVESTMENT
Page 1

MEASURING INVESTMENT

- What do economists mean by "gross" and "net" investment?
- How is investment related to the capital stock and economic growth?
- How much of GDP is investment?

What is the economic definition of investment?

- *Investment (I)* = production of new economic (or physical) capital.
- This is different from the finance definition.
- Distinguish:
  - *Gross investment* = all new capital produced.
  - *Net investment* = gross investment minus _____

The flow of investment and the stock of capital

- From one year to the next, the capital stock grows by the amount of *net* investment.
- Next January 1's capital stock =

Last January 1's capital stock	This year's gross investment	This year's depreciation

---

What "I" in the national accounts includes

- Officially called "gross private domestic investment." Components are:
  - Business fixed investment:
    - _____.
    - _____.
  - Residential structures
  - Increase in business inventories

Components of I: "gross private domestic investment"
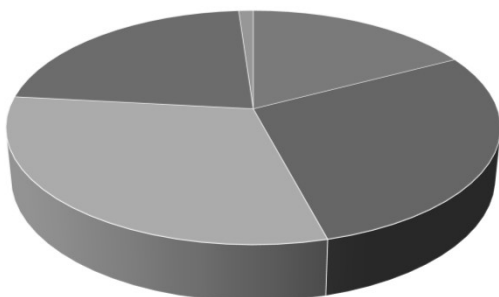
Source: BEA, table 1.1.5, May 2024. Data are for 2023.

What "I" in the national accounts does *not* include

Some goods that add to future output are *not* included in I:
- government investment in infrastructure.
  - examples: _____
- consumer durables.
  - examples: _____

MEASURING INVESTMENT
Page 2

Investment's share of GDP

- Since GDP = Y = C + I + G + X, then:

$$100\% = \frac{C}{Y} + \frac{I}{Y} + \frac{G}{Y} + \frac{X}{Y}$$

- Since end of World War II, investment's share of GDP
  - has averaged around 17%.
  - has varied between 14% and 20%.

Trends in GDP shares
(excluding net exports)
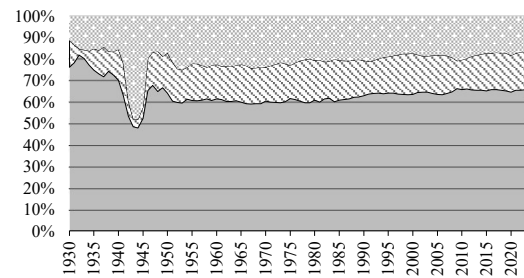
Source: BEA, table 1.1.5, May 2024. Net exports omitted.

Conclusions

- *Gross investment* (I) is spending for new
  _____.
- *Net investment* subtracts _____.
- The *capital stock* grows by the amount of
  _____*investment*.
- Investment's share of GDP in the U.S. has been roughly _____ since the late 1940s.

THE INTEREST RATE AS AN OPPORTUNITY COST
Page 1

THE INTEREST RATE AS AN OPPORTUNITY COST

- What is the opportunity cost of consumption?
- How is it affected by the interest rate?

Consumption

= spending by consumers on
- durable goods like _____.
- nondurable goods like _____.
- services like _____.

Consumption: now or later?

- Consumption (C) = disposable income - savings.
- But savings are used for _____ consumption.
- So people's decisions about consumption are really decisions about whether to consume _____ or in the _____.

People respond to opportunity costs

- The opportunity cost of consumption now is sacrificed consumption in the future.
- If the opportunity cost of consumption now increases, they consume _____.
- If the opportunity cost of consumption now decreases, they consume _____.

What is the opportunity cost of consumption now?

- Suppose a consumer is choosing whether to consume a dollar now or save it for consumption next year.
- If the interest rate is r, then a dollar of consumption foregone now grows to _____ dollars next year.
- So the opportunity cost of a dollar of consumption now is _____ dollars of consumption next year.

The opportunity cost of consumption next year

- Conversely, suppose the consumer is planning for consumption next year.
- To consume an additional dollar next year, one must save an addition _____ dollars now.
- So the opportunity cost of a dollar of consumption next year is: _____ dollars of consumption now.

THE INTEREST RATE AS AN OPPORTUNITY COST
Page 2

Opportunity cost of consumption now rises as the interest rate rises

- What is the opportunity cost of consuming $1000 now?
- How much consumption next year would be sacrificed?

Interest rate	Formula	Answer
3%	1000 (1.03)	
5%	1000 (1.05)	
8%	1000 (1.08)	

Effect of the interest rate over longer periods

- The effect of the interest rate on opportunity cost is stronger as comparisons are made over longer periods.
- If the interest rate is r, then a dollar of consumption foregone now grows in n years to _____ dollars.

Opportunity cost of consumption now rises as the interest rate rises

- What is the opportunity cost of consuming $500 now?
- How much consumption **20 years** from now would be sacrificed?

Interest rate	Formula	Answer
3%	$500 (1.03)^{20}$	
5%	$500 (1.05)^{20}$	
8%	$500 (1.08)^{20}$	

Consumption and the interest rate

- Consumption now is therefore negatively related to the interest rate.
- As the interest rate rises, people consume _____ and save _____ .
- As the interest rate falls, people consume _____ and save _____ .

Conclusions

- The opp. cost of $1 of consumption now =
  - _____ dollars of consumption next year,
  - or _____ dollars of consumption, n years from now.
- The opportunity cost of consumption now _____ as the interest rate rises.
- Therefore, as the interest rate rises, people consume less and save more.

GDP SPENDING COMPONENTS AND THE INTEREST RATE
Page 1

GDP SPENDING COMPONENTS AND THE INTEREST RATE

- How does the interest rate affect consumption, investment, and net exports?

Inputs to potential GDP

- Potential GDP depends on the amount of inputs available: labor, _____, and technology.
- But what determines the amount of capital in the economy?
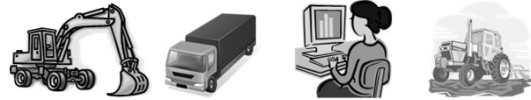
Capital available today depends on past investment spending

- But what determines the amount of investment spending?
- Many things, but among the most important is the _____.
- In fact, the _____ affects all 3 non-government spending components of GDP to some extent.

Effect of the interest rate on consumption

- An increase in the interest rate raises the opportunity cost of consumption today.
- Thus, the interest rate has a _____ effect on consumption.
- Conversely, the interest rate has a _____ effect on savings.

The consumption share curve

- C/Y is negatively related to r, ceteris paribus.
- Other things affecting consumption can shift the curve.

r

C/Y
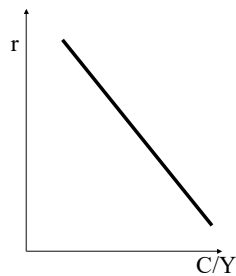
Rightward shifts in the consumption share curve

The C/Y curve shifts right if
- people's wealth increases.
- population ages so fewer people are saving for retirement.
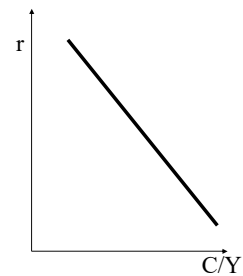
r

C/Y

GDP SPENDING COMPONENTS AND THE INTEREST RATE
Page 2

Leftward shifts in the consumption share curve

The C/Y curve shifts left if
- income tax were replaced by a consumption tax.
- government adopts tax incentives for saving.
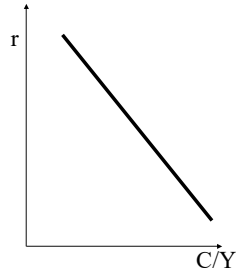
Effect of the interest rate on investment by firms

- When firms buy new plant and equipment, they typically *borrow* the necessary funds.
- At higher rates of interest, borrowing becomes more expensive, so they buy _____.
- The interest rate has a _____ effect on investment by firms.

Effect of the interest rate on residential investment by households

- When people buy new houses or condominiums, they usually take out a mortgage.
- At higher rates of interest, borrowing becomes more expensive, so they buy _____ houses and condominiums.
- The interest rate has a _____ effect on investment in housing.

The investment share curve

- I/Y is negatively related to r, ceteris paribus.
- Other things affecting investment can shift the curve.
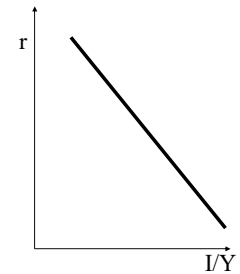
Rightward shifts in the investment share curve

The I/Y curve shifts right if
- business people became more optimistic about the future.
- government offers tax incentives for investment.
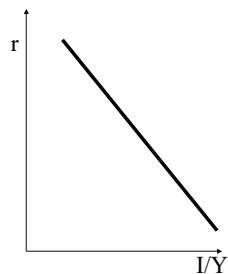
Leftward shifts in the investment share curve

The I/Y curve shifts left if
- business people became more pessimistic about the future.
- government eliminates tax deductions for mortgage interest.
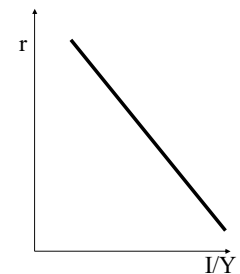
GDP SPENDING COMPONENTS AND THE INTEREST RATE
Page 3

The market exchange rate

- *Exchange rate* = price of a dollar in terms of foreign currency.
- Examples: Price of dollar recently was
  - _____ Euros
  - _____ Canadian dollars
  - _____ Japanese yen

Source: https://www.federalreserve.gov/releases/h10/current/, Dec 17, 2021.

What happens to the exchange rate as the interest rate rises?

- Bonds and bank accounts here become more attractive than bonds and bank accounts in other countries.
- International investors try to _____ foreign currency and _____ dollars to use to buy bonds in the U.S.
- Increasing demand for U.S. dollars causes the U.S. dollar to _____ (rise in price).

What happens to the exchange rate as the interest rate falls?

- Conversely, bonds and bank accounts here become less attractive than bonds and bank accounts in other countries.
- International investors try to _____ dollars and _____ foreign currency.
- Decreasing demand for U.S. dollars causes the U.S. dollar to _____ (fall in price).

Example: U.S. interest rate *lowered* by 0.5% on September 18, 2007

Price of a US dollar in terms of Canadian dollars

1.04
1.03
1.02
1.01
1.00

9/14/2007 9/15/2007 9/16/2007 9/17/2007 9/18/2007 9/19/2007

Price of a US dollar in terms of Euros

0.73
0.725
0.72
0.715
0.71

9/14/2007 9/15/2007 9/16/2007 9/17/2007 9/18/2007 9/19/2007
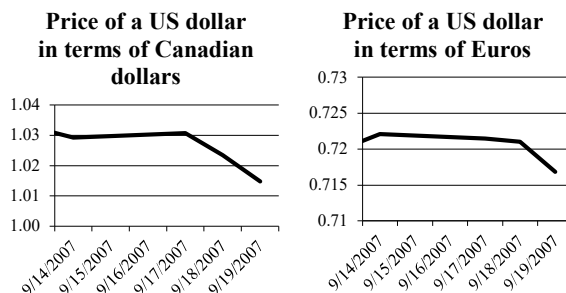
What happens to net exports as the exchange rate *rises*?

- Dollars and U.S.-made goods become relatively more expensive than foreign-made goods.
- Foreigners demand fewer U.S.-made aircraft, corn, software, etc., so exports _____.
- U.S. firms and households demand more foreign-made cars, clothes, etc., so imports _____.

What happens to net exports as the exchange rate *falls*?

- Dollars and U.S.-made goods become relatively less expensive than foreign-made goods.
- Foreigners demand more U.S.-made aircraft, corn, software, etc., so exports _____.
- U.S. firms and households demand fewer foreign-made cars, clothes, etc., so imports _____.
- Conclude: The exchange rate has a _____ effect on net exports.

GDP SPENDING COMPONENTS AND THE INTEREST RATE
Page 4

Effect of the interest rate on net exports

- Thus, if the interest rate rises, the exchange rate _____ and net exports _____.
- Conversely, if the interest rate falls, the exchange rate _____ and net exports _____.

| Interest rate | $\Rightarrow$ | Exchange rate | $\Rightarrow$ | Net exports |
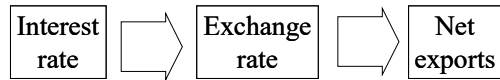
The net exports share curve

- X/Y is negatively related to r, ceteris paribus.
- Note: net exports X/Y can be positive or negative.
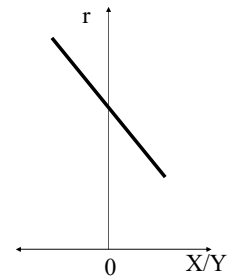
Which component of GDP is most sensitive to the interest rate?

- I is most sensitive.
- X is not as sensitive, but can change sign when the interest rate changes.
- C is somewhat sensitive, but probably less than either investment or net exports.
- G does not depend on the interest rate.
  - Depends on the political process.

Conclusions

- Consumption, investment, and net exports are each _____ related to the interest rate.
- _____ is the most sensitive to the interest rate, of all GDP components.
- Government purchases depend on the political process, not the interest rate.

HOW GDP SPENDING COMPONENTS ARE DETERMINED IN THE LONG RUN
Page 1

HOW GDP SPENDING COMPONENTS ARE DETERMINED IN THE LONG RUN

- How does G determine C, I, and X?
- Why is there a tradeoff between the size of government and economic growth?

Investment spending is critical to long-run economic growth

- Economic growth depends partly on how resources are allocated between

  - _____ spending on physical capital (I).
  - Other spending (C, G, X).

Production-possibility curve

Investment spending

Other spending
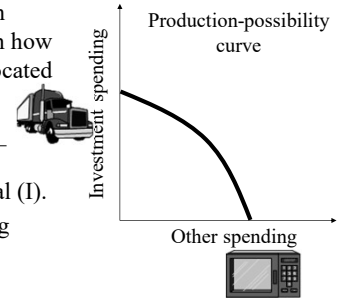
What determines the GDP components, such as investment?

- How are resources allocated between producing I versus producing C, G, and X?
- In a command economy, the government controls C, I, G, and X directly.
- In a market economy, the government controls only G.
- What determines C, I, and X in a market economy?

Preview of answer

- Total GDP (or "Y") is fixed by potential GDP—the aggregate production function.
- G/Y is fixed by the political process.
- C/Y, I/Y, and X/Y are then allocated by the real _____.

Graphical demonstration

- Define "nongovernment share" as sum of consumption share, investment share, and net exports share:
- NG/Y = C/Y + I/Y + X/Y
- Note that each right-hand side term is _____ related to r, the real interest rate.
- So NG/Y is also _____ related to r.

NG/Y curve is horizontal sum of C/Y, I/Y, and X/Y curves

C/Y   I/Y   X/Y   NG/Y
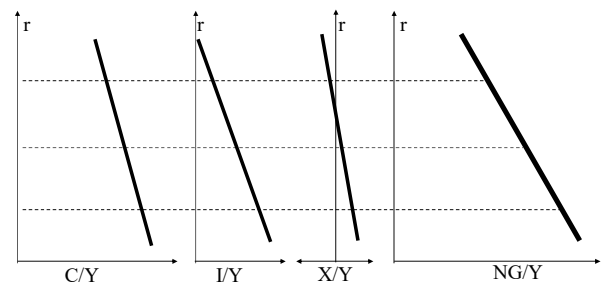
HOW GDP SPENDING COMPONENTS ARE DETERMINED IN THE LONG RUN
Page 2

Government share

- Meanwhile, the government share G/Y is decided by the legislative process.
- But that leaves   [100% - (G/Y)] available for the nongovernment share.
- Example: If G/Y = 20%, then nongovernment share must be _____.
- The interest rate adjusts to make all shares add up to 100 percent.

G/Y thus determines interest rate and thereby C/Y, I/Y, and X/Y
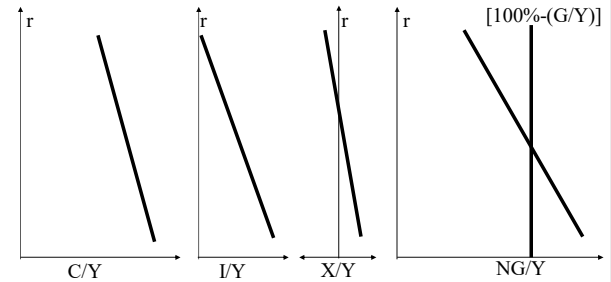
Algebraic demonstration

- Let Y denote total potential GDP.
- The nongovernmental share of GDP is:
  $(NG/Y) = (C/Y) + (I/Y) + (X/Y)$.
- Since all its parts are negatively related to the interest rate, NG/Y is also _____ related to the interest rate.

Algebraic demonstration (cont'd)

- But from another perspective, (NG/Y) must be given. Reasons:
- Government share (G/Y) is fixed by the political process.
- $(NG/Y) =$ _____.
- Something must give: the interest rate.
- Equilibrium interest rate r* is the value at which NG/Y exactly equals 100% - (G/Y).

Example 1

- Suppose:
  $(C/Y) = 75\% - r$.
  $(I/Y) = 25\% - 2r$.
  $(X/Y) = 5\% - r$.
- Then $(NG/Y) = (C/Y) + (I/Y) + (X/Y)$
  = _____
  = _____

Example 1: graph of NG/Y

- Note how (NG/Y) is negatively related to the interest rate here.
- Given (G/Y) we can find the fixed total value of (NG/Y) and solve for the equilibrium interest rate r*.
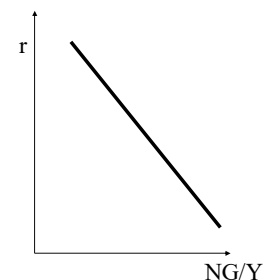
HOW GDP SPENDING COMPONENTS ARE DETERMINED IN THE LONG RUN
Page 3

Example 1: finding r*

- Suppose first that (G/Y) = 15%.
- Then (NG/Y) = 100% - 15% = _____ .
- Set this equal to 105% - 4 r   and solve to get   r* = _____

Example 1: graph of r*

- Thus we have found the equilibrium interest rate r*.
- We now insert this into the original share equations.

$[100\%-(G/Y)] = 85\%$

r

$r^*=5\%$

NG/Y
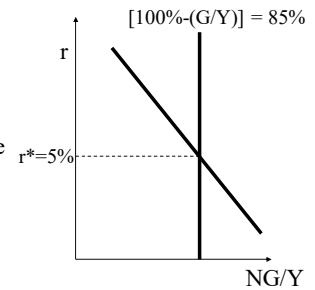
Example 1:
Finding C/Y, I/Y, and X/Y

- Insert r* = 5% into the original equations to get
  (C/Y) = 75% - r = _____
  (I/Y) = 25% - 2r = _____
  (X/Y) = 5% - r = _____

Example 2

- Keep the same equations for (C/Y), (I/Y) and (X/Y), but suppose that (G/Y) = 23%.
- Then (NG/Y) = 100% - 23% = _____ .
- Set this equal to 105% - 4 r   and solve to get   r* = _____ .
- Note how the increase in   G   has caused the interest rate to _____ .

Example 2:
Finding C/Y, I/Y, and X/Y

- Insert   r* = 7% into the original equations to get
  (C/Y) = 75% - r = _____
  (I/Y) = 25% - 2r = _____
  (X/Y) = 5% - r = _____

When G increases, the interest rate rises, and C, I and X _____ .

r   r   r   r $[100\%-(G/Y)]$

r^*

C/Y   I/Y   X/Y   NG/Y
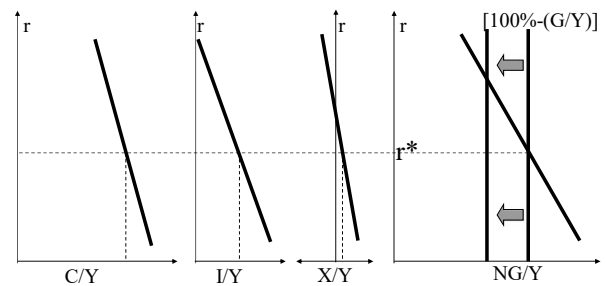
HOW GDP SPENDING COMPONENTS ARE DETERMINED IN THE LONG RUN
Page 4

Effects of increase in G

- I/Y decreases.
- Less spending on new physical capital, such as

  _____
  _____
  _____.

- Economic growth is

  _____.

Investment spending | Production-possibility curve

Other spending
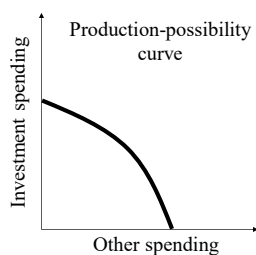
Effects of *decrease* in G

- I/Y increases.
- More spending on new physical capital, such as

  _____
  _____
  _____.

- Economic growth is

  _____.

Investment spending | Production-possibility curve

Other spending
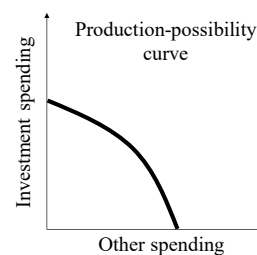
Conclusions

- In the long run, the larger the share of government purchases in GDP, the _____ the interest rate.
- The higher the interest rate, the _____ the shares of consumption, net exports and–critically– _____.
- Thus bigger government purchases can bring _____ economic growth.

SHIFTS IN NONGOVERNMENT SHARES
Page 1

SHIFTS IN NONGOVERNMENT SHARES

- How do shifts in nongovernment shares affect investment and economic growth in the long run?

Physical capital

- Workers who can use machinery, equipment, vehicles, computers, and software can get *much more work* done.
- The faster an economy accumulates physical capital, the _____ it grows.

Investment spending is critical for economic growth

- Investment = spending on new capital.
- Increases in investment spending cause _____ economic growth.
- Decreases in investment spending cause _____ economic growth.

Investment spending

Production-possibility curve

Other spending
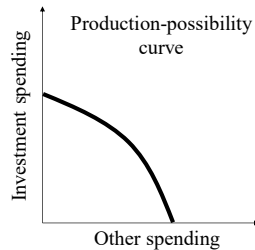
Shifts in (G/Y)

- In the last slideshow, we showed if G increases, the real interest rate r* increases and I _____.
- Similarly, if G decreases, r* decreases and I _____.

[100%-(G/Y)]

r

r*

NG/Y
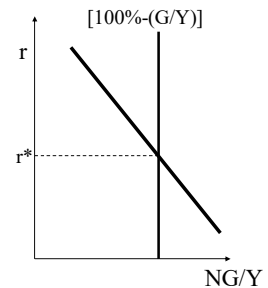
Shifts in (C/Y) or (I/Y)

- Other share curves can also shift.
- As they do, they cause the (NG/Y) curve to shift.
- This affects the real interest rate r*.

[100%-(G/Y)]

r

r*

NG/Y
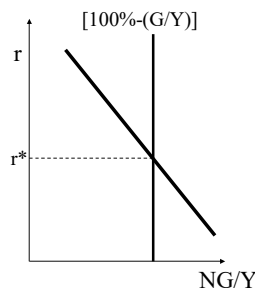
Shifts in (C/Y) curve

- Consumption share curve might shift _____ because of
  - increase in Social Security benefits,
  - aging of the population.
- Consumption share curve might shift _____ because of
  - new tax incentives to save,
  - switch from income tax to consumption tax.

SHIFTS IN NONGOVERNMENT SHARES
Page 2

Effect of rightward shift of (C/Y) curve
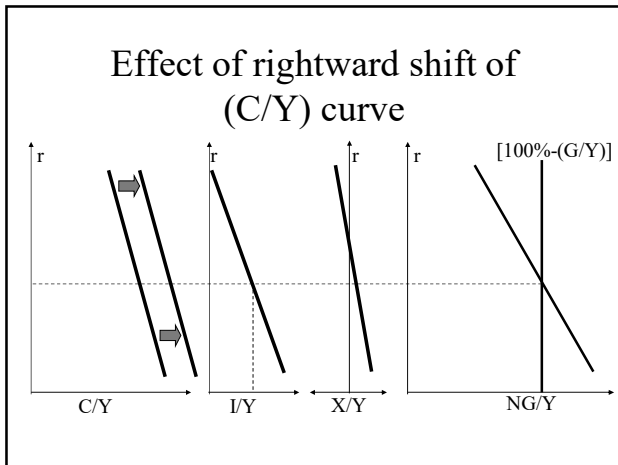
Effect of rightward shift in (C/Y) curve on investment spending

- (NG/Y) curve shifts right by same amount.
- r* _____.
- (I/Y) curve does *not* shift, but higher interest rate pushes economy up and to the left along this curve.
- Investment spending (I/Y) _____.
- Incidentally, net exports (X/Y) decrease.

Effect on future economic growth

- Less spending on new physical capital, such as _____
  _____
  _____.
- Workers will not become more productive as quickly.
- Economic growth is _____.

Production-possibility curve

Effect of leftward shift of (C/Y) curve
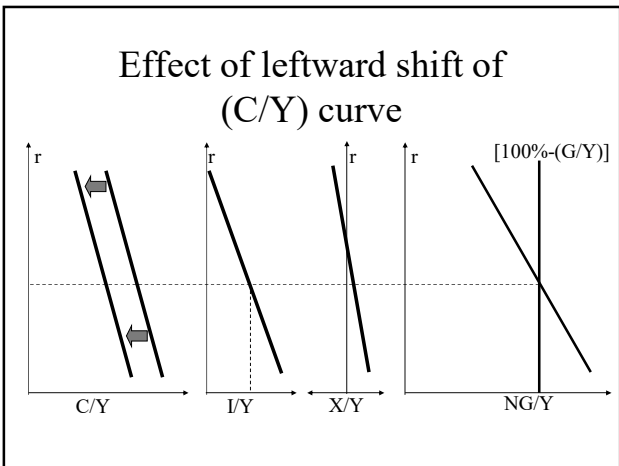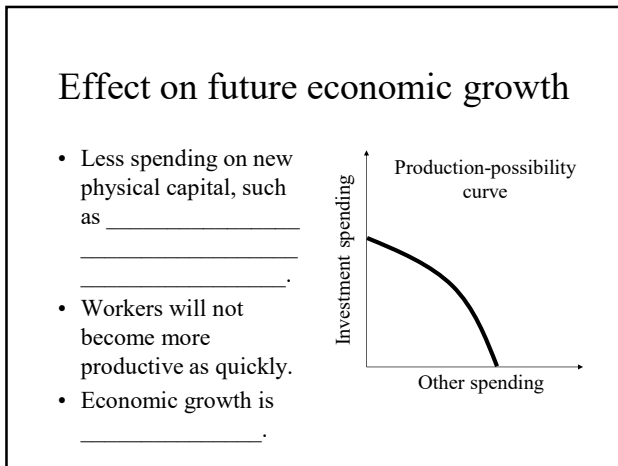
Effect of leftward shift in (C/Y) curve on investment and growth

- (NG/Y) curve shifts left by same amount.
- r* _____.
- Move along fixed (I/Y) curve to lower real interest rate.
- Investment spending _____.
- Economic growth is _____.
- Incidentally, X/Y increases.

Shifts in (I/Y) curve

- Investment share curve might shift _____ because of
  - higher investment tax credit.
- Investment share curve might shift _____ because of
  - decline in business confidence.

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SHIFTS IN NONGOVERNMENT SHARES
Page 3

Effect of rightward shift of (I/Y) curve
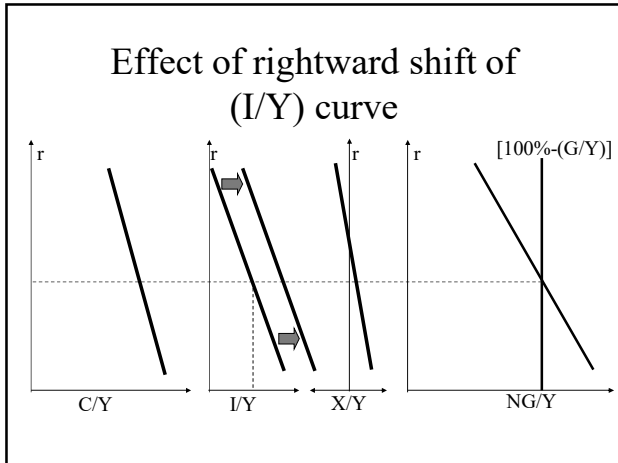
Effect of rightward shift in (I/Y) curve on investment spending

- (NG/Y) curve shifts right by same amount.
- r* _____, causing C and X to decrease.
- Therefore we know that shift in (I/Y) must outweigh increase in r*, and investment spending must _____.

Effect on future economic growth

- More spending on new physical capital.
- Workers become more productive.
- Economic growth is _____.

Effect of leftward shift of (I/Y) curve
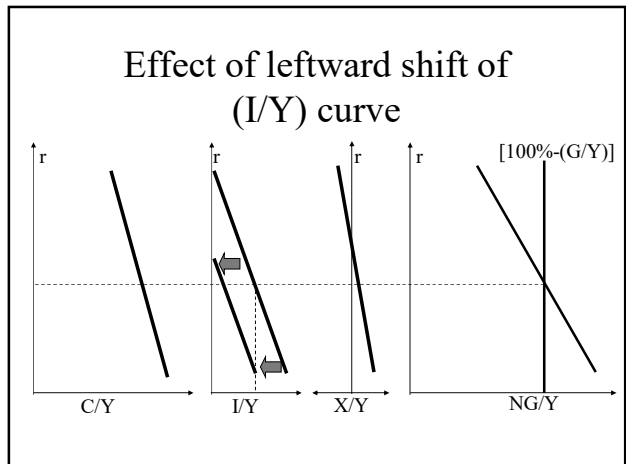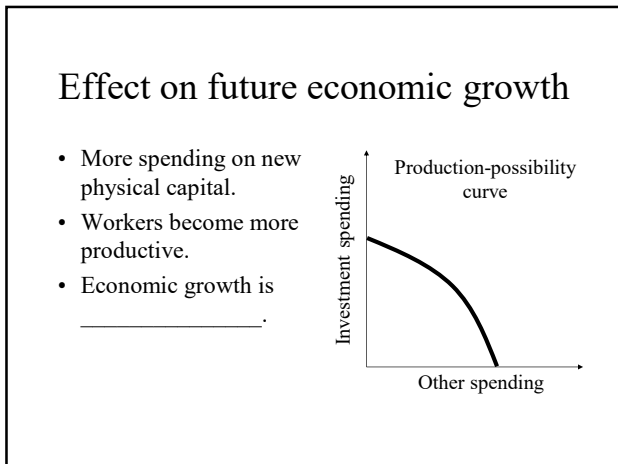
Effect of leftward shift in (I/Y) curve on investment and growth

- (NG/Y) curve shifts left by same amount.
- r* _____, causing C and X to increase.
- Therefore we know that shift in (I/Y) must outweigh decrease in r*, and investment spending must _____.
- Economic growth is _____.

Conclusions

- In the long run, a rightward shift in the consumption share curve _____ the real interest rate, _____ investment spending.
- A rightward shift in the investment share curve also _____ the real interest rate, but investment spending _____ anyway.
- Leftward shifts have opposite effects.

OUTPUT AND THE LABOR FORCE
Page 1

OUTPUT AND THE LABOR FORCE

•How is potential GDP related to the labor force?

Potential GDP depends on inputs

- Total amount that the economy can produce depends on total available resources through the *aggregate production function*:
- Potential GDP = f (L, K, T), where
  L = _____ = total hours of all workers.
  K = _____ = factories, equipment, etc.
  T = _____ = available know-how.

Labor input

- Labor (L) is particularly important because most people's income is almost entirely from working.
- The number of people who *could* work is determined by demographic trends and changes very slowly.
- But the number of people who *are* working can change quickly.

Conclusions

- The total amount of output that can be produced depends, in part, on the amount of _____ input available.
- Most people's income is almost entirely from working.

MEASURING THE LABOR FORCE
Page 1

MEASURING THE LABOR FORCE

- How is the labor force counted?
- How does the labor force in the U.S. today compare with other countries and with the past?

Who collects the data?

- Census Bureau surveys about 60,000 households each month in its "Current Population Survey."
- Working-age population = persons 16 years old and older, not in institutions (prison, mental institutions, active duty in military, etc.).

How people are classified

- All working-age persons are categorized as either:
  - Employed (at a paid job).
  - Unemployed (looking for work).

  - Not in labor force.

Who is counted as "employed"?

- Worked full time _____
- Worked part time _____
- Self-employed _____
- Worked in a family business _____
- Did unpaid work at home _____
- Did volunteer work _____

> Last week, did you do any work for pay?

Who is counted as "unemployed"?

- Temporary layoff _____
- Contacted employer _____
- Cont. empl. agency _____
- Cont. friends, relatives _____
- Sent out resumes _____
- Placed or answered ads _____
- Looked at ads _____
- Attended job training course _____

> Have you been doing anything to find work during the last 4 weeks?

Who is counted as "in the labor force"?

- Employed _____
- Unemployed _____
- Been hired for job but not yet started work _____

- Want a job but have given up looking for one ("discouraged worker") _____

MEASURING THE LABOR FORCE
Page 2

Trends in U.S. working-age population

Source: FRED, May 2024.
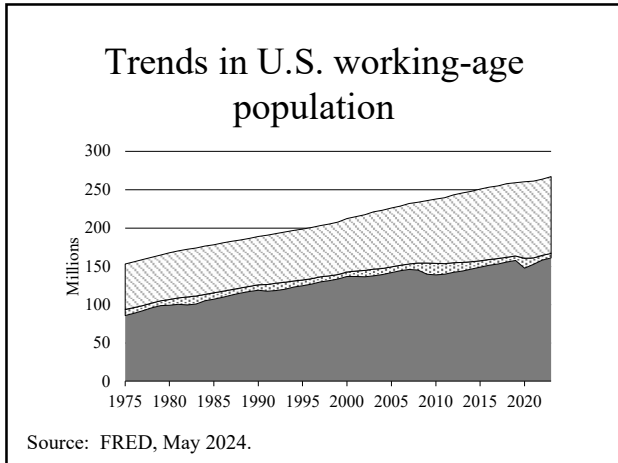
Labor market indicators

- *Unemployment rate =*

- *Labor force participation rate =*

- *Employment/population ratio =*

Example: 2019

- Working-age population = 259.2 million
- Employed = 157.5 million
- Unemployed = 6.0 million
- Labor force = _____ million
- Unemployment rate = _____ %
- Labor force participation rate = _____ %
- Employment/population ratio = _____ %

Source: FRED.

Trends in labor force participation rate and employment/population ratio

Trends in labor force participation by gender

Trends in U.S. unemployment rate

MEASURING THE LABOR FORCE
Page 3

Unemployment rates in other countries (2019)

Country	Rate
Argentina	9.8%
Brazil	11.9%
China	3.6%
France	8.4%
Germany	3.2%
Japan	2.4%
Mexico	3.5%
South Africa	28.7%
United States	3.7%
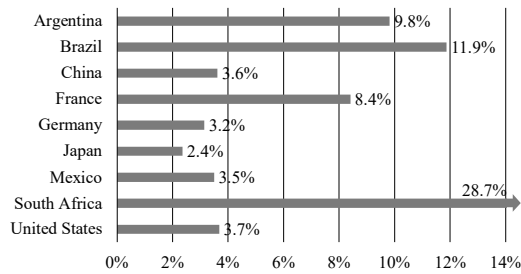
Source: IMF, World Economic Outlook.

The "natural rate" of unemployment

- *Natural rate of unemployment* = unemployment rate in the absence of booms or recessions.
  - That is, when GDP = _____ GDP.
- Also called "non-accelerating-inflation rate of unemployment" or _____.

The "natural rate" varies...

...over time
- Was probably around 5% in the 1950s.
- Probably increased to 6% or 7% in the 1980s and 1990s.
- Seems to be around _____ now.

... and across countries.

Measuring labor input to production

- Labor input to production depends on:
  - the number of people working.
  - how many hours they work.
- Aggregate hours = total hours of work by all workers.

Conclusions

- Each month, _____ estimates the number of people *employed, unemployed*, and *out of the labor force.*
- U*nemployment rate* =
  _____.
- The "*natural rate*" of unemployment seems to be about _____ in the U.S. now.
- *Labor force participation* has risen sharply for women over the last few decades.

WHO IS UNEMPLOYED?
Page 1

WHO IS UNEMPLOYED?

- How do people become unemployed?
- How long do they typically remain unemployed?
- Which workers are most likely to be unemployed?

Causes of unemployment

- _____ unemployment is caused by normal turnover of workers and firms.
- _____ unemployment is caused by mismatch of worker skills to jobs, or insufficient work incentives.
- _____ unemployment is caused by recessions or depressions.

Unemployment and job openings coexist

- At any given moment,
  - some people are unemployed.
  - some employers have unfilled job openings.
- Unemployed workers often cannot fill those openings. Why?

Unemployment and job openings over the business cycle

- Recessions:
  - unemployment _____ ,
  - openings _____.
- Booms:
  - unemployment _____ ,
  - openings _____.

Unemployment and job openings

Source: U.S. Bureau of Labor Statistics

Unemployment-openings curve

2024 1st quarter

2001 1st quarter

Source: FRED. $Job\ openings\ rate = \frac{job\ openings}{employment + job\ openings}$

WHO IS UNEMPLOYED?
Page 2

Dynamics of the labor market
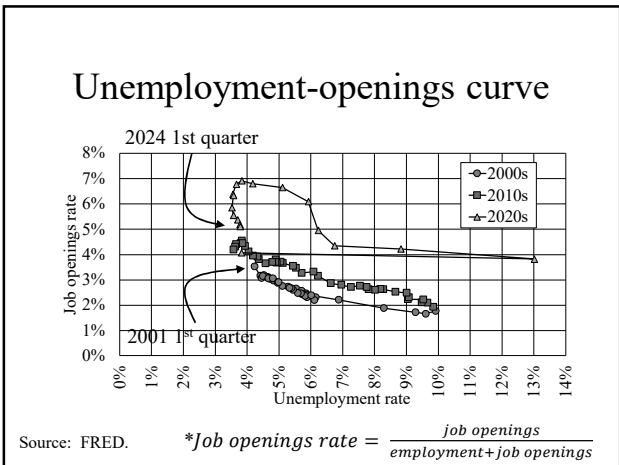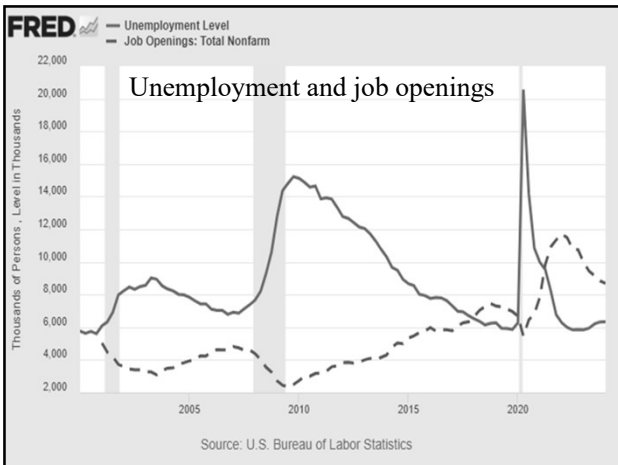
Employed

Unemployed ⇄ Out of labor force
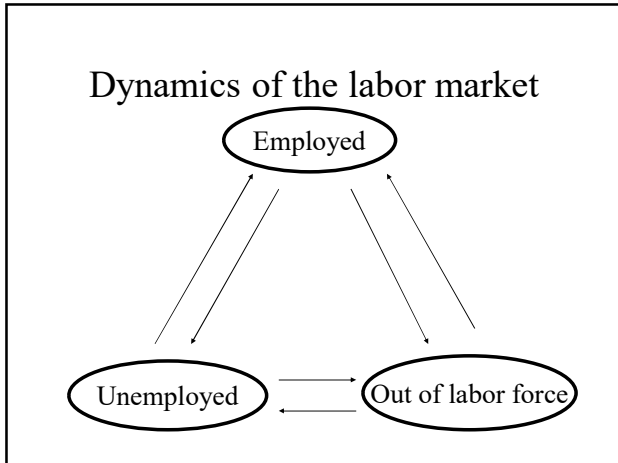
What is the most common reason for unemployment?

❑ Lost job (laid off or fired for cause).

❑ Left job (quit).

❑ Re-entering labor force (after raising kids, going back to school, etc.)

❑ Entering labor force for the first time (graduated from high school or college).

(See BLS News Release "The Employment Situation,"
Household Data Summary Table A.)

How long have most unemployed people been unemployed?

❑ Less than 5 weeks (a month).

❑ 5 to 14 weeks (1-3 months).

❑ 15 to 26 weeks (3-6 months).

❑ 27 weeks and over (more than 6 months).

(See BLS News Release "The Employment Situation,"
Household Data Summary Table A.)

What group has the highest unemployment rate?

❑ Adult men.

❑ Adult women.

❑ Teenagers.

❑ Black or African American.

❑ Asian.

❑ Hispanic or Latino ethnicity.

(See BLS News Release "The Employment Situation,"
Household Data Summary Table A.)

Which industries usually have highest unemployment rates?

❑ agriculture (wage and salary workers)

❑ construction

❑ finance and service industries

❑ government workers

❑ manufacturing

❑ mining

❑ transportation and public utilities

❑ wholesale and retail trade

Conclusions

• Unemployment coexists with job openings.

• Workers move between employment, unemployment, and being

_____.

• Unemployment rates vary by demographic group and by industry.

THE LABOR MARKET AND UNEMPLOYMENT
Page 1

THE LABOR MARKET AND UNEMPLOYMENT

- What is the labor market?
- Why is there unemployment?
- What can the government do to reduce unemployment?

Labor market

- "Price" = real wage (wage / price level).
- "Quantity" = quantity of workers employed, (measured by EPR).
- Demand = demand for workers by firms.
- Supply = supply of workers by households.
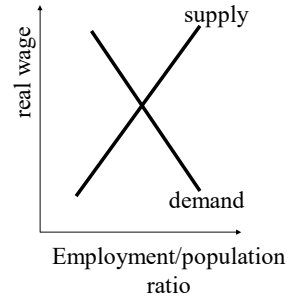
Labor demand and supply

- Demand slopes down because the higher the _____ workers employers will want to hire.
- Supply slopes up because the higher the wage, the _____ people will want to work.
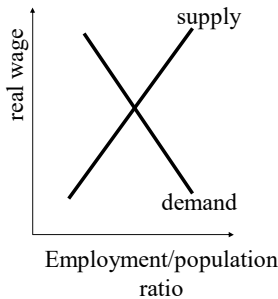
Shifts in supply and demand in the labor market for women

- Long-term trends to explain:
  - sharp rise in wages and employment.
- Demand curve, esp. for service industries, has shifted right.
- Women's labor supply has shifted right a bit.
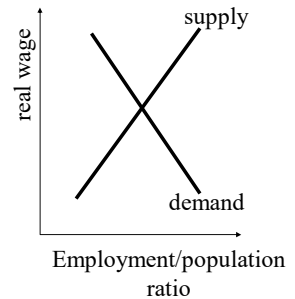
Shifts in supply and demand in the labor market for men

- Long-term trends to explain:
  - rise in wages
  - slight decline in employment.
- Demand curve has shifted right a bit.
- Men's labor supply has shifted left.
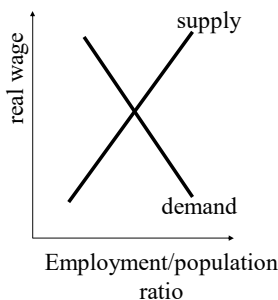
Why is there unemployment in the labor market?

- In equilibrium, everyone who wants to sell or buy at the market price _____.
- There seems no room in the supply-and-demand model for unemployment.

© 2024 William M. Boal
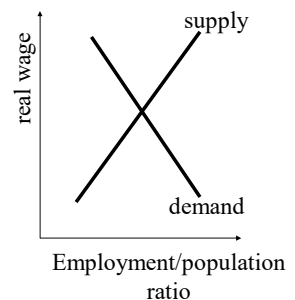
THE LABOR MARKET AND UNEMPLOYMENT
Page 2

Explanations for unemployment

- Two popular types of explanations have been suggested:

  (A) job rationing.

  (B) job search.

(A) The job rationing explanation

- *Job rationing* = employment less than equilibrium level because the wage is stuck above its equilibrium level.
- Unemployment is thus a form of *excess supply.*
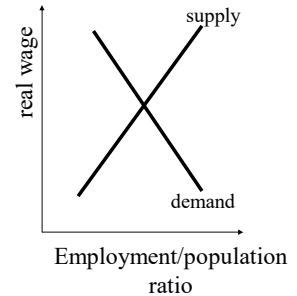
Why do wages get stuck above equilibrium? Two ideas

(A1) Legal minimum wages

(A2) Insiders versus outsiders

- Employed people ("_____") keep wages up, through union action or perhaps informal pressure.
- Prevent wages from falling enough to encourage firms to hire the unemployed ("_____").

Why do wages get stuck above equilibrium? A third idea

(A3) "Efficiency wages"

- Firms deliberately pay above-equilibrium wages
- Why?

Implications for public policy

- If unemployment is caused by job rationing, it can be reduced by keeping wages flexible.
- How can the government help?

(B) The job search explanation

- Labor market is in constant flux.
- Old jobs are destroyed as old businesses _____.
- New jobs are created as old businesses expand and new start-ups are formed.

THE LABOR MARKET AND UNEMPLOYMENT
Page 3

Search often requires being unemployed for a while

- It takes time for unemployed workers and firms with vacancies to find each other.
  - Why?
- While searching for a job, workers are often unemployed.
- Search unemployment is also called "_____ unemployment."

Implications for public policy

- If unemployment is caused by job search, it can be reduced by speeding up search process.
- How can the government help?

Conclusions

- The simple supply-and-demand model can explain trends in employment, but not _____.
- Two popular types of explanations for unemployment are:
- _____(wage stuck above equilibrium level)
- _____(time required to find new job)

MEASURING TECHNOLOGY IN ECONOMIC GROWTH
Page 1

MEASURING TECHNOLOGY IN ECONOMIC GROWTH

- Can growth be explained by capital accumulation alone?
- How much of growth should be attributed to new technology?

Recall Malthus's model: output = F (labor)

1. Available land is fixed.
2. Labor is subject to _____ returns.
3. Output required to sustain population is proportional to population size.
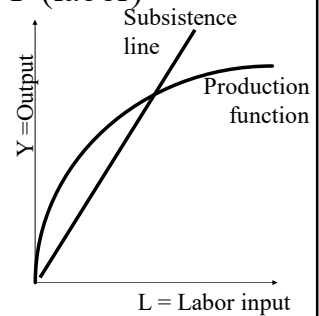
Recall Malthus's dismal conclusion

- Output always converges to the subsistence level _____.
- No growth.
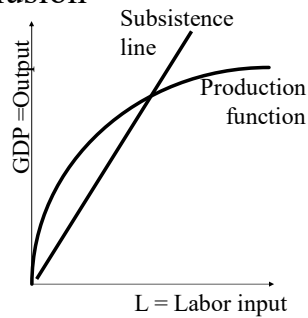
But output per person *has* grown since the industrial revolution

Real GDP per capita, 2011 dollars

United Kingdom ‑‑‑France ——Germany ‑□‑Japan ····United States
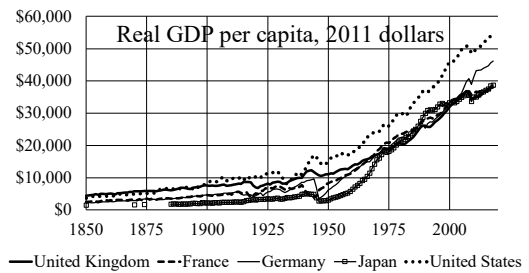
Source: Maddison Project Database.

What changed?

- The "iron law of wages" has not held true.
- Productivity (output per worker) has remained above the subsistence level, even though population has increased.
- Evidently, capital is important: GDP = F (labor, capital).
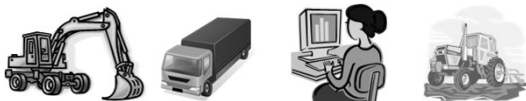
A growth model with two variable factors: labor and capital

- Write aggregate production function as GDP = F(L,K).
- Both L and K have positive effects on GDP.
- Increases in capital (K) raise graph of production function.
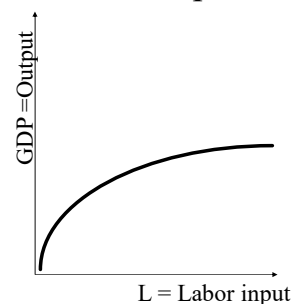
MEASURING TECHNOLOGY IN ECONOMIC GROWTH
Page 2

Implications of the two-factor model

- Population can continue to increase while productivity (GDP/L) stays above subsistence.
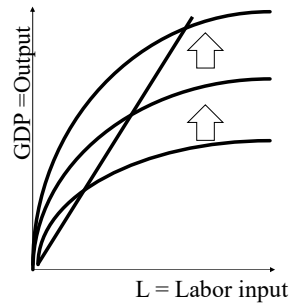
A problem with the two-factor model

- Under the two-factor model, it can be shown mathematically that productivity (GDP/L) should approach a maximum value (greater than subsistence.)
- *Does not fit the facts:* productivity growth rates have been _____, not decreasing, from one century to the next.

Productivity growth has _____, not decreased, over the centuries.

Productivity growth of fastest-growing economies
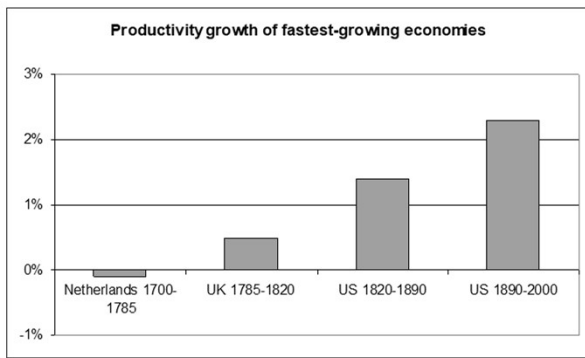
Another problem with the two-factor model

- It can be shown mathematically that the following *growth accounting formula* should hold (S_K = capital income / GDP).
- *Does not fit the facts:* for developed countries, left side always ____ right side.

$$\boxed{\begin{array}{c}\text{Growth} \\ \text{rate of} \\ \text{GDP/L}\end{array}} = S_K \times \boxed{\begin{array}{c}\text{Growth} \\ \text{rate of} \\ \text{K/L}\end{array}}$$

A role for "technology"

- Because the two-factor model cannot account fully for economic growth, a third factor must be at work.
- *Technology* = know-how that determines how much real GDP that be produced from given amounts of labor and capital.
- *Technical change* = change in the stock of technology (normally positive).

A growth model with technology

- Write production function as: GDP = F(L,K,T), where T = technology.
- Output increases if either L, K, or T increase.
- If GDP is growing faster than can be explained by growth in L and K, then _____ must be growing.

MEASURING TECHNOLOGY IN ECONOMIC GROWTH
Page 3

A model of productivity with technology

- Modify production function to by dividing by L:

$$GDP/L = f(\ K/L \ , \ T)$$

- Here, GDP/L = output per unit of labor = "productivity."
- K/L = ratio of physical capital per unit of labor = "capital/labor ratio."
- T = technology.

Growth accounting with technology

- Technology is difficult to measure directly.
- Instead, contribution of technology to growth is measured as *residual* in growth accounting formula. ($S_K = 1/3$)

$$\boxed{\begin{array}{c}\text{Growth} \\ \text{rate of} \\ \text{GDP/L}\end{array}} = S_K \times \boxed{\begin{array}{c}\text{Growth} \\ \text{rate of} \\ \text{K/L}\end{array}} + $$

Example 1: U.S. productivity growth

	1956-1975	1976-1995	1996-2003
Growth rate of productivity	2.5%	1.2%	2.9%
Growth rate of capital/labor ratio	3.3%	1.8%	2.7%
Capital's contribution to productivity growth			
Technology's contribution to productivity growth			

Example 2: Productivity growth in Soviet Union

	1971-1975	1976-1980	1981-1985
Growth rate of productivity	4.5%	3.3%	2.7%
Growth rate of capital/labor ratio	9.0%	11.7%	10.5%
Capital's contribution to productivity growth			
Technology's contribution to productivity growth			

Conclusions

- The *2-factor model,* with both labor and capital, can explain why productivity remains above the subsistence level.
- But it cannot explain why productivity continues to _____.
- _____ is needed to explain continuing productivity growth over time.
- _____*'s* contribution to growth is found by the *growth accounting formula.*

TECHNOLOGY POLICY
Page 1

TECHNOLOGY POLICY

- Where does new technology come from?
- What is wrong with the "market" for technology?
- How can the government promote production of new technology?

GDP per capita is correlated with other measures of well-being

Countries of the world, 2019
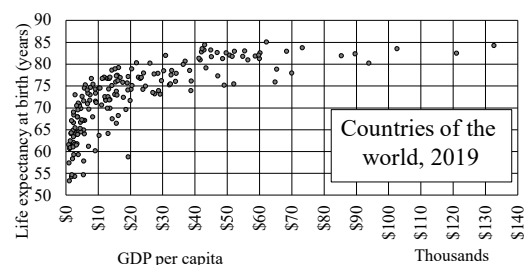
Source: databank.worldbank.org, accessed December 2021.

Technology as the engine of productivity growth

- Increases in capital labor ratio (K/L) raise productivity (GDP/L) and GDP per capita.
- But with only growth of capital, it can be shown mathematically that productivity (GDP/L) approaches a maximum value.
- So productivity growth is not sustainable without growth in _____.

Sources of technology growth ("technical change")

- *Basic research* into scientific principles.
- *Development* of new products and production processes using these principles (also called *innovation*).
- *Diffusion* of new ideas throughout the economy.

Example: Computer "mouse" and "windows"

- *Basic research* done at _____
- *Developed* into a commercial product by _____ as the _____.
- *Diffused* later into many other computers.

Other sources of technical change: specialization and division of labor

- Requires large-scale production.
- Adam Smith's (1776) estimated that productivity in a British pin factory increased several hundred times because of specialization:
  "One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head ..."

Source: Smith, A. (1910 [1776]). *The Wealth of Nations*. London: J. M. Dent ; E. P. Dutton. Vol. 1, p. 5.

TECHNOLOGY POLICY
Page 2

Other sources of technical change: human capital

- *Human capital* = education and training of workers that makes them more productive.
- Similar to physical capital in that up-front investment yields future returns (increased output).
- Examples: _____

  _____

Other sources of technical change: learning by doing

- Workers and firms become more productive as they gain experience.
- Example:

  _____

  _____

Output per day

Days of experience

Special features of technology

Two features of technology tend to reduce production of technology below the level that is best for society:

- "nonrival."
- "nonexcludable."

Technology as a "nonrival" good

- *Nonrival good* = a good whose use by one person does not necessarily preclude use by another person.
- Examples: _____

  _____

- New ideas are *nonrival*—many people can use them at once.

Using an idea does **not** preclude others from using the same idea

- "He who receives an idea from me receives instruction without lessening mine; as he who lights a taper at mine receives light without darkening me."
                                -- Thomas Jefferson

Source: Letter to Isaac McPherson, August 13, 1813.

Technology as a "nonexcludable" good

- *Nonexcludable good* = a good that people cannot be forced to pay for using.
- Examples: _____

  _____

- New ideas are nonexcludable, unless protected by patents or copyrights.

TECHNOLOGY POLICY
Page 3

Problems in the market for technology

- New ideas often spill over, providing broad benefits to society (nonrival).
- But creators of new ideas cannot be fully compensated (nonexcludable).
- So market incentives for producing new ideas are inadequate.

How can government encourage production and use of technology?

(1) Intellectual property laws (copyrights, patents, licensing laws).

- Advantage: allows producers to charge a price for using their ideas. Fixes the _____ problem.
- Disadvantage: price > cost, so users less likely to use the ideas. Exacerbates the _____ problem.

What can government do? (cont'd)

(2) Government production of research (in its own labs or under contract).

- Advantage: new ideas can be distributed for free. Fixes both the _____ _____ problem and the _____ problem.
- Disadvantage: government must choose which projects to fund.

What can government do? (cont'd)

(3) Tax credits for private research.

(4) Exemptions to antitrust laws permitting firms in same industry to cooperate on research.

Conclusions

- Sustainable growth in GDP per capita requires technical change.
- Sources of technical change include research and development, investment in _____, and _____.
- However, new ideas are typically _____ and _____, so producers of ideas cannot be fully compensated.
- Intellectual property laws and government funding address these problems.

CONVERGENCE IN GDP PER CAPITA
Page 1

CONVERGENCE IN GDP PER CAPITA

- Should we expect poor countries to catch up with rich countries?
- Are they in fact catching up?

Worldwide distribution of GDP per capita

- There is tremendous variation in income per capita around the world.
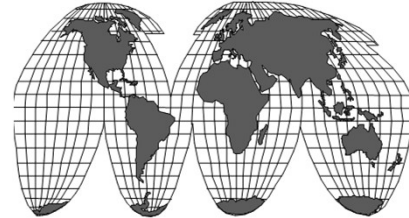
GDP per capita (PPP) 2023
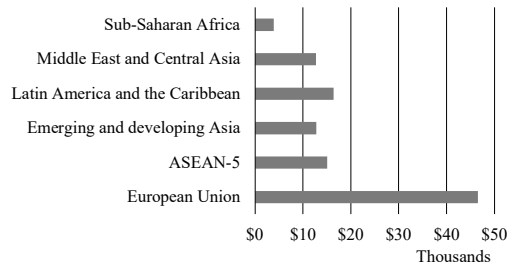
Source: International Monetary Fund, World Economic Outlook Database, April 2024.

What determines a country's potential GDP?

- Total amount that economy CAN produce depends on total available resources through the *aggregate production function*:
- Potential GDP = F (L, K, T), where
  L = _____ = total hours of all workers.
  K = _____ = factories, equipment, etc.
  T = _____ = available know-how.

Why countries have different levels of GDP *per capita*

- According to growth theory, differences in GDP *per capita* are explained by:
  - differences in capital/labor ratio (K/L).
  - differences in available technology (T).
- For developing countries to catch up, their technology and capital must grow faster.

Technology in developing countries

- If technology is portable, it should diffuse _____ high-tech areas _____ low-tech areas.
- Entrepreneurs in poor countries have incentive to borrow existing technology, not "reinvent wheel."

CONVERGENCE IN GDP PER CAPITA
Page 2

Differences in rates of return on capital

- Capital yields diminishing returns.
- Therefore, it yields the highest rate of return where it is scarce, *ceteris paribus*.
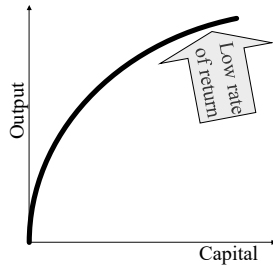
Capital in developing countries

- Owners of capital will look for the highest rate of return they can find.
- If capital it mobile, it should migrate _____ high-capital areas _____ low-capital areas.
- That is, in developing countries, investment should exceed savings: I > S .

What simple growth theory predicts

- Technology and capital should grow _____ in developing countries than in developed countries.
- Developing countries should _____, according to simple growth theory.
- GDP per capita in countries around the world *should* converge.
- But *is* it converging?

Graphical representation of convergence

- Convergence implies countries that begin poor should grow faster than countries that begin rich.
- Negative relationship between initial GDP per capita, and subsequent growth.
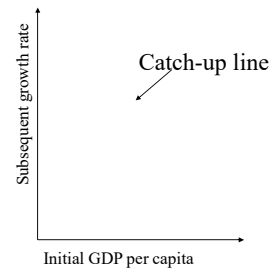
Convergence among U.S. states
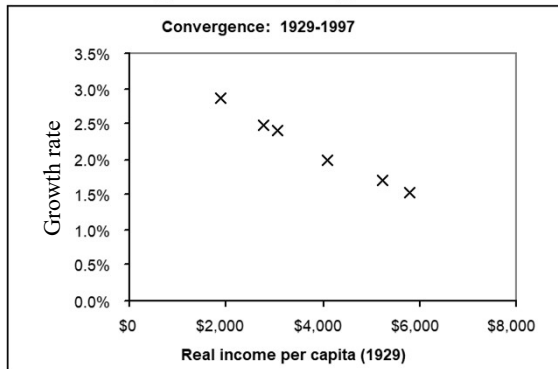
Convergence continues

CONVERGENCE IN GDP PER CAPITA
Page 3

Convergence in advanced countries

Source: IMF WEO database. GDP is measured in constant 2017 PPP dollars.

Convergence in developing Asia

Source: IMF WEO database. GDP is measured in constant 2017 PPP dollars.

Convergence in eastern Europe

Source: IMF WEO database. GDP is measured in constant 2017 PPP dollars.

Convergence in Latin America and the Caribbean

Source: IMF WEO database. GDP is measured in constant 2017 PPP dollars.

Convergence in the Middle East and North Africa

Source: IMF WEO database. GDP is measured in constant 2017 PPP dollars.

Convergence in Sub-Saharan Africa

Source: IMF WEO database. GDP is measured in constant 2017 PPP dollars.

CONVERGENCE IN GDP PER CAPITA
Page 4

Lack of worldwide convergence

- The data show that many of the developing countries are _____ with the developed countries.
  - Exceptions: _____
- Conclude that technology and capital are _____ flowing easily to these countries.

Exceptions: real GDP per capita (PPP) in 4 Asian countries

Source: IMF WEO database. GDP is measured in constant 2017 PPP dollars.
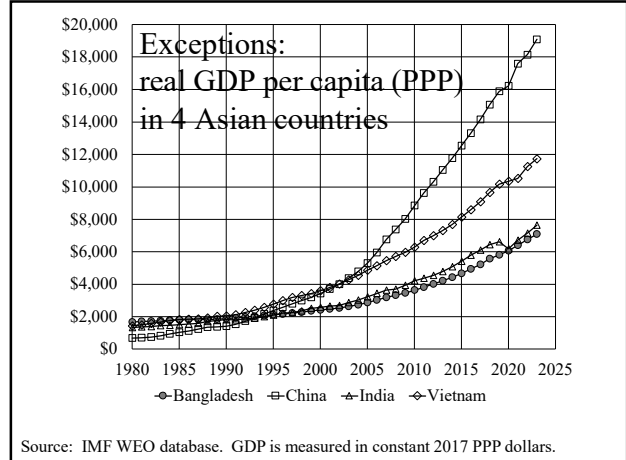
Conclusions

- GDP per capita varies greatly across countries.
- Simple growth theory predicts _____ of GDP per capita, as technology diffuses worldwide and investment flows to countries where it yields _____ returns.
- But in fact, many *developing countries* are growing at the same rate or slower than *developed countries.*

RAISING GROWTH RATES IN DEVELOPING COUNTRIES
Page 1

RAISING GROWTH RATES IN DEVELOPING COUNTRIES

- What is holding poor countries back?
- What can be done to help poor countries catch up with rich countries?

Lack of worldwide convergence

- The data show that many of the developing countries are _____ catching up with the industrialized countries.
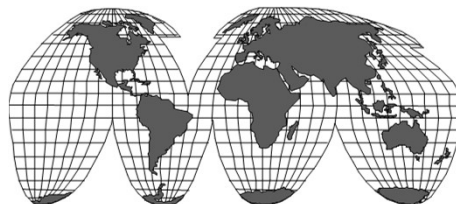
Lack of worldwide convergence

- The data show that many of the developing countries are ___not___ catching up with the industrialized countries.
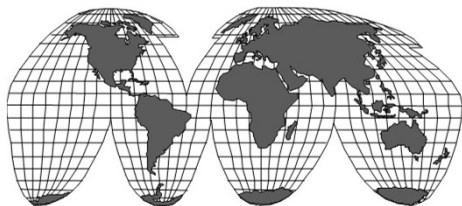
Possible explanations for lack of worldwide convergence

(1) These countries are not getting as much output (GDP) from their inputs (L,K, T) as industrialized countries are.
  - Likely cause: inefficient legal system.
(2) Technology (T) is not diffusing to these countries fast enough.
(3) Capital (K) is not migrating to these countries fast enough to allow high levels of investment.

What is an efficient legal system?

- Clear property rights, to facilitate free exchange.
- Few restrictions on starting and operating businesses.
- Any residual profits must be given to entrepreneurs.
  - *Residual claimant* = person entitled to difference between revenues and costs.

Examples of inefficient legal systems in developing countries

- Collective agriculture.
  - Examples: _____
- Regulations making it difficult to start or operate a business.
  - Examples: _____
- Lack of laws to help investors observe profits and collect debts.
  - Examples: _____

RAISING GROWTH RATES IN DEVELOPING COUNTRIES
Page 2

Examples of policies that discourage technical diffusion

- Restrictions that limit technical diffusion directly. Examples:

  _____

- Restrictions that reduce incentives for obtaining the best technology. Examples:

  _____

- Low levels of human capital. Examples:

  _____

Investment spending requires sources of funds

- Domestic savings: savings by people who live in the country.

- Investment by foreigners: foreigners willing to lend money for investment projects.

Why domestic savings tend to be low

- Private savings may be low if interest rates on bank accounts are regulated--sometimes _____ the rate of inflation!

- Governments tend to _____ because
  - tax system is not well-developed.
  - government expenditures are not under control.

Why foreign investment tends to be low

- *Country risk* = risk to investments in a particular country due to political or economic instability or insecure property rights. Examples:

- Political instability: _____

  _____

- Insecure property rights: _____

  _____

International organizations to promote stability and investment

- Two international organizations established at the end of World War II.
- International Monetary Fund
- World Bank

International Monetary Fund (IMF)

- Makes short-term loans to countries in temporary trouble.

- Frequently imposes "conditionality": requires economic reform as condition of the loan.

- Recent examples in the news:

  _____

RAISING GROWTH RATES IN DEVELOPING COUNTRIES
Page 3

World Bank

- Borrows money at market interest rates.
- Makes long-term loans to encourage investment and economic growth in developing countries.
  - Charges interest rate slightly higher than it pays.
- Also administers a special fund to lend money at below-market rates.

Recent policy changes

- Many developing countries have recently tried to stabilize their economies, make their legal systems more efficient, and encourage foreign investment.
- Motivation:
  - Prodding from IMF and World Bank, and industrialized countries
  - Examples of success stories:

Barriers to foreign investment apparently still exist

- Recall that X = S - I.
- Many developed countries have trade deficits: X < 0.
  - Implication: _____
- Many developing countries have trade surpluses: X > 0.
  - Implication: _____

Development strategies: import substitution

- Developing country tries to boost domestic production of goods it traditionally imports from industrialized countries.
- Typical industries promoted: _____ _____.
- How: _____.
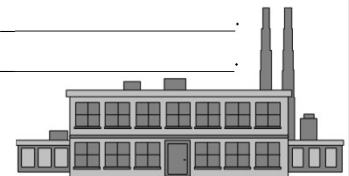
Development strategies: export-led growth

- Developing country tries to boost international trade by expanding exports.
- Typical industries promoted: _____ _____.
- How: _____ _____.

Conclusions

- Why are many developing countries growing so slowly? Possible explanations:
- inefficient _____
- slow diffusion of _____
- inadequate foreign investment due to *trade restrictions* or _____
- Export-led growth is more effective than import substitution.

FORMS AND FUNCTIONS OF MONEY
Page 1

FORMS AND FUNCTIONS OF MONEY

- What is money and what are its functions in the economy?
- Is money just currency?
- What is the "money supply"?

What is money?

- *Money* = that part of person's wealth that can be used for transactions:

Money · Stocks · Bonds · Real estate

Three functions of money

1) Medium of exchange
   - Buy and sell.
2) Store of value
   - Sell things now and buy other things later.
3) Unit of account
   - Compare values in dollars.

---

(1) Medium of exchange

- Money is used for buying and selling in stores, by mail, over the internet, etc.
- Easier than barter, which requires "_____."

---

(2) Store of value

- What if income arrives before you want to spend it?
  - Might get paid at the beginning of the month, but spend throughout the month.
  - Might need to save for children's education, retirement.
- Can use money to store wealth for spending later.
- Alternatives to money as store of value: _____.

---

(3) Unit of account

- How much is this house worth?
- Who has more wealth, Warren Buffet or Bill Gates?
- What is Japan's GDP per capita?
- Answers are usually expressed in terms of _____.

FORMS AND FUNCTIONS OF MONEY
Page 2

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(3) Unit of account

- How much is this house worth?
- Who has more wealth, Warren Buffet or Bill Gates?
- What is Japan's GDP per capita?
- Answers are usually expressed in terms of _____money_____.

Forms of money

1) Commodity money (gold, silver, etc.).
2) Paper money.
3) Deposits (in banks).

---

(1) Commodity money

- *Commodity money* = form of money that has alternative use, thus intrinsic value.
- Useful characteristics of commodity money:
  - Portable (convenient as medium exchange)
  - Durable (convenient as store of value)
  - Divisible (for small purchases)
- Examples: _____

Problems with commodity money

- Any increase in supply causes decrease in relative value, i.e., inflation.
  - Example: _____
    _____
- Commodity money has substantial opportunity cost (by definition).
  - Example:_____
    _____

Paper currency
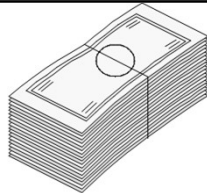
- Also called "fiat money" because its value derives from government decree.
- "Legal tender for all debts public and private."
- More efficient than commodity money because has _____.

Origins of paper currency

- First used in Tang Dynasty, China in _____ century.
- Used in Europe and U.S. beginning in late _____ century.

Currency from Northern Song Dynasty. The text reads: 除四川外許於諸路州縣公私從便主管並同見錢七百七十陌流轉行使, which essentially means that except in Sichuan the bill may be used instead of 77,000 *wen* of metal coinage.
SOURCE: www.wikipedia.org "banknote."

FORMS AND FUNCTIONS OF MONEY
Page 3

Paper currency and the "gold standard"

- Quantity of paper currency originally linked to supply of commodities.
  - One reason: _____
  _____
- *Gold standard* = government agrees to buy or sell gold at a fixed price (e.g., $35 per ounce).
- Today, U.S. no longer on gold standard.

Money supply and inflation: 1850-1890
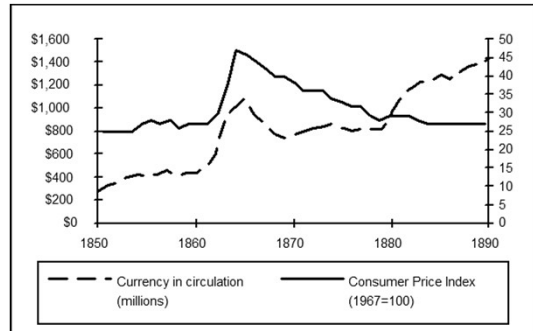
Checking deposits

- Also called "demand deposits" because available on demand.
- Even more efficient than paper currency.
- Advantages:

Many ways to use checking deposits for payment

- Write checks.
- Use debit card.
- Online bill payment.
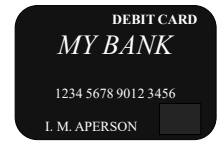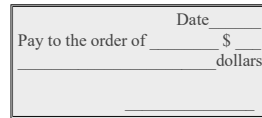
How checking deposits function as a medium of exchange

- Buyer writes check (or swipes card) for 10 dollars.
- When check "clears" the bank:
  - buyer's balance goes down by 10 dollars.
  - seller's balance goes up by 10 dollars.
- All without use of currency.

Cryptocurrencies

- Digital assets that can be transferred securely (e.g., Bitcoin).
- Supply is limited because cryptographic methods must be used to create the asset.
- Many cryptocurrencies have fluctuated in value, which has limited their attractiveness as a medium of exchange.

FORMS AND FUNCTIONS OF MONEY
Page 4

Money supply: general definition

- *Money supply* = amount of currency held by public + deposits at banks.
- Different kinds of deposits exist in U.S. Examples:
- Checking deposits, savings deposits, time deposits (CDs), money-market mutual funds (MMFs).

Deposits vary in their liquidity

- *Liquidity* = availability for use as medium of exchange.
- Most liquid: _____
- Least liquid: _____

Deposits vary in their liquidity

- *Liquidity* = availability for use as medium of exchange.
- Most liquid: __checking deposits__ .
- Least liquid: __certificates of deposit__ .

What counts as money?

- How liquid must an asset be to be useful for transactions?
- Answer is unclear.
- All economists agree that currency and checking deposits should count as money.
- Economists disagree about other deposits, so there are several definitions of the money supply.

Alternative definitions of money

- _____ = paper currency and coins outside U.S. Treasury and Federal Reserve Banks.
- _____ = currency + checking and saving deposits.
- _____ = M1 + small time deposits and money-market mutual funds (except those in retirement accounts)

Source: https://www.federalreserve.gov/releases/h6/

Values of M1 and M2 as of April 2024

Component	Value (billions)
Currency	$ 2,346
Checking & savings deposits	$ 15,724
Small time deposits & MMF deposits	$ 2,898
M1	
M2	

Source: https://www.federalreserve.gov/releases/h6/20240528/

FORMS AND FUNCTIONS OF MONEY
Page 5

Recent change in definition of M1

- Formerly, savings deposits were included in M2 but not M1, because there were limits on transferring money out of savings accounts (6 transfers per month).
- In April 2020, the Fed removed those limits.
- So beginning May 2020, the Fed started including savings deposits in both M1 and M2.

Source: Federal Reserve Board of Governors, *Technical Q&As*, posted 12/17/2020, https://www.federalreserve.gov/releases/h6/h6_technical_qa.htm

Current and New Monetary Aggregates; Seasonally Adjusted
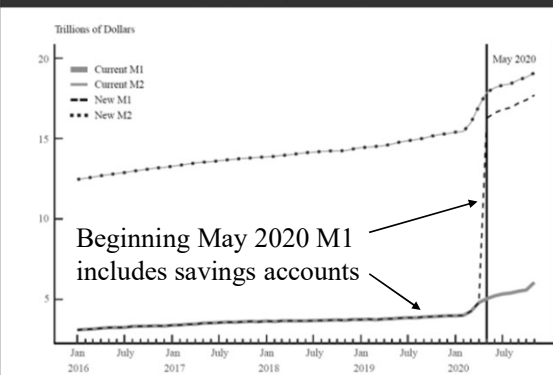
Beginning May 2020 M1 includes savings accounts

Source: Federal Reserve Board of Governors, *Technical Q&As*, posted 12/17/2020, https://www.federalreserve.gov/releases/h6/h6_technical_qa.htm

Conclusions

- Money has three functions: a *medium of exchange*, a *store of value*, and a *unit of account*.
- _____ *money* has intrinsic value.
- _____ *money* can be controlled by the government (for better or for worse).
- *Deposits* are far more important today than either commodity or paper money.

BANKS
Page 1

BANKS AND THE FEDERAL RESERVE

- How do banks create money?
- What is the Federal Reserve?
- How does the Federal Reserve affect money creation?

Banks: financial intermediaries

- *Financial intermediary* = institution that channels funds from savers to investors.
- Accepts funds from _____.
- Lends funds to _____.
- Covers costs and earns profits by charging higher interest rate to borrowers than it pays to depositors.

Types of banks in the U.S.

- Commercial banks:
  - lend mostly to _____.
- Thrift institutions:
  - lend mostly to _____.

What is a central bank?

- *Central bank* = ultimate financial intermediary for private financial intermediaries.
- Accepts deposits from banks.
- Makes loans to banks and other financial intermediaries.
- Almost always a government agency.

Examples of central banks

- The central bank in U.S. is the Federal Reserve ("Fed") established in 1913.
- Every country has a central bank.
- Canada: _____
- United Kingdom: _____
- Japan: _____

BANK OF CANADA BANQUE DU CANADA

The _____ Central Bank is the central bank for many countries.

Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, and Spain.

Source: European Central Bank, https://www.ecb.europa.eu/euro/20_years_of_euro/html/index.en.html

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BANKS
Page 2

A bank's balance sheet

Asset=something owned. Bank's assets include:	*Liability*=something owed to someone else. Bank's liabilities include:
• _____	
• _____	• _____
• _____ (the bank's deposits at the Fed)	

How banks create money

- When people make deposits at banks, those deposits can still potentially be used for transactions.
- But banks also lend out those deposits, creating money for borrowers that can potentially be used for transactions.
- *Both deposits and loans are thus money.*

Reserves at the Fed

- Banks don't need to loan out all deposits they receive. They can deposit funds at the Fed as _____.
- The Fed can increase total reserves by buying bonds from banks and paying for them by crediting banks' reserves.

How the Fed can push banks to create more money through lending

- Suppose the Fed creates lots of new reserves by _____ bonds.
- Reserves are safer than loans, but loans make a _____ return for banks.
- So banks may want to withdraw some reserves to make new loans.
- New loans are new money, available to use for transactions.

Reserve balances of banks
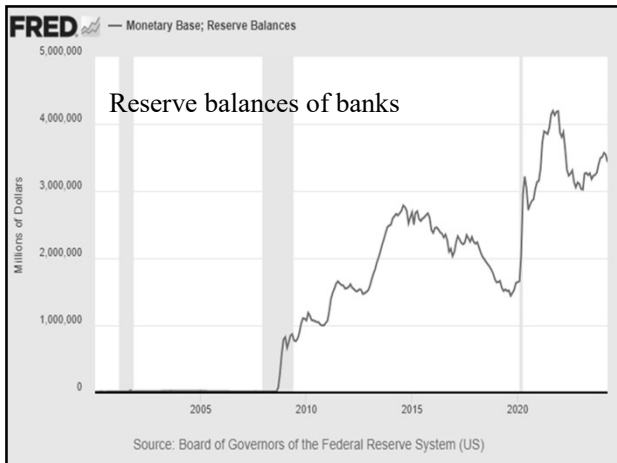
Interest on reserves

- In 2008, the Fed began paying interest on reserve balances.
- Initially, the interest rate was low.
- Nevertheless, it evidently encouraged banks to hold more reserves.

BANKS
Page 3

Source: Board of Governors of the Federal Reserve System (US)
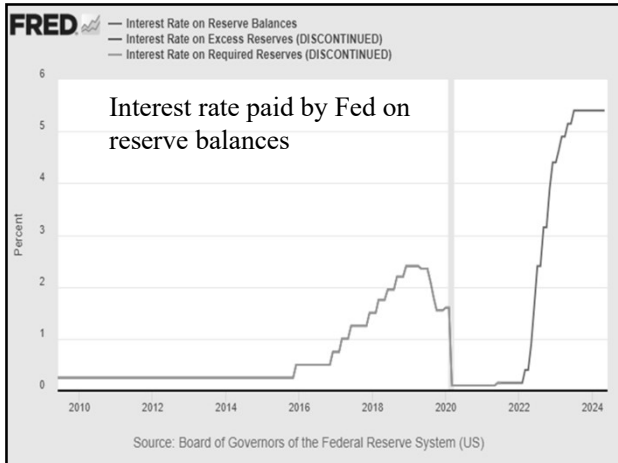
Bank reserves are now very large, even though not required

- In the past, most banks were required to hold a minimum fraction of their deposits as reserves with the Fed.
- Beginning March 2020, reserves were no longer required.
- At the time of the change, most banks held much more reserves than required.

Source: Federal Reserve Board of Governors,
https://www.federalreserve.gov/monetarypolicy/reservereq.htm

Conclusions

- Banks are financial _____ between depositors and borrowers.
- Banks make a profit by paying a lower rate of interest to depositors than they earn from borrowers. Both deposits and loans are _____.
- Instead of making loans, banks can deposit funds at the Fed (called "_____").
- The Fed can encourage money creation by buying bonds and paying for them with reserves.

THE "QUANTITY EQUATION" FOR MONEY AND INFLATION
Page 1

THE "QUANTITY EQUATION" FOR MONEY AND INFLATION

- What causes inflation and hyperinflation?

Why hold money?

- People hold many kinds of assets:
  - Examples: _____
- Advantage of money as an asset:
  - Most _____.
  - Can be used directly as a medium of exchange.
- Disadvantage of money as an asset:
  - Earns little or no return.

Money and spending

- People normally hold money only to facilitate spending.
- Amount of money held is proportional to rate of spending.
- For the economy as a whole, there is a strong relationship between GDP and money holdings.

The "velocity" of money

- *Velocity* = ratio of GDP to money supply.
  - Thus $V = GDP/M$ or $M \times V = GDP$.
- Velocity measures how fast the money supply "turns over" in a year through spending on final goods and services.
- Note that GDP is a _____ and the money supply is a _____.

The Meaning of "velocity"

- High V implies:

- Low V implies:

What determines velocity?

- If banking technology is advanced and you can transfer funds easily in and out of your checking account, you will not need as much money, so velocity will be

  _____.

- If credit is easy to get (e.g., with a VISA card), you will not need as much money, so velocity will be _____.

THE "QUANTITY EQUATION" FOR MONEY AND INFLATION
Page 2

What determines velocity? (cont'd)

- If other assets generate much bigger returns than money, the opportunity cost of holding your wealth as money will be greater.
- So you will keep as little money as possible for spending purposes, and velocity will be _____ .

Quantity equation for money

- Recall M x V = GDP,
  and GDP = (price level) × (real GDP).

- This implies the *quantity equation:*

$$\mathbf{M \times V = (price\ level) \times (real\ GDP).}$$

Quantity equation for money in growth-rate form

- Approximation rule: if $Z = X \times Y$, then growth rate of Z equals growth rate of X _____ growth rate of Y.
- Using this rule, we can rewrite both sides of the quantity equation:

$$\begin{pmatrix} \text{growth} \\ \text{rate of} \\ \text{money} \end{pmatrix} + \begin{pmatrix} \text{growth} \\ \text{rate of} \\ \text{velocity} \end{pmatrix} = \begin{pmatrix} \text{inflation} \\ \text{rate} \end{pmatrix} + \begin{pmatrix} \text{growth} \\ \text{rate of} \\ \text{real GDP} \end{pmatrix}$$

Money and inflation in the long run

- Since velocity is roughly constant, its growth rate is _____ , so

$$\begin{pmatrix} \text{growth} \\ \text{rate of} \\ \text{money} \end{pmatrix} = \begin{pmatrix} \text{inflation} \\ \text{rate} \end{pmatrix} + \begin{pmatrix} \text{growth} \\ \text{rate of} \\ \text{real GDP} \end{pmatrix}$$

- Implication: If money supply grows faster than real GDP, then _____ occurs.

Using the quantity equation

- Suppose the long-run growth rate of the money supply is 5% and the long-run growth rate of real GDP is 2%.
- Then one would expect the long-run inflation rate to be about _____%.

Origins of the quantity equation

- Goes back at least to David Hume (1748) and others, who noticed that imports of gold and silver from the Western Hemisphere were causing inflation in Europe.
- Made popular in 1960s by Milton Friedman.

David Hume (1748), "Of Money" and "Of Interest" in *Essays Moral and Political.*

THE "QUANTITY EQUATION" FOR MONEY AND INFLATION
Page 3

Does the quantity equation work?

- The quantity equation holds if the growth rate of velocity is zero, or at least constant.
- Fed Chair Jerome Powell: "The connection between monetary aggregates and either growth or inflation was very strong for a long, long time, which ended about 40 years ago …. It was probably correct when it was written, but it's been a different economy and a different financial system for some time."

Source: Paul Krugman, "Wonking Out: Money Isn't Everything," *New York Times*, December 3, 2021.

Velocity of M1
(V = GDP / M1)
is no longer stable

Change in definition of M1

Source: Federal Reserve Bank of St. Louis

Velocity of M2
(V= GDP / M2)
is no longer stable

Source: Federal Reserve Bank of St. Louis

Money growth rates and inflation rates in the U.S.

Growth rate of M1
Growth rate of M2
Inflation (CPI)

Sources: M1 and M2 from ERP 2010 table B69; CPI from BLS (www.bls.gov). Three-year moving averages.

Quantity equation is only roughly accurate for the U.S.

- Money growth and inflation both decreased in U.S. from the 1970s to the 2000s.
- But quantity equation is only accurate plus or minus 4 or 5 percent, due to changes in

  _____.

- However, if money growth is very fast, changes in velocity become relatively small.

Hyperinflation

- Sometimes governments deliberately create money rapidly to pay for government spending.
- Typical reasons:
  - High expenditures and an inadequate tax system.
- Result is *hyperinflation*.

THE "QUANTITY EQUATION" FOR MONEY AND INFLATION
Page 4

Famous hyperinflations

U.S. during Revolutionary War: Paper currency was quickly "not worth a continental."

Germany 1923: Inflation peaked at _____% per WEEK in October.

1 "Gold"Mark = "Reichs"Mark 1918-1924
Price level in Germany 1918-1923

Note: 1 "Gold"Mark value in grammes of fine gold (1913) = 0.35842g;
"Reichs"Mark = Currency not tied to the goldstandard in 1918 to 1924.

Source: Wolfgang Chr. Fischer - Template:Wolfgang Chr. Fischer, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=11013489 , cited in Wikipedia.

Hyperinflation in Argentina

Growth rate of money

Inflation rate (consumer prices)

Source: IMF, *International Financial Statistics Yearbook*, 2000.

Hyperinflation in Brazil

Growth rate of money

Inflation rate (consumer prices)

Source: IMF, *International Financial Statistics Yearbook*, 2000.

Hyperinflation in Bolivia

Growth rate of money

Inflation rate (consumer prices)

Source: IMF, *International Financial Statistics Yearbook*, 2000.

Hyperinflation in Zimbabwe

2007: Inflation = 66,212%
Money growth = 66,710%

Inflation rate
Growth rate of money supply

Sources: Inflation rate: World Bank Data Catalog, Global Financial Development Database. Money supply: IMF International Financial Statistics.

Conclusions

- GDP is roughly proportional to money holdings. Their ratio is called _____.
- According to the *quantity equation*, the growth rate of the money supply equals the growth rate of real GDP plus the _____ rate.
- The quantity equation is more accurate when the money supply grows fast.
- Very high inflation, or _____ *inflation*, occurs when the money supply grows explosively.

PART 4

Short-Run Business Cycles

Big ideas: Actual GDP fluctuates around potential GDP in booms and recessions. The inflation rate tends to rise or fall, depending on whether GDP is above or below potential GDP. Recessions raise unemployment and cause hardship for millions of people. Governments can use fiscal and monetary policy to dampen business cycles.

Famous quote: "The psychology of the community is such that when aggregate real income is increased, aggregate consumption is increased, but not by so much as income."
--John Maynard Keynes, *The General Theory of Employment, Interest, and Money* (1935).

Another famous quote: "Wall Street [stock] indexes predicted nine out of the last five recessions!"
--Paul Samuelson, "Science and Stocks," *Newsweek* (September 19, 1966). [Nobel Prize 1970]

ECONOMIC FLUCTUATIONS
Page 1

ECONOMIC FLUCTUATIONS

- What causes economic fluctuations?

What drives the economy in the short run?

- This section of course is on short-run fluctuations: *deviations* from potential GDP.

Recall definitions

Potential GDP
= long run trend
= how much economy CAN produce.

Output gap
= actual GDP
   – potential GDP

When GDP < potential GDP, unemployment is high

When GDP > potential GDP, unemployment is low
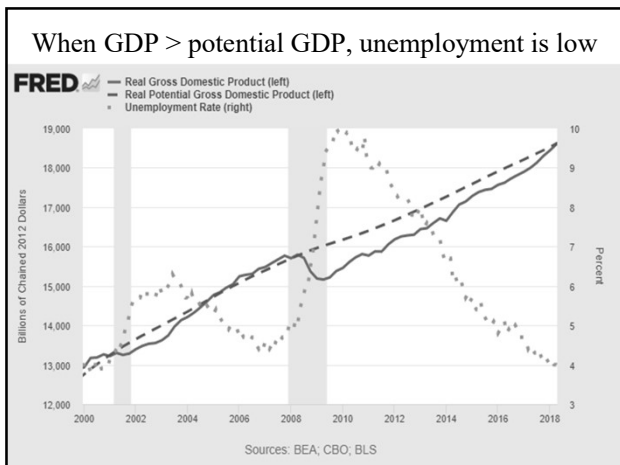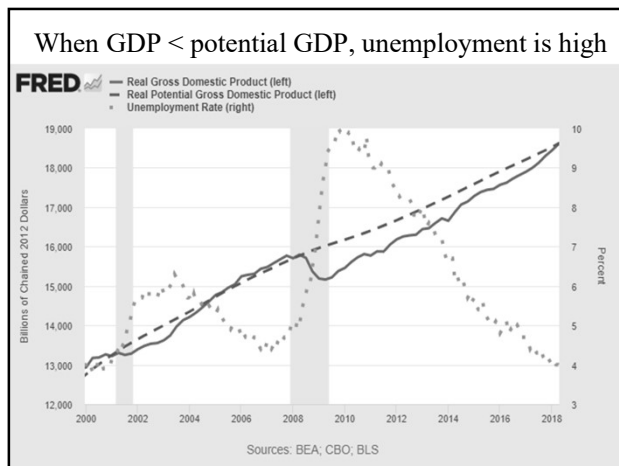
How recessions and booms start

- What causes real GDP to deviate from potential GDP?
- Generally believed to be caused by changes in *aggregate demand*.

ECONOMIC FLUCTUATIONS
Page 2

What is aggregate demand?

Aggregate demand =
  amount of consumption goods that
  consumers want to buy

+ amount of capital goods that businesses
  want to buy

+ amount that government wants to purchase

+ amount that foreigners want to buy.

Behavior of large manufacturing firms in normal times

- Operate at about 80% capacity.
- Economy's unemployment rate is at so-called "natural rate" (probably now about 5%).
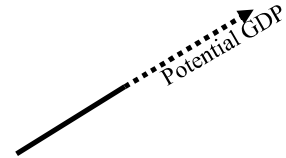
Behavior of large manufacturing firms when demand increases

- Firms boost output.
- Operate at about 90% capacity.
- Existing workers put on overtime.
- More workers hired.
- Unemployment _____ _____natural rate.
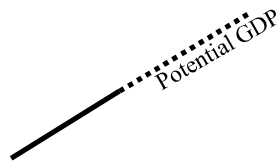
Behavior of large manufacturing firms when demand decreases

- Firms cut output.
- Operate at about 70% capacity.
- Overtime eliminated.
- Workers laid off.
- Unemployment _____ _____natural rate.
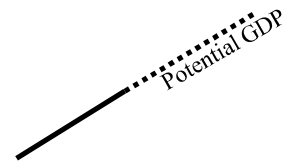
Could economic fluctuations also be caused by changes in aggregate *supply?*

- Theories that economic fluctuations are caused by changes in potential GDP are called *real business cycle* theories.
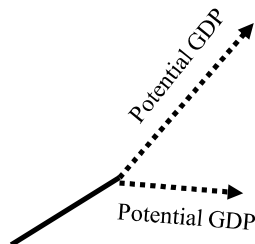
What might cause changes in aggregate *supply?*

- Recall that potential GDP
  = F (labor, capital, technology).
- But labor, capital, and technology do not increase or decrease suddenly.
- What about weather? Certainly, floods and droughts affect productivity in agriculture.
- But agriculture is a small part of today's economy.

ECONOMIC FLUCTUATIONS
Page 3

Conclusions

- Economic fluctuations are mainly caused by shifts in _____.
- Firms increase production and employment when demand increases, and decrease production and employment when demand decreases.
- Changes in potential GDP, as suggested by _____ theories, may also occur, but are likely small.

THE CONSUMPTION FUNCTION
Page 1

THE CONSUMPTION FUNCTION

- How are consumption and income related in the short run?

Shift focus from long-run to short-run

- Earlier, studied LR relationships that determine _____ GDP.
- Now study SR relationships that determine _____ GDP over business cycle.
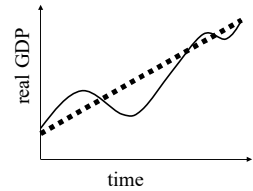
Forecasting GDP

- Economic fluctuations imply that real GDP usually does not grow as smoothly as potential GDP.
- So economic forecasting is challenging but important.
- How to do it?

Two kinds of forecasts

- *Conditional ("what if?") forecast:* shows outcome under alternative assumptions. Used for public policy analysis.
- *Unconditional forecast:* shows outcome under best guess or most likely assumptions. Used for business.

Forecasting GDP components

- Simple naive approach:
  - Forecast each GDP spending component separately: _____.
  - Sum the results.
- Better more sophisticated approach:
  - recognize short-run *interrelationships* between GDP components.
  - Most important interrelationship is the _____.

The consumption function

- *Consumption function* = the short-run relationship between consumption and aggregate income over business cycle.
- Idea is due to John Maynard _____.
- A behavioral relationship: the more income people have, the _____ they spend on consumption goods.

THE CONSUMPTION FUNCTION
Page 2

The marginal propensity to consume (MPC)

- *Marginal propensity to consume* (MPC) = fraction of every additional dollar of income that goes to consumption (rather than savings).
- MPC = _____
  = _____ of consumption function.
- MPC < 1 (because people save a little).

Form of consumption function

- Roughly linear:
- C = a + bY
  C = consumption
  Y = aggregate income
- Slope = _____
- Intercept = _____
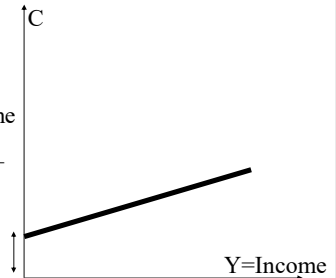
$\Delta C = MPC \times \Delta Y$

- Suppose MPC = 0.6.
- Then if Y increases by $50 billion, C increases by _____.
- If Y increases by $300 billion, C increases by _____ .
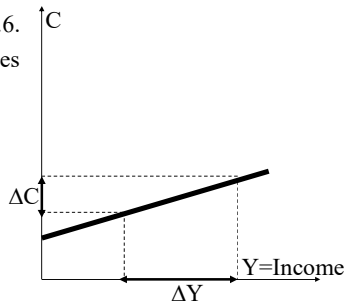
Conclusions

- Sophisticated short-run forecasting recognizes interrelationships between GDP components.
- The *consumption function*, due to _____, shows SR relationship between consumption and aggregate _____.
- *Marginal propensity to consume* (_____) = fraction of every additional dollar of income that goes to consumption

THE KEYESIAN CROSS
Page 1

THE KEYNESIAN CROSS

- In the short run, consumption depends on income, and income depends on consumption.
- So how is GDP determined?

Two equations relating consumption and income

(1) *GDP identity:* aggregate income = aggregate expenditure:
- Y = GDP = _____

(2) *Consumption function:*
- C = _____

- Given values for I, G, and X, the two equations *together* determine C and Y.

Joint determination of C and Y: the algebra

- So C affects Y, but Y affects C!
- To find where it all ends, solve the two equations jointly.
- Substitute consumption function into GDP identity:

  Y = C + I + G + X

  = (_____) + I + G + X

Numerical example

- Suppose a = 1 and b = 0.75.
- Then the consumption function is
  C = _____ .
- Suppose I = $1 trillion, G = $2 trillion, X = $0 trillion.
- Then the GDP identity is
  Y = C + I + G + X = C + 1+2+0 = C +____ .

Numerical example (cont'd)

- Must solve simultaneously:
  C = 1 + 0.75 Y   and   Y = C + 3.
- Substitute: Y = (_____) + 3.
- Simplify: Y = _____ .
- Subtract 0.75 Y: 0.25 Y = _____ .
- So Y = $____ trillion and C = $___ trillion.

Graphical interpretation

- What did we just do?
- Substitute consumption function
  Y = a + b Y   into GDP identity:

  Y = C + I + G + X

  = (_____) + I + G + X

- Now graph left- and right-hand sides separately, each as functions of Y.

THE KEYESIAN CROSS
Page 2

Left-hand side: a 45° line

Left-hand side: Y = Y
- Just forms a 45° line through origin.

Expenditure (vertical axis)
Income (horizontal axis)
45°

Right-hand side: expenditure

Right hand side:
Expenditure
$= (a+bY) + I + G + X$
- Graphed by stacking I, G, and X on top of consumption function.

Expenditure (vertical axis)
Income (horizontal axis)
C+I+G+X
C+I+G
C+I
C

Right-hand side: expenditure (cont'd)

Expenditure line
$= (a+bY) + I + G + X$
$= (a+I+G+X) + bY$
- Note expenditure line has same slope as consumption function:
  _____.
- But has bigger intercept:
  _____.

Expenditure (vertical axis)
Income (horizontal axis)
C+I+G+X

Spending balance: the Keynesian cross

- When the two functions cross, the equation is in balance.
- Called "point of spending balance."

Expenditure (vertical axis)
Income (horizontal axis)
45°

Interpreting the Keynesian cross as an equilibrium

Intersection is like an equilibrium.

If income were less than expenditure:
- firms would not be producing enough goods to satisfy spending.
- production would increase.

Expenditure (vertical axis)
Income (horizontal axis)
45°

Interpreting the Keynesian cross as an equilibrium (cont'd)

If income were more than expenditure:
- firms would be producing too many goods
- so production would fall.

However, it is only a *temporary* equilibrium.

Expenditure (vertical axis)
Income (horizontal axis)
45°

THE KEYESIAN CROSS
Page 3

What if G (or I or X) changes?

- GDP identity shows that Y must increase.
- Consumption function shows that any increase in Y causes an increase in C.
- GDP identity shows that any increase in C feeds back into a further increase in Y.
- etc.

| Changes in income | Changes in consumption |

Revised numerical example

- Again a = 1 and b = 0.75, so consumption function is C = _____ .
- Again suppose I = $1 trillion, X = $0 trillion, but now G = **$3 trillion**.
- Then the GDP identity is
  Y = C + I + G + X = C + 1+3+0 = C +____ .

Revised numerical example (cont'd)

- Must solve simultaneously:
  C = 1 + 0.75 Y   and   Y = C + 4.
- Substitute: Y = (_____) + 4.
- Simplify: Y = _____ .
- Subtract 0.75 Y: 0.25 Y = _____ .
- So Y = $____ trillion and C = $___ trillion.

What this numerical example shows

- A small change in G ($1 trillion) blew up into a large change in Y ($4 trillion)!
- Reason: Keynesian cross has a feedback loop through the _____ function.
- Change in G feeds back into change in C.

| Changes in income | ➡ ⬅ | Changes in consumption |

Keynesian cross can explain how booms might start

- Suppose real GDP initially = potential GDP.
- Then G (or I or X) increases,
- real GDP rises above potential GDP,
- starting a boom.
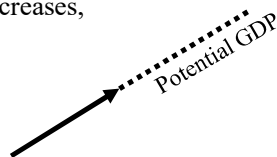
Keynesian cross can explain how recessions might start

- Suppose real GDP initially = potential GDP.
- Then G (or I or X) decreases,
- real GDP falls below potential GDP,
- starting a recession.
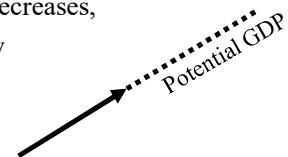
THE KEYESIAN CROSS
Page 4

Keynesian cross can help build sophisticated forecasts

- The total change in GDP is _____ than the original change in G, because _____ changes also.
- Any change in income _____ into consumption.
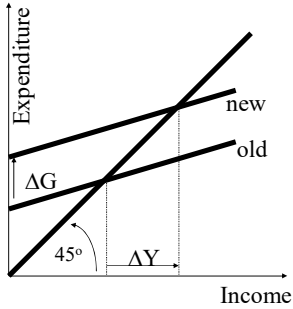
Conclusions

- *Aggregate expenditure* means C+I+G+X , viewed as a function of aggregate income (Y) in the short run.
- Slope of expenditure line is positive (but < 1) because _____ depends on Y.
- The *Keynesian cross* diagram shows expenditure line and 45º line, with *spending balance* at intersection.
- Any change in I, G, or X causes a _____ change in Y.

THE SIMPLE KEYNESIAN MULTIPLIER
Page 1

THE SIMPLE KEYNESIAN MULTIPLIER

- How much does a change in government purchases affect GDP in the short run?

Vertical shifts in expenditure line

Can be caused by:
- changes in G.
- changes in I
- changes in X.
- "autonomous" changes in C (that is, changes in a, intercept of consumption function).
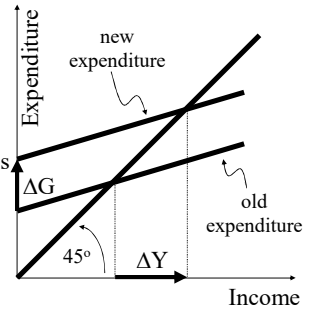
Impact on GDP

- The total change in GDP is _____ than the original change in G, I, or X.
- Reason: _____ changes also.
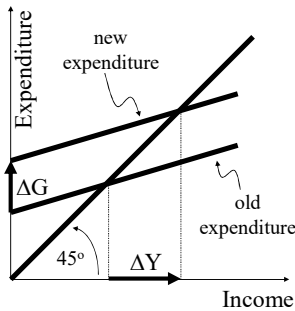
General definition of Keynesian multiplier

Multiplier = ratio of total change in GDP (ΔY) to original change in G, I, or X (that is, to vertical shift in expenditure line)

$= \Delta Y / \Delta$ (G, I, or X)
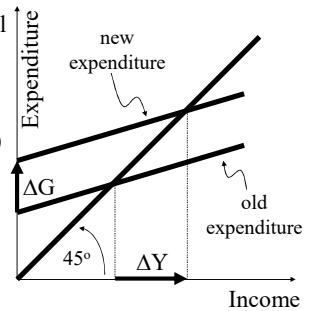
Multiplier: example

- Suppose government decides to spend an additional $100 billion dollars on roads.
- ΔG = $100 billion.
- This shifts expenditure line shifts up by $_____.
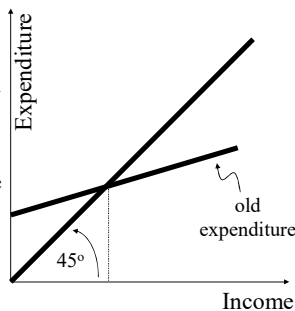
Multiplier: example

- By definition, multiplier = ΔY / vertical shift
- Suppose multiplier = 3.5.
- Then GDP increases by ΔY = 3.5 × $100 b = $_____ billion.
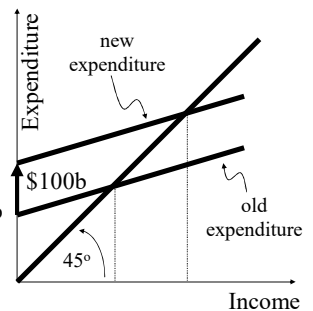
THE SIMPLE KEYNESIAN MULTIPLIER
Page 2

The multiplier and the MPC

- The size of the multiplier depends on the size of the marginal propensity to consume (MPC=b).
- This is because the MPC describes how changes in income _____ into changes in C and further raise expenditure.

| Changes in income | Changes in consumption |

Building the multiplier from the MPC

- Suppose government decides to increase spending on military by ΔG = $1 billion.
- Y immediately increases by $1 billion.
- Suppose MPC = 0.6.
- Then consumption increases by $1 billion × 0.6 = $_____ billion.

Building the multiplier from the MPC (cont'd)

- The increase in consumption causes an increase in income by the same amount.
- Which causes consumption to increase further by $1 billion × 0.6 × 0.6 = $_____ billion.

Building the multiplier from the MPC (cont'd)

- *That* increase in consumption causes an increase in income by the same amount.
- Which causes consumption to increase further by $1 billion × 0.6 × 0.6 × 0.6 = $_____ billion.
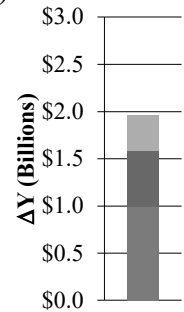
Building the multiplier from the MPC (cont'd)

- And again, *that* increase in consumption causes an increase in income by the same amount.
- Which causes consumption to increase further by $1 billion × 0.6 × 0.6 × 0.6 × 0.6 = $_____ billion.
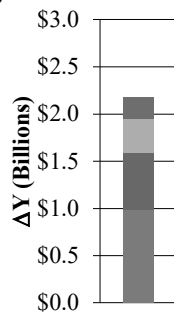
Formula for the simple multiplier

- Each increase in consumption equals previous increase times _____.
- Summed altogether, they form an infinite series:
  $\Delta Y = \Delta G + \Delta G \times MPC + \Delta G \times MPC^2 + \Delta G \times MPC^3 + \Delta G \times MPC^4 + ...$
- It can be shown that this infinite series sums to
  $\Delta Y = \Delta G \times 1 / (1-MPC)$.
- Which proves that simple multiplier $= \Delta Y / \Delta G$
  $= $ _____.

THE SIMPLE KEYNESIAN MULTIPLIER
Page 3

Computing the simple multiplier = 1 / (1-MPC)

- If MPC = 0.2, then multiplier = _____.
- If MPC = 0.4, then multiplier = _____.
- If MPC = 0.6, then multiplier = _____.
- If MPC = 0.8, then multiplier = _____.

Size of the simple multiplier

- The bigger the MPC, the _____ the multiplier.
- This is because the MPC measures the fraction of any change in G, I, or X that **feeds back** into changes in

  _____.

Using the simple Keynesian multiplier: example 1

- Suppose MPC = 0.6.
- Then simple Keynesian multiplier = 1/(1-0.6) = _____.
- If G increases by ΔG = $40 billion, then GDP increases by ΔY = _____ × $40 billion = $_____ billion.

$40b ; old expenditure ; 45°

Expenditure / Income
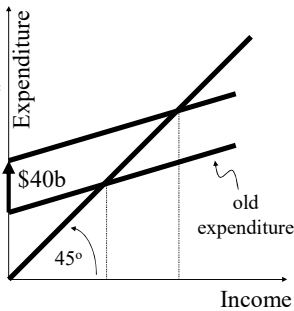
The multiplier and the marginal propensity to save

- *Marginal propensity to save* (MPS) = fraction of every additional dollar of income that goes to savings (rather than consumption).
- Thus MPS = _____.
- So we can alternatively write multiplier as: $\Delta Y/\Delta G$ = _____.

MPS and the simple Keynesian multiplier: example 2

- Suppose MPS = 0.3.
- Then simple Keynesian multiplier = 1/(0.3) = _____.
- If G increases by ΔG = $60 billion, then GDP increases by ΔY = _____ × $60 billion = $_____ billion.

$60b ; old expenditure ; 45°

Expenditure / Income
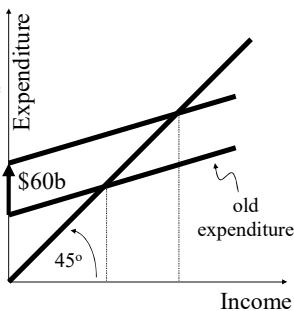
MPS and the simple Keynesian multiplier: example 2

- Suppose MPS = 0.3.
- Then simple Keynesian multiplier = 1/(0.3) = __ 3 1/3 __.
- If G increases by ΔG = $60 billion, then GDP increases by ΔY = _____ × $60 billion = $_____ billion.

$60b ; old expenditure ; 45°

Expenditure / Income
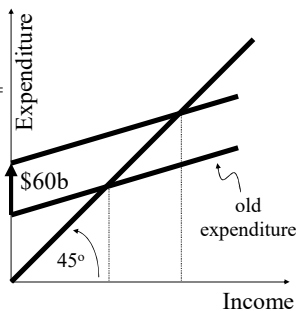
THE SIMPLE KEYNESIAN MULTIPLIER
Page 4

Autonomous changes in consumption

- Perhaps consumers become worried about bad times ahead.
- Suppose then all consumers, regardless of income, decide to save more.
- Consumption function shifts _____ .
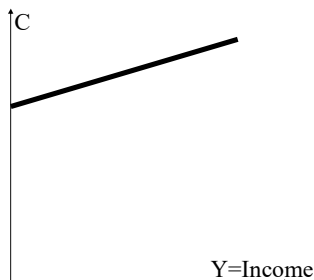
Keynes's "paradox of thrift"

- Suppose everyone saves more and consumption function shifts down.
- Then expenditure function shifts by same amount.
- What happens to GDP? _____ .
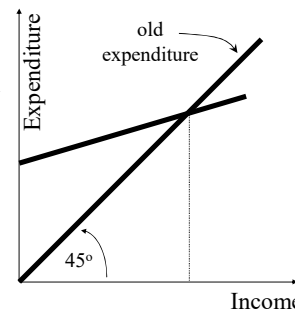
Using the simple Keynesian multiplier: example 3

- Suppose MPC = 0.4.
- Then simple Keynesian multiplier = 1/(1-0.4) = _____ .
- If cons. shifts down by $0.3 trillion, then GDP decreases by ΔY = _____ × $0.3 trillion = $_____ trillion.
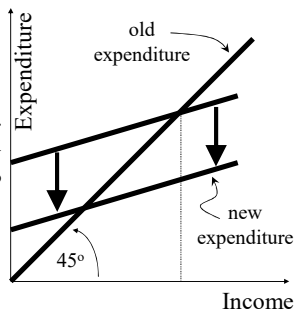
Conclusions

- The *multiplier* is the ratio of total short-run changes in GDP (or Y) to changes in G, I, X, or autonomous changes in C.
- When only C depends on Y, the simple multiplier = _____ or = _____ .
- The larger the MPC, the larger the multiplier.

THE KEYNESIAN MULTIPLIER AND NET EXPORTS
Page 1

THE KEYNESIAN MULTIPLIER AND NET EXPORTS

- How are net exports and income related in the short run?
- What is the multiplier when this relationship is taken into account?

Net exports

- X = net exports = exports - imports.
- *Exports* = purchases of U.S.-made goods and services by people in other countries.
- *Imports* = purchases of foreign-made goods and services by people in U.S.
- Imports form part of spending by consumers, businesses, and the government.

Net exports depend on income

- _____ are affected by income of people in the U.S.
- _____ are affected by incomes of people in other countries.
- Therefore, as U.S. income grows _____ increase and _____ remain constant (assuming other countries' incomes are unchanged).

Marginal propensity to import

- *Marginal propensity to import* (MPI) = slope of imports as a function of income.
- MPI = fraction of every additional dollar of income that goes to imports.
- MPI is _____.
- But MPI _____ MPC because most consumption is not imported.

Net exports and income

- X = net exports = exports - imports.
- Imports grow as income grows.
- X therefore depends *negatively* on income:
  X = c - d Y,
  where d = MPI.

slope = -d
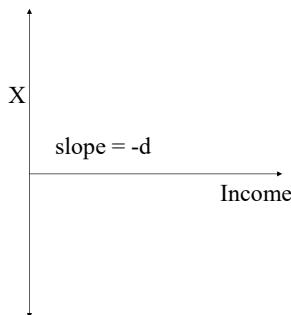
The expenditure line when both X and C depend on Y

- Expenditure is given by
  Y = C+I+G+X
  = (a+bY)+I+G+(c-dY)
  = (a+I+G+c) + (b-d)Y
- Graphed by stacking I, G, and X on top of consumption function.

C+I +G+X

C+I +G

C+I

C
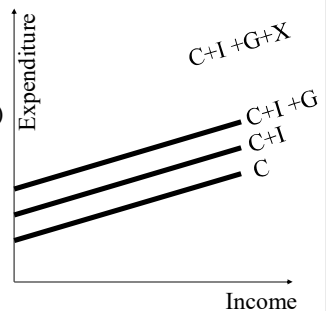
THE KEYNESIAN MULTIPLIER AND NET EXPORTS
Page 2

The expenditure line when both X and C depend on Y (cont'd)

- Intercept = _____.
- Slope = _____.

C+I +G+X

Expenditure
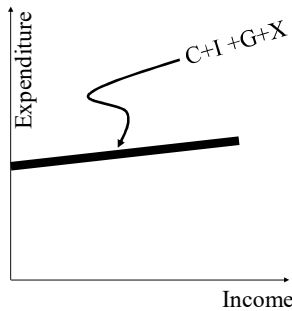
Income

Imports dampen the effect of changes in G or I

- Net exports and consumption respond in opposite directions to changes in income.
- As income rises, consumption rises but net exports _____.
- Thus the effects of changes in G or I on GDP are _____.

Changes in income	➡	Changes in consumption *less* changes in net exports
	⬅	
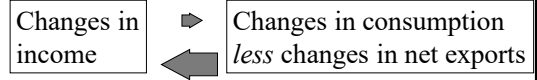
Building the multiplier from the MPC and the MPI

- Suppose ΔG = $1 billion.
- Suppose MPC=0.6 and MPI=0.2.
- Then consumption increases by $1 billion × 0.6 = $_____ billion.
- But net exports decrease by $1 billion × 0.2 = $_____ billion.
- Net increase by only $1 billion × (0.6-0.2) = $_____ billion.

ΔY (Billions)
$3.0
$2.5
$2.0
$1.5
$1.0
$0.5
$0.0
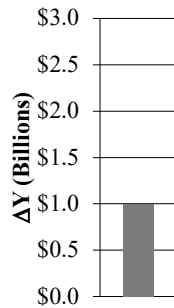
Building the multiplier from the MPC and the MPI (cont'd)

- Which causes consumption to increase further by $1 billion × 0.4 × 0.6.
- And net exports to decrease by $1 billion × 0.4 × 0.2.
- Further net increase by only $1 billion × 0.4 × (0.6-0.2) $1 billion × 0.4 × 0.4 = $_____ billion.

ΔY (Billions)
$3.0
$2.5
$2.0
$1.5
$1.0
$0.5
$0.0
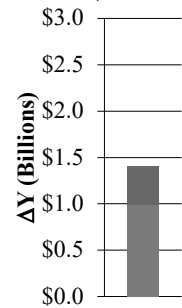
Formula for the multiplier with net exports

- Each increase in consumption equals previous increase times _____.
- Summed altogether, they form an infinite series:
  $\Delta Y = \Delta G + \Delta G×(MPC-MPI) + \Delta G×(MPC-MPI)^2 + \Delta G×(MPC-MPI)^3 + ...$
- It can be shown that this infinite series sums to $\Delta Y = \Delta G × 1 / (1-MPC+MPI)$.
- Which proves that multiplier with net exports = $\Delta Y / \Delta G$ = _____.

Computing the multiplier with net exports: example

- Suppose MPC = 0.3 and MPI = 0.1 .
- Then the multiplier = $\Delta Y / \Delta G$ = 1 / (1 − 0.3 + 0.1) = 1/0.8 = _____.
- If government purchases increase by ΔG = $40 billion, then GDP increases by ΔY = _____ x $40 billion = $_____ billion.

THE KEYNESIAN MULTIPLIER AND NET EXPORTS
Page 3

What determines the size of the multiplier

- The size of the multiplier depends _____ on MPC, and _____ on MPI.
- Countries with large foreign trade will have a large value for MPI and consequently a _____ value for the multiplier.

Conclusions

- Net exports depend _____ on income, because as income rises, imports of consumption goods rise.
- When we recognize that both C and X depend on Y, the multiplier becomes = 1 / (1 – MPC + MPI) .
- This multiplier is _____ than the simple multiplier when only C depends on Y.

MORE KEYNESIAN MULTIPLIERS
Page 1

MORE KEYNESIAN MULTIPLIERS

- How do other changes in fiscal policy affect GDP in the short run?

The government-purchases multiplier

- We have shown that, in the short run, a change in government purchases causes a much larger change in GDP.
- If only C depends on Y, the government-purchases multiplier equals:
  $\Delta Y/\Delta G =$ _____.
- If both C and X depend on Y, the multiplier equals: $\Delta Y/\Delta G =$ _____.

Numerical example: Suppose MPC=0.7 and MPI=0.1

- What is the value of the government-purchases multiplier?
- Write $\frac{\Delta Y}{\Delta G} = \frac{1}{1 - MPC + MPI} = \frac{1}{1 - \quad + \quad}$

  $=$ _____.

Numerical example (cont'd)

- If $\Delta G =$ \$200 billion, then by how much does GDP increase?
- Write $2.5 = \frac{\Delta Y}{\Delta G} = \frac{\Delta Y}{\quad}$.
- Solve $\Delta Y = 200 \times 2.5 =$ \$_____ billion.

Numerical example (cont'd)

- How big an increase in G is needed to raise GDP by \$300 billion?
- Write $2.5 = \frac{\Delta Y}{\Delta G} = \frac{\quad}{\Delta G}$.
- Solve $\Delta G = 300/2.5 =$ \$_____ billion.

Fiscal policy

- *Fiscal policy* = government spending, taxing, and borrowing.
- Taxes also affect GDP in short run.
- Mechanism is similar: increase in disposable income induces consumers to spend more, which raises income further, etc.

MORE KEYNESIAN MULTIPLIERS
Page 2

A tax cut is different from an increase in gov't purchases

- An increase in govt. purchases (G) **by itself** increases GDP, even before consumption responds.
  - Govt. is paying for something to be **produced**: _____ .
- But a tax cut does **not** by itself increase GDP.
  - Govt. is _____ paying for a good or service, just writing a refund check.

Building the tax-cut multiplier

- If government cuts taxes, it will cause increases in consumption and imports.
- However, the tax cut by itself does **not** raise GDP—not a payment for a good or service.
- So we must exclude amount of tax cut in computing the multiplier.
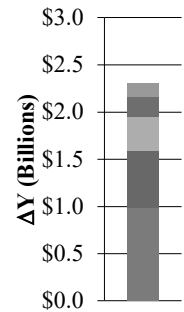
Formula for tax-cut multiplier

- Because that first payment by the government is **not** a payment for a good or service, the tax cut multiplier = govt purchases multiplier **minus 1**.
- Add a negative sign because a tax cut is really a **decrease** in taxes, to get the multiplier:
$$\frac{\Delta Y}{-\Delta T} =$$

Computing tax-cut multiplier: example

- Suppose MPC=0.7 and MPI=0.1.
- Compute govt purchases multiplier:
- $\frac{\Delta Y}{\Delta G} = \frac{1}{1-MPC+MPI} = \frac{1}{1-+} = \underline{}$
- Compute tax-cut multiplier:
- $\frac{\Delta Y}{-\Delta T} = \left(\begin{matrix} govt\ purchases \\ multiplier \end{matrix}\right) - 1 = \underline{}$.

Tax-cut multiplier example (cont'd)

- If taxes are cut by $200 billion, then by how much does GDP increase?
- Write $1.5 = \frac{\Delta Y}{-\Delta T} = \frac{\Delta Y}{}$.
- Solve $\Delta Y = 200 \times 1.5 = \$\underline{}$ billion.

Tax-cut multiplier example (cont'd)

- How big a tax cut is needed to raise GDP by $300 billion?
- Write $1.5 = \frac{\Delta Y}{-\Delta T} = \frac{}{-\Delta T}$.
- Solve $-\Delta T = 300/1.5 = \$\underline{}$ billion.

MORE KEYNESIAN MULTIPLIERS
Page 3

Simultaneous increases in taxes and government purchases

- Suppose the government increases purchases and taxes simultaneously by the *same amount*. The budget deficit will neither increase or decrease.
- To find the effect on GDP, we must apply *both* the government-purchases multiplier and (negative of the) tax cut multiplier.

Finding the formula for the "deficit neutral" multiplier

- $\frac{\Delta Y}{\Delta G} - \frac{\Delta Y}{-\Delta T} = \left(\frac{1}{1-MPC+MPI}\right) - \left(\frac{1}{1-MPC+MPI} - 1\right) = \underline{\quad}.$
- The "deficit neutral" multiplier always equals _____ because there is no change in consumption or net exports.
- Taxes "soak up" change in income caused by the increase in government purchases, so there is no feedback.

"Deficit neutral" multiplier example

- If ΔG = $100 billion and ΔT = $100 billion, then by how much does GDP increase?
- ΔY = $ _____ billion.
- Don't need to know MPC or MPI !

Conclusions

- The *tax-cut multiplier* = government-purchases multiplier minus one.
- The *deficit-neutral multiplier* = government-purchases multiplier minus tax-cut multiplier. It must always = _____.

FORWARD-LOOKING CONSUMPTION
Page 1

FORWARD-LOOKING CONSUMPTION

- In practice, the MPC and the multiplier are unstable. Why?

Instability in the Keynesian multiplier

- Sometimes the MPC and the multiplier appear to be much smaller than at other times. Examples:
- People saved almost all of the 1975 tax cut.
- People spent almost all of the 1981 tax cut.
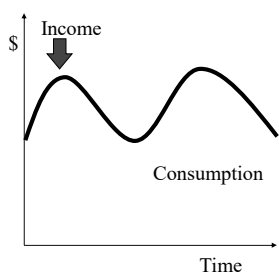
Why the multiplier is unstable

- The sizes of the MPC and the multiplier depend on whether the change in disposable income is expected to be permanent or temporary.
- Reason: people prefer to keep consumption relatively constant, even if their income fluctuates.

Consumption smoothing
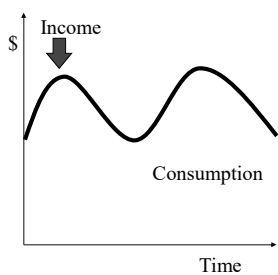
People with temporarily...
- low income—draw down savings or maybe borrow to pay for current consumption.
- high income—save money for a rainy day.

Not everyone can smooth their consumption

- People who have little savings and cannot borrow face *liquidity constraints*.
- When income is temporarily low, they must reduce consumption.

Two theories of consumption smoothing

- *Permanent income hypothesis* (Milton Friedman): people base consumption decisions on their permanent (or long-run average) income.
- *Life-cycle income hypothesis* (Franco Modigliani): people base consumption decisions on income they expect over their lifetimes.

FORWARD-LOOKING CONSUMPTION
Page 2

Implications of both theories

- Any changes in income that people believe are permanent will cause people to change their consumption.
- Any changes in income they believe are temporary will affect consumption _____.

Implications of consumption smoothing for the MPC

- A temporary change in income has a small MPC and a _____ multiplier.
  - Example: Tax cut of 1975 was announced as temporary.
- A permanent change in income has a large MPC and a _____ multiplier.
  - Example: Tax cut of 1981 was perceived to be long-term if not permanent.

Consumption smoothing in the Great Recession

- Great Recession began at the end of 2007.
- A one-time tax cut in 2008 sharply increased consumers' disposable income.
- But consumption spending hardly budged.

Source: U.S. Bureau of Economic Analysis
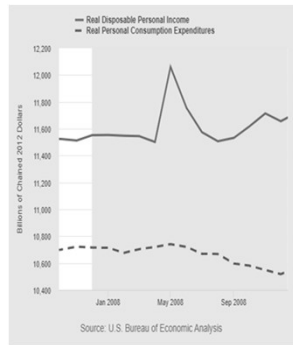
Another implication of consumption smoothing

- Changes in consumption could even *precede* changes in income, if income changes are anticipated.
- Consumers expecting a _____ in income will start spending more now.
- Consumers expecting a _____ in income will cut spending now.

Consumption smoothing in the COVID Pandemic Recession

- Pandemic hit U.S. in March 2020.
- Small drop in income, but big drop in consumption spending.
- "Stimulus payments" from gov't sent in April 2020.

Source: U.S. Bureau of Economic Analysis
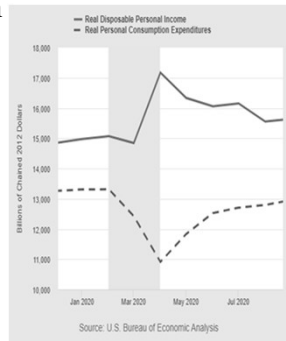
Conclusions

- Most people try to smooth their consumption patterns, even if their income fluctuates.
- They base their consumption decisions on what they believe is their _____ income.
- Theories of consumption smoothing predict that the MPC and multiplier are _____ for permanent changes in income, and _____ for temporary changes.

INFLATION OVER THE BUSINESS CYCLE:
Page 1

INFLATION OVER THE BUSINESS CYCLE

- What is the classic pattern of inflation over the business cycle?
- What causes this pattern?

Recoveries

So far, we have explained why GDP might move away from potential GDP in the short run.

Now we must explain why recovery tends to follow recession in a cycle.

The classic pattern of inflation

Over a business cycle, inflation...
- rises during booms.
- reaches a maximum in early stages of recession
- falls toward end of recession and early part of recovery.

Inflation rises during booms and falls during recessions and recoveries

Sources: CBO; BEA

Inflation rises during booms and falls during recessions and recoveries

Sources: CBO; BEA

Inflation rises during booms and falls during recessions and recoveries

Sources: CBO; BEA

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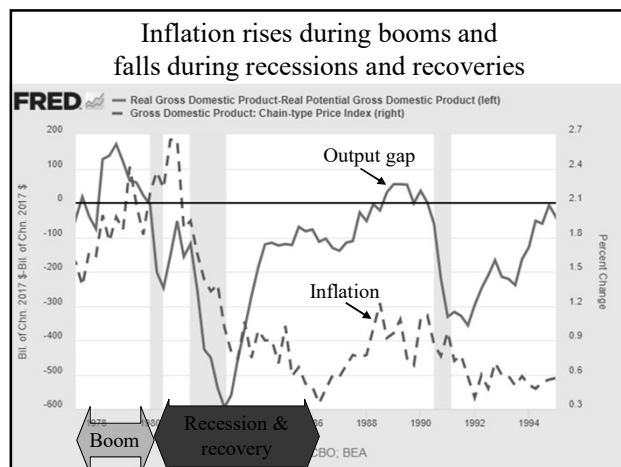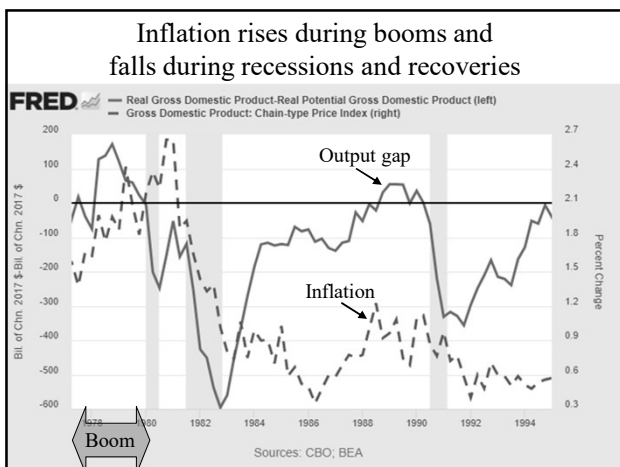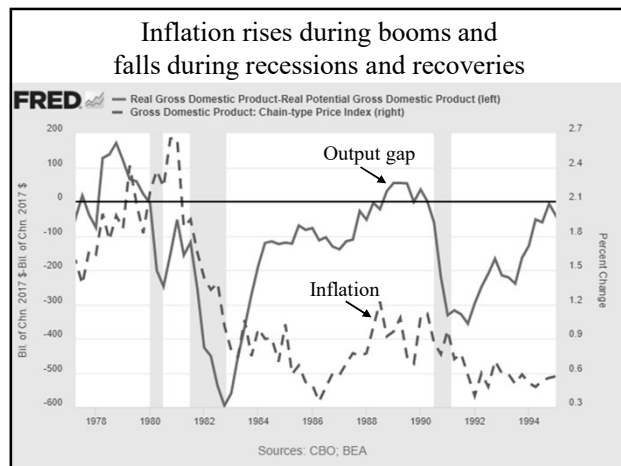
INFLATION OVER THE BUSINESS CYCLE:
Page 2

Inflation rises during booms and falls during recessions and recoveries

Inflation rises during booms and falls during recessions and recoveries

---

Inflation... (cont'd)

Another way of showing inflation over the business cycle of 1987-94.

Inflation versus GDP: classic counter-clockwise cycle

On a graph with
- inflation on vertical axis,
- deviation of GDP from potential GDP on horizontal axis,

economy moves through counter-clockwise cycle.

Alternative view: inflation versus unemployment

On a graph with
- inflation on vertical axis,
- **unemployment** on horizontal axis,

economy moves through **clockwise** cycle.

Explaining the pattern

- Why does this pattern occur?
- In the next presentations, we will see that the interest rate provides a link between inflation and real GDP:
  - inflation affects the real interest rate
  - the real interest rate affects real GDP.

| Inflation | ? | Real interest rate | ? | Real GDP |

INFLATION OVER THE BUSINESS CYCLE:
Page 3

Conclusions

- To understand why recoveries occur, one must first understand the classic pattern of inflation over the business cycle.
- Inflation rises during a _____ and falls toward the end of a _____ and during the early stages of _____.
- We will see later that the interest rate helps explain this pattern.

HOW THE INTEREST RATE AFFECTS GDP
Page 1

HOW THE INTEREST RATE AFFECTS GDP

- Why does a change in the real interest rate typically cause a change in GDP?
- Why does a fall in the interest rate typically cause GDP to rise?

Inflation and GDP

- If inflation falls, GDP eventually rises.
- If inflation rises, GDP eventually falls.
- Why does this pattern occur?

Inflation rate

\- ← → +

Output gap
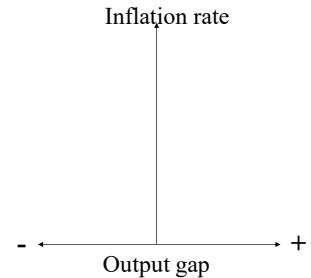
Inflation, the interest rate, and GDP

The pattern occurs because :
- inflation affects the real interest rate,
- the real interest rate affects real GDP.

This presentation explains the *second* part of this relationship.

Inflation ?> Real interest rate ?> Real GDP
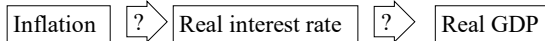
How the interest rate affects consumption

A rise in the interest rate...
- raises opportunity cost of consumption now compared with consumption in the future.

Thus:
- consumption (now) _____.
- saving (for consumption in the future) _____.

How the interest rate affects investment

A rise in the interest rate raises the cost of borrowing funds. This makes
- businesses less willing to purchase business fixed investment,
- businesses and consumers less willing to purchase residential investment.

Thus investment spending _____.

How the interest rate affects the exchange rate ...

A rise in the interest rate...
- makes dollars more attractive because dollar-denominated assets yield a higher rate of return than assets in other currencies, such as euros.
- which _____ the exchange rate (the price of a dollar in terms of euros),

---

HOW THE INTEREST RATE AFFECTS GDP
Page 2

... which then affects net exports

- This rise in the exchange rate:
  - makes U.S. exports more expensive for foreigners,
  - and makes imports from abroad cheaper for Americans.
- So foreigners buy _____ of our exports, but we import _____.
- Thus net exports _____ when the interest rate rises.

The Keynesian cross revisited

- Recall: expenditure line shows the short-run relation between income and spending.
- Expenditure line shifts if any factor changes other than _____.
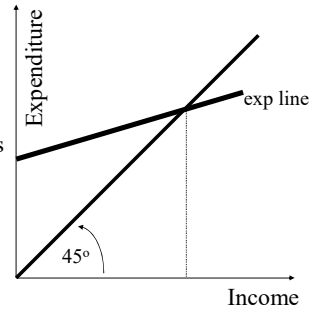
Effect on GDP of an increase in the interest rate

An increase in the interest rate:
- reduces C, X, and I as we have seen,
- shifts expenditure line down,
- lowers the point of spending balance (real GDP).
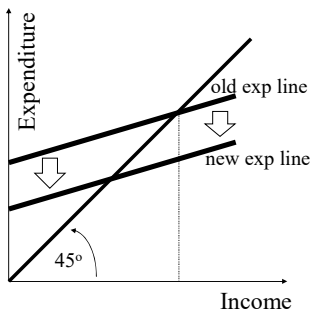
Effect on GDP of a **de**crease in the interest rate

A **de**crease in the interest rate:
- **in**creases C, X, and I,
- shifts expenditure line up.
- raises the point of spending balance (real GDP).
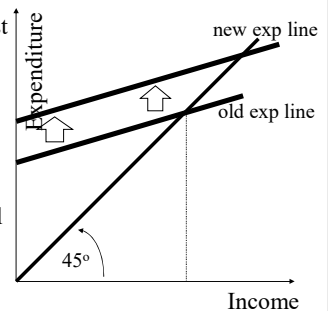
The interest rate and GDP

- Thus the real interest rate has a _____ effect on real GDP.

| Inflation | ? > | Real interest rate | ⟹ | Real GDP |
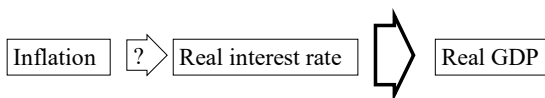
Conclusions

- An increase in the real interest rate _____ C, I, and X
- In the short run, this shifts the expenditure line _____, lowering the point of spending balance and real GDP.
- A decrease in the real interest rate has the opposite effect, raising GDP.
- There is a _____ *short-run relationship* between the real interest rate and real GDP.

HOW INFLATION AFFECTS THE INTEREST RATE
Page 1

HOW INFLATION AFFECTS THE INTEREST RATE

- Why does a change in the inflation rate typically cause a change in the real interest rate?
- What happens to GDP as a result?

Inflation and GDP

- If inflation falls, GDP eventually rises.
- If inflation rises, GDP eventually falls.
- Why does this pattern occur?

Inflation rate (vertical axis), Output gap (horizontal axis, - to +)
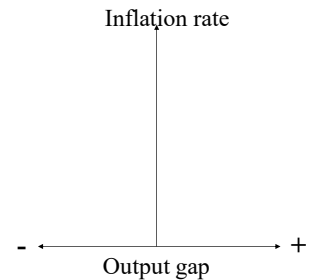
Inflation, the interest rate, and GDP

This pattern occurs because
- inflation affects the real interest rate,
- the real interest rate affects real GDP.

This presentation explains the *first* part of this relationship.

| Inflation | ? ⟩ | Real interest rate | - ⟩ | Real GDP |
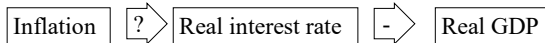
Who is in charge?

- In the short run, the real interest rate is determined by the behavior of a country's _____, which typically follows some *policy rule*.
- Details vary, but most central banks _____ the real interest rate if inflation rises and _____ it if inflation falls.

| Inflation | ⟩ | Real interest rate |

The monetary policy rule curve

- Policy rule can be graphed as upward-sloping curve.

Policy rule curve. Real interest rate (vertical axis), Inflation rate (horizontal axis)
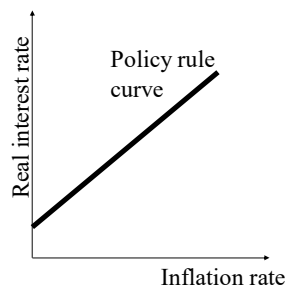
Example of a monetary policy rule

Inflation rate	Interest rate	Real interest rate
1%	1.0%	
2%	2.5%	
3%	4.0%	
4%	5.5%	
5%	7.0%	
6%	8.5%	
7%	10.0%	
8%	11.5%	
9%	13.0%	

HOW INFLATION AFFECTS THE INTEREST RATE
Page 2

Example of a monetary policy rule: graph

Lower real interest rate when inflation is _____ .

Raise real interest rate when inflation is _____ .
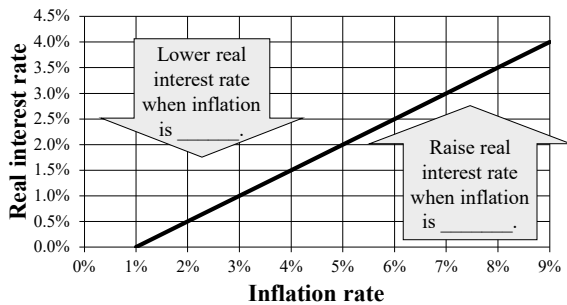
Inflation, interest rates, and GDP

Thus there is an overall _____ relationship between inflation and real GDP, driven by

• the central bank's monetary policy rule relating inflation to the real interest rate,

• the effect of real interest rates on spending.

Inflation ⟹ + ⟩ Real interest rate ⟩ - ⟩ Real GDP
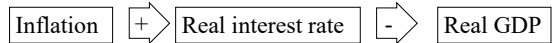
Graphical representation: the AD curve

• The negative relationship between inflation and GDP can be graphed as a downward-sloping curve.

• Textbook calls this the "aggregate demand curve."
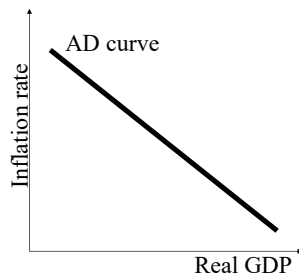
Movements along the AD curve

Changes in inflation, which prompt the central bank to change interest rates, create movements along this curve.

Inflation ⟩ - ⟩ Real GDP

Any change in the monetary policy rule shifts the AD curve

Example: Central bank gets tougher on inflation
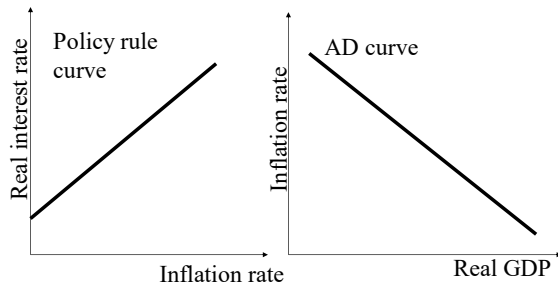
Any shift in the expenditure line also shifts the AD curve

Example: increase in government purchases
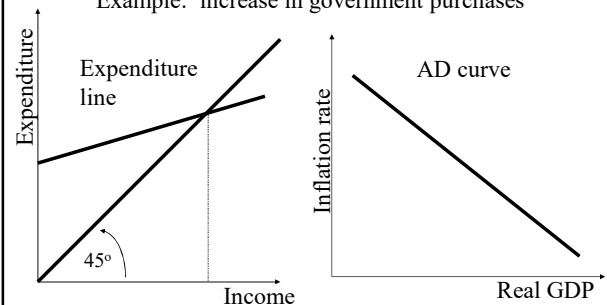
HOW INFLATION AFFECTS THE INTEREST RATE
Page 3

> ### Conclusions
>
> - Typical *monetary policy rules* prompt the central bank to raise the real interest rate when inflation _____.
> - Given the effect of the interest rate on GDP, this implies a _____ relationship between inflation and GDP, the *AD curve*.
> - The AD curve shifts if the Fed switches from one monetary policy rule to another, or if the expenditure line shifts.

INFLATION ADJUSTMENT
Page 1

INFLATION ADJUSTMENT

- What happens to inflation over the course of a boom or recession?
- How do booms and recessions end?

Recall: prices are sticky

- Firms often respond to unexpected changes in demand in short run by adjusting output and employment, not prices or wages.
- Explanations point to firms'
  - *limited information* about demand for their products
  - *implicit contracts* to keep prices and wages stable.

Inflation adjustment in the short run

- In the short run, firms hardly adjust prices at all to unexpected changes in demand.
- Firms stick to their earlier plans, whether for stable prices or steadily increasing prices.
- Thus inflation has _____ in the short run.

Slow adjustment of inflationary expectations

- Given time, firms do adjust their prices, but slowly. Why slowly?
- People are slow to change their *expectations* of future inflation.
- If inflation has been 5% for a while, people tend to assume it will continue to be 5%.

Staggered price-setting

- Another reason prices adjust slowly:
- In many markets, prices and wages are set in *staggered* fashion: first one price, then another, then another.
- Examples:

Inflation adjustment in the medium run when demand is strong

If demand is persistently strong, (that is, real GDP > potential GDP)
- then prices and wages are raised somewhat relative to expected inflation,
- inflation rate then _____ somewhat.
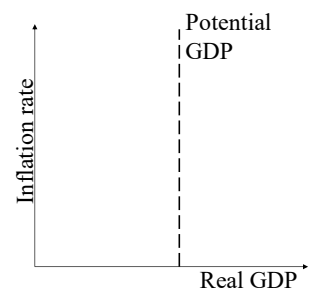
INFLATION ADJUSTMENT
Page 2

Inflation adjustment in the medium run when demand is slack

If demand is persistently slack, (that is, real GDP < potential GDP)

- then prices and wages are lowered somewhat relative to expected inflation.

- inflation rate then _____ somewhat.
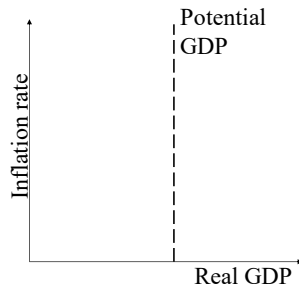
Inflation adjustment in reality

The following graph shows that most of the time,

- when real GDP > potential GDP, inflation rate is rising,

- when real GDP < potential GDP, inflation rate is falling.

Real GDP – potential GDP = output gap
Inflation rate (GDP PI)

Inflation rises when output gap is positive, and falls when output gap is negative

Sources: BEA; CBO
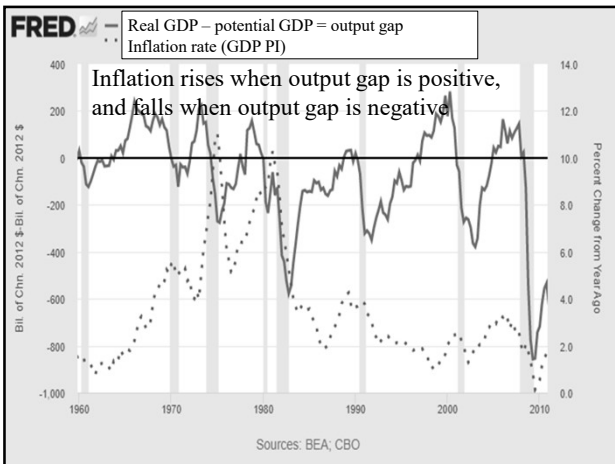
Inflation adjustment in the long run

Once real GDP reaches potential GDP,

- then prices and wages are raised exactly in step with expected inflation.

- inflation rate no longer tends to change.
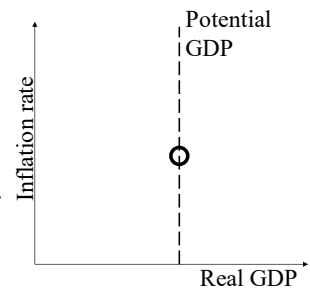
Graphing the "inflation adjustment" line

- Horizontal line represents response of inflation rate to real GDP in the short run.

- Flat because real GDP has no effect on inflation in short run.

- In short run, inflation has momentum.
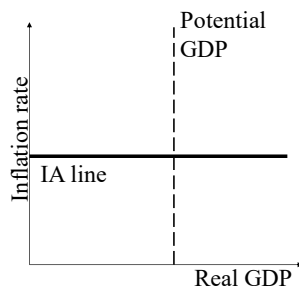
Shifts in the IA line in the medium and long run

In the medium and long run, however, the IA line shifts whenever real GDP is not equal to potential GDP.

If real GDP > potential GDP, the IA line rises.
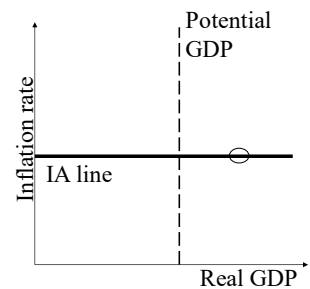
INFLATION ADJUSTMENT
Page 3

Shifts in the IA line in the medium and long run

If real GDP < potential GDP, the IA line falls.

Potential GDP

Inflation rate

IA line

Real GDP
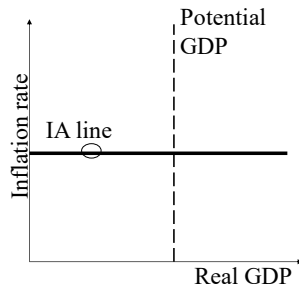
The AD curve and IA line together

Recall: AD curve shows _____ relationship between inflation and GDP, driven by:
- central bank's monetary policy rule relating inflation to the real interest rate,
- effect of real interest rates on spending (expenditure line).

AD curve

Inflation rate
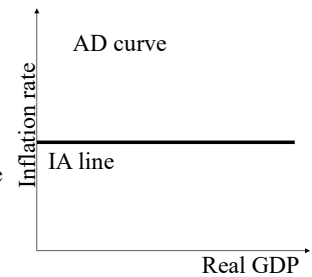
IA line

Real GDP

Determination of inflation and GDP in the *short run*

- Inflation is determined by expectations.
- Thus IA line is fixed in short run.
- The AD curve shows how this level of inflation determines real GDP (through interest rates set by the central bank).

AD curve

Inflation rate
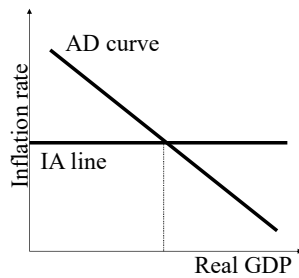
IA line

Real GDP

What happens in the *medium run* if real GDP > potential GDP

Suppose real GDP > potential GDP.
- Boom.
- Tight labor market.

In the medium run:
- IA line rises.
- Inflation rises and real GDP falls.
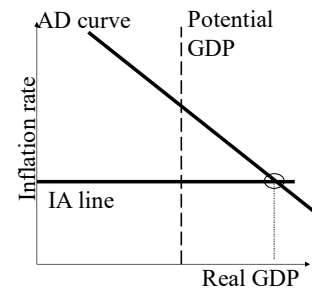
AD curve

Potential GDP

Inflation rate

IA line

Real GDP

What happens in the *long run* if real GDP > potential GDP

- IA stops moving only when GDP again = potential GDP.
- Booms end at a _____ inflation rate than before.

AD curve

Potential GDP

Inflation rate
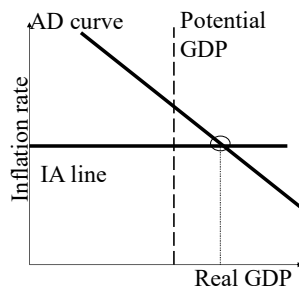
IA line

Real GDP

What happens in the *medium run* if real GDP < potential GDP

Alternatively, suppose real GDP < potential GDP.
- Recession.
- Slack labor market.

In the medium run:
- IA line falls.
- Inflation falls and real GDP rises.

Potential GDP

AD curve

Inflation rate

IA line
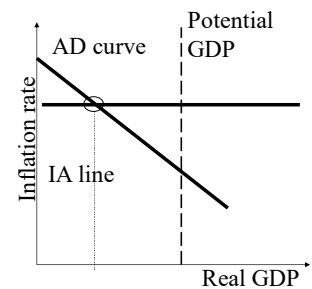
Real GDP

INFLATION ADJUSTMENT
Page 4

What happens in the *long run* if real GDP < potential GDP

- IA stops moving only when GDP again = potential GDP.
- Recessions end at a _____ inflation rate than before.
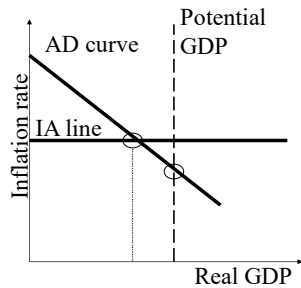
Conclusions

- Slow adjustment of inflation is illustrated by a horizontal "*inflation adjustment line.*"
- In the short run, the IA line is _____, no matter what the level of real GDP.
- In the medium run, the IA line _____ if real GDP differs from potential GDP.
- In the long run, the IA line stops moving when real GDP = potential GDP, ending the boom or recession.

CLASSIC BUSINESS CYCLES TRIGGERED BY CHANGES IN FISCAL POLICY
Page 1

CLASSIC BUSINESS CYCLES TRIGGERED BY CHANGES IN FISCAL POLICY

- How do changes in fiscal policy trigger business cycles?
- How do such business cycles end?

Counter-clockwise pattern of classic business cycles

- Many past business cycles have followed a counter-clockwise pattern when inflation is graphed against GDP.
- Can we explain this pattern using the AD-IA model?
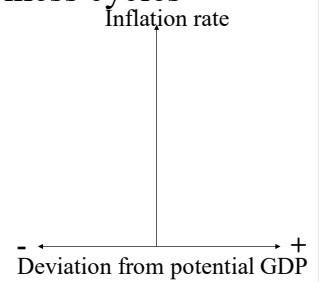
Definition: *Baseline* = what would have happened without any policy change

- *Baseline inflation* means the same inflation rate as before (*not* the same price level).
- *Baseline real GDP* means real GDP growing at the LR rate before the policy change.
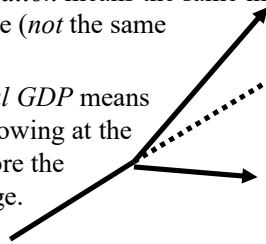
Cut in government purchases: how the recession begins
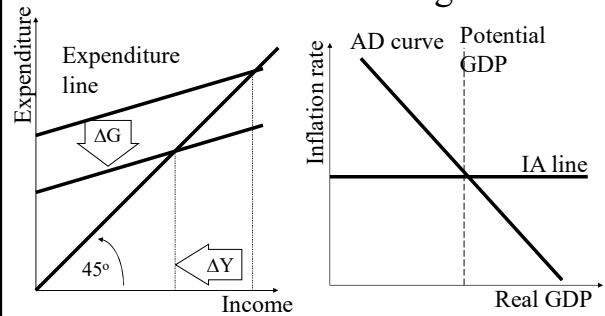
Cut in government purchases: the short run

- In the short run, the inflation rate does not change. It has _____.
- However, real GDP decreases by ΔG × _____.
- Therefore the AD curve shifts left by exactly this amount.

Cut in government purchases: the medium run

- Now real GDP < potential GDP.
- Inflation rate begins to fall, shown by fall in IA line.
- Real GDP begins to increase.
- Recovery begins.
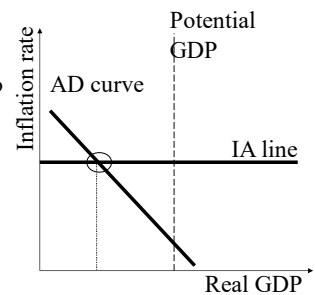
CLASSIC BUSINESS CYCLES TRIGGERED BY CHANGES IN FISCAL POLICY
Page 2

Cut in government purchases: the long run

- Real GDP finally recovers to potential GDP.
- No further changes in inflation or real interest rates.
- Recovery complete.

[Graph: Inflation rate (vertical axis) vs Real GDP (horizontal axis), showing AD curve (downward sloping), Potential GDP (vertical dashed line), and IA line (horizontal)]
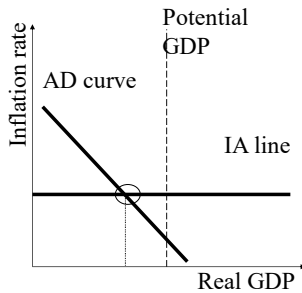
Cut in government purchases: effect on long-run growth

- Potential GDP grows faster than baseline. Why?
- Real interest rate is lower than baseline because government's share of GDP is smaller.
- Lower interest rate increases _____ which leads to _____ growth.

Rise in government purchases: how the boom begins
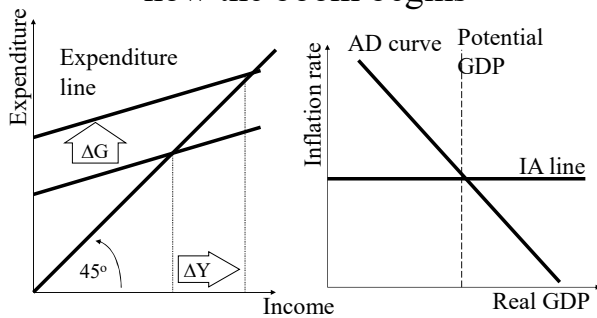
[Left graph: Expenditure (vertical axis) vs Income (horizontal axis), showing Expenditure line, ΔG, 45° angle, ΔY. Right graph: Inflation rate (vertical axis) vs Real GDP (horizontal axis), showing AD curve, Potential GDP, IA line]

Rise in government purchases: the short run

- In the short run, the inflation rate does not change (momentum).
- However, real GDP increases by
  ΔG × _____.
- Therefore the AD curve shifts right by exactly this amount.

Rise in government purchases: medium and long run

- Now real GDP > potential GDP.
- Medium run: inflation rate begins to rise, shown by IA line.
- Long run: IA rises sufficiently to bring real GDP back down to potential GDP.

[Graph: Inflation rate (vertical axis) vs Real GDP (horizontal axis), showing AD curve, Potential GDP (vertical dashed line), IA line]
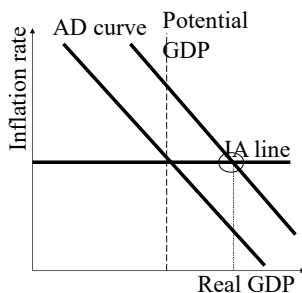
Rise in government purchases: effect on long-run growth

- Potential GDP grows slower than baseline. Why?
- Real interest rate is higher than baseline because government's share of GDP is larger.
- Higher interest rate decreases _____ which leads to _____ growth.

CLASSIC BUSINESS CYCLES TRIGGERED BY CHANGES IN FISCAL POLICY
Page 3

What about changes in taxes?

- A tax increase shifts the AD curve _____ by the amount of the tax increase times the _____.
  - Thus can cause a _____.
- A tax cut shifts the AD curve _____ by the amount of the tax cut times the _____.
  - Thus can cause a _____.

What about a simultaneous increase in both taxes and government purchases?

- If taxes and government purchases are *increased* by the same amount, the AD curve shifts _____ by the amount of the increase times _____.
- If taxes and government purchases are *decreased* by the same amount, the AD curve shifts _____.

The counter-clockwise pattern of booms

- Booms triggered by rises in government purchases or cuts in taxes eventually end.
- But they _____ the rate of inflation in the long run.
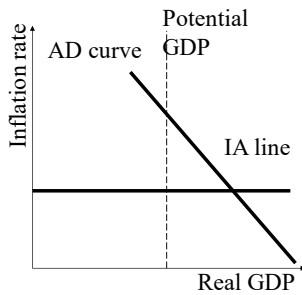
The counter-clockwise pattern of recessions

- Recessions triggered by cuts in government purchases or rises in taxes eventually end.
- But they _____ the rate of inflation in the long run.
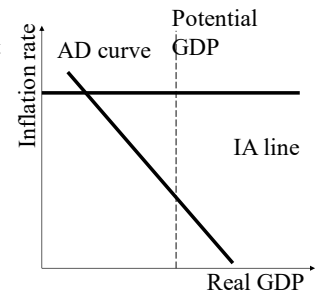
Conclusions

- Changes in fiscal policy cause shifts in the AD curve, triggering booms or recessions that follow a classic _____ pattern.
- Booms eventually _____ the inflation rate.
- Recessions eventually _____ it.
- Booms or recessions end when the rate of inflation adjusts sufficiently to bring real GDP back to potential GDP.

CLASSIC BUSINESS CYCLES TRIGGERED BY CHANGES IN MONETARY POLICY
Page 1

CLASSIC BUSINESS CYCLES TRIGGERED BY CHANGES IN MONETARY POLICY

- How do changes in monetary policy trigger business cycles?
- How do such business cycles end?

Counter-clockwise pattern of classic business cycles

- Many past business cycles have followed a counter-clockwise pattern when inflation is graphed against GDP.
- Can we explain this pattern using the AD-IA model?

Inflation rate

− Deviation from potential GDP +
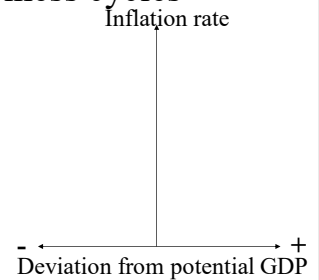
Tightened monetary policy: how the recession begins

Monetary policy rule curve

- Central bank raises policy rule curve.
- No change in inflation rate in SR.
- But real interest rate _____ .

Policy rule curve

Real interest rate

Inflation rate
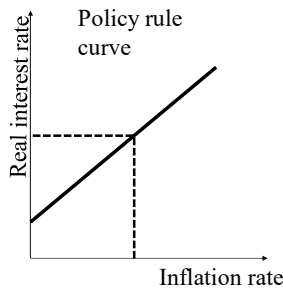
Tightened monetary policy: how the recession begins (cont'd)

Keynesian cross diagram
Increase in real interest rate...

- reduces C, X, and I as we have seen,
- shifts expenditure line down,
- decreases point of spending balance (real GDP).
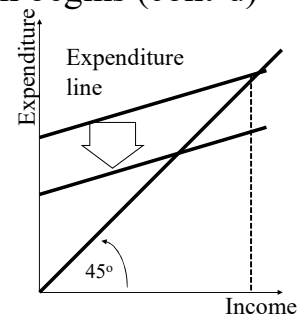
Expenditure

Expenditure line

45°

Income

Tightened monetary policy: how the recession begins (cont'd)

AD-IA diagram

- Aggregate demand curve shifts _____ by exactly same amount as in Keynesian cross diagram.
- No change in inflation rate in SR.

Inflation rate

AD curve

Potential GDP
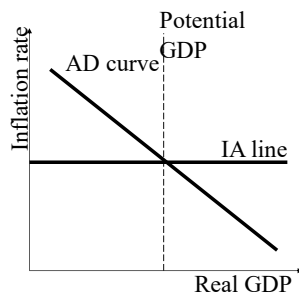
IA line

Real GDP

Tightened monetary policy: the medium run

- Now real GDP < potential GDP.
- Inflation rate begins to fall, shown by fall in IA line.
- Real GDP begins to rise.
- Recovery begins.

Inflation rate

AD curve

Potential GDP

IA line
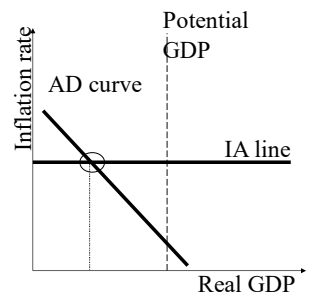
Real GDP

CLASSIC BUSINESS CYCLES TRIGGERED BY CHANGES IN MONETARY POLICY
Page 2

Tightened monetary policy: the long run

- Real GDP finally recovers to potential GDP.
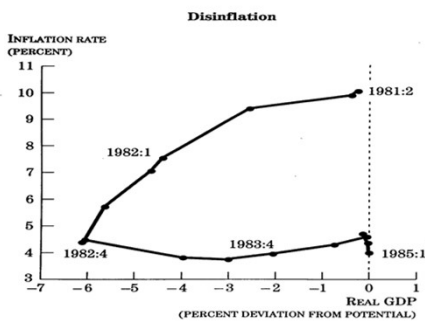- No further changes in inflation or real interest rates.
- Recovery complete.

Tightened monetary policy: what the recession should look like

- The AD-IA model predicts a counter-clockwise pattern when inflation is graphed against GDP.
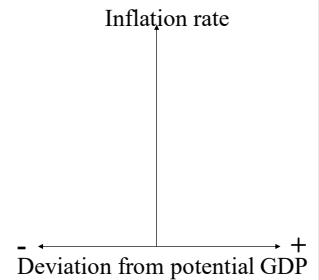
## Example of tightened monetary policy: the 1981 recession

Tightened monetary policy: effects in long run

- Tightened monetary policy causes a great deal of pain in the short run.
  - High unemployment.
  - Businesses make lower profits.
- Are there any benefits in the long run?
  - Inflation is _____.
  - Growth might be faster.

Relaxed monetary policy: how the boom begins

Monetary policy rule curve
- Central bank lowers policy rule curve.
- No change in inflation rate in SR.
- But real interest rate _____.
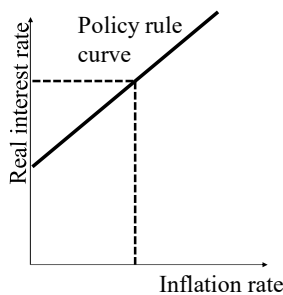
Relaxed monetary policy: how the boom begins (cont'd)

Keynesian cross diagram
Decrease in real interest rate...
- increases C, X, and I as we have seen,
- shifts expenditure line up,
- increases point of spending balance (real GDP).
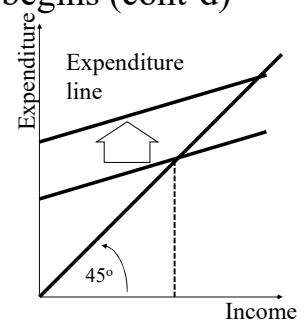
CLASSIC BUSINESS CYCLES TRIGGERED BY CHANGES IN MONETARY POLICY
Page 3

Relaxed monetary policy: how the boom begins (cont'd)

<u>AD-IA diagram</u>
- Aggregate demand curve shifts _____ by exactly same amount as in Keynesian cross diagram.
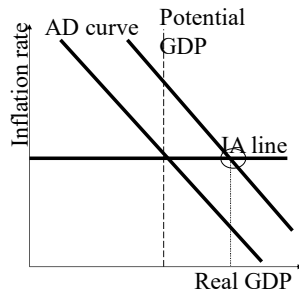- No change in inflation rate in SR.
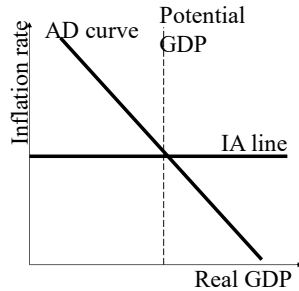
Relaxed monetary policy: medium and long run

- Now real GDP > potential GDP.
- Medium run: inflation rate begins to rise, shown by IA line.
- Long run: IA rises sufficiently to bring real GDP back down to potential GDP.
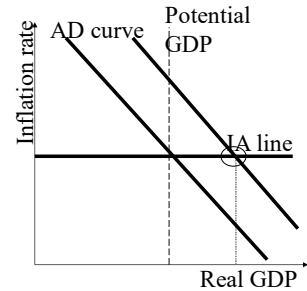
Relaxed monetary policy: what the boom should look like

- Our model predicts a counter-clockwise pattern when inflation is graphed against GDP.
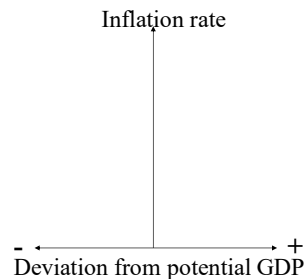
Example of relaxed monetary policy: 1971-74
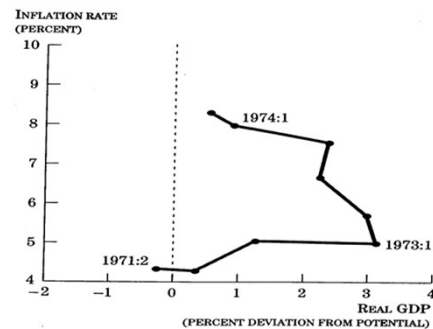
Relaxed monetary policy: effects in long run

- Reflation causes a boom in the short run.
  - Low unemployment.
  - Businesses make higher profits.
- Are there any consequences in the long run?
  - Inflation is _____.
  - Growth might be slower.

Monetary policy error and correction

- Suppose the Fed makes an error, mistakenly lowering interest rates.
  - Downward shift in policy rule curve.
- Then suppose the Fed tries to correct the error, raising interest rates back up again.
  - Upward shift in policy rule curve.
- What happens to the economy?

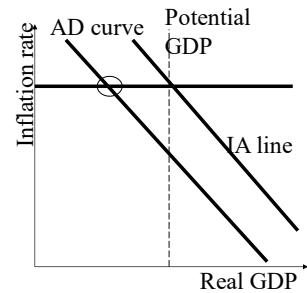CLASSIC BUSINESS CYCLES TRIGGERED BY CHANGES IN MONETARY POLICY
Page 4

First: the monetary policy error

- Initial policy error shifts AD curve right.
- Short run: IA line fixed, boom occurs.
- Medium run: IA begins to rise, real GDP begins to fall.
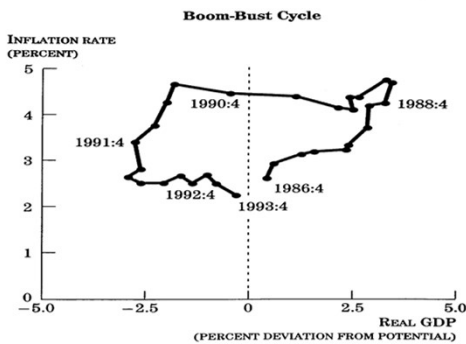- Long run: IA stops, real GDP falls back to potential GDP.

Next: the policy correction

- Now real GDP < potential GDP.
- Medium run: inflation rate begins to fall, shown by IA line.
- Long run: IA falls sufficiently to bring real GDP back up to potential GDP.

Monetary policy error and correction: the 1990-91 recession

Boom-Bust Cycle

INFLATION RATE (PERCENT)

1988:4
1990:4
1991:4
1986:4
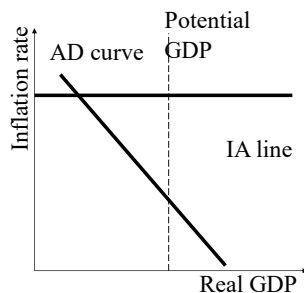1993:4
1992:4

REAL GDP (PERCENT DEVIATION FROM POTENTIAL)

The counter-clockwise pattern of booms

- Booms triggered by relaxed monetary policy eventually end.
- But they _____ the rate of inflation in the long run.
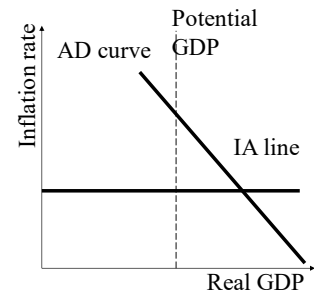
The counter-clockwise pattern of recessions

- Recessions triggered by tightened monetary policy eventually end.
- But they _____ the rate of inflation in the long run.

Conclusions

- Changes in monetary policy cause shifts in the AD curve, triggering booms or recessions that follow a classic _____ pattern.
- Booms or recessions end when the rate of inflation adjusts sufficiently to bring real GDP back to potential GDP.
- A policy error and correction can cause a complete _____.

BUSINESS CYCLES FROM A PRICE SHOCK
Page 1

BUSINESS CYCLES FROM A PRICE SHOCK

- How can a price shock cause a recession?
- Does this kind of recession fit the classic pattern?

## What is a price shock (also called a supply shock)?

- Sometimes inflation changes abruptly on its own, for reasons unrelated to the output gap.
- Examples:

Spot Oil Price: West Texas Intermediate

Source: Dow Jones & Company/FRED
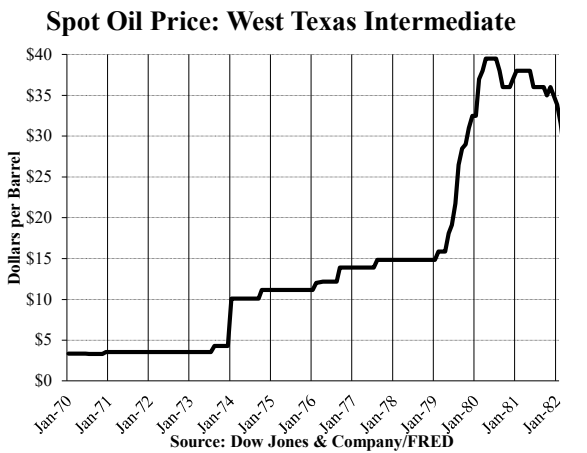
Response to a price shock

- If the central bank follows a typical policy rule, it will see inflation and respond by _____ real interest rates.
- Causes C, I, and X to _____, as we have seen.
- Causes expenditure line to shift _____ in the Keynesian cross diagram.

Effect on GDP of an increase in the interest rate
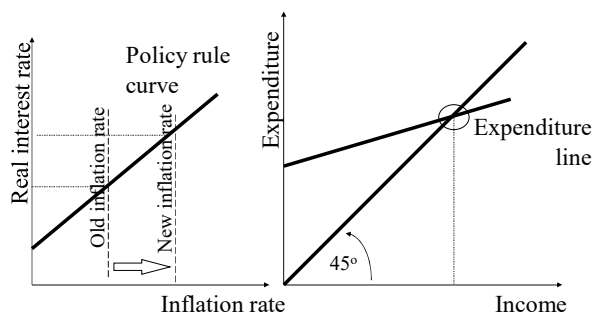
Price shock: how the recession begins

- No change in fiscal or monetary policy.
- Therefore, AD curve is fixed.
- But price shock causes IA line to move of its own accord!
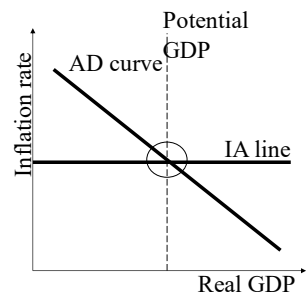
BUSINESS CYCLES FROM A PRICE SHOCK
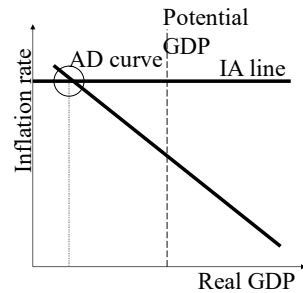### Page 2

Price shock: the short run

- The price shock causes the central bank to increase the real interest rate.
- IA line shifts up, AD curve remains fixed.
- Recession (decrease in GDP) coincides with big increase in inflation:

  _____

Price shock: the medium run

- Now real GDP < potential GDP.
- Inflation rate begins to fall, shown by fall in IA line.
- Real GDP begins to rise.
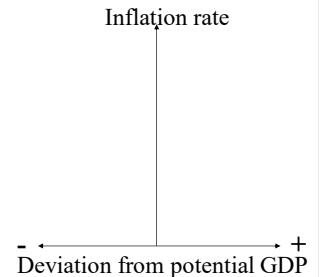- Recovery begins.

Price shock: the long run

- GDP rises because, as inflation subsides, the Fed lowers interest rates.
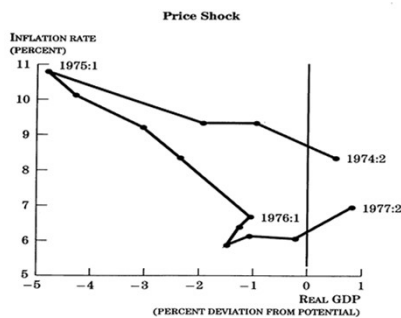- Once real GDP reaches potential GDP, IA line no longer falls.
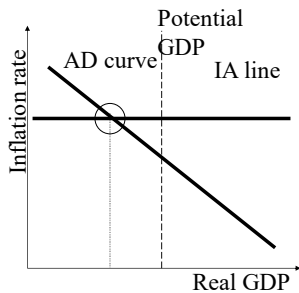
Price shock: what the recession should look like

- The AD-IA model predicts a diagonal pattern when inflation is graphed against GDP.

### Example of price shock: the recession of 1974-75

Conclusions

- If a price shock occurs without a change in fiscal or monetary policy, then in short run,
  - the IA curve shifts _____.
  - the AD curve remains constant.
  - _____ occurs.
- In the medium run to long run, inflation falls and real GDP recovers.

THE GREAT RECESSION OF 2007-2009
Page 1

THE GREAT RECESSION OF 2007-2009

- How did the recession start?
- How did it end?

The "Great Recession"

Sources: BEA; CBO; BLS
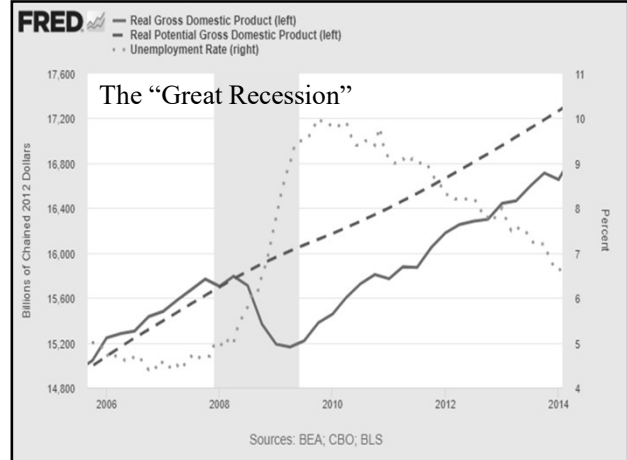
How did the recession start?

- Most people believe recession of 2007-09 began with the bursting of the "price bubble" in the housing market.
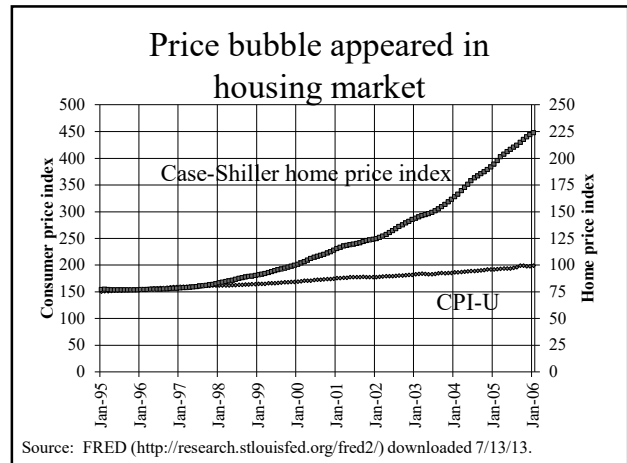- What is a "price bubble"?

Expectations of future prices affect demand

- When people expect price to rise in the future, they buy more *now*.
- Shifts demand curve to the right.
- Raises price.

Price bubbles

- If enough people believe price will rise,
  and can afford to buy,
  and if supply curve is steep enough,
  then price *really will rise substantially*.
- People's expectations become "_____-_____" for a while.
- But eventually they will be disappointed.

Price bubble appeared in housing market

Case-Shiller home price index

CPI-U

Source: FRED (http://research.stlouisfed.org/fred2/) downloaded 7/13/13.

THE GREAT RECESSION OF 2007-2009
Page 2

Mortgages

- A mortgage is a loan to help buy a house.
- House is *collateral*. Bank can take possession of house ("foreclose") if mortgage is not paid.
- Equity = Assets – Liabilities.
- So for homeowners, equity = price of house – amount still owed on mortgage.

Example

- Suppose a homeowner takes out a $150,000 mortgage to buy a $200,000 house.
- Then the down payment, and the homeowner's initial equity, is _____.
- Suppose a homeowner takes out a $180,000 mortgage to buy a $200,000 house.
- Then the down payment, and the homeowner's initial equity, is _____.

Mortgages (cont'd)

- Recently, many banks loaned to homeowners with modest incomes, and permitted low down payments.
- Thus homeowners had little equity when they bought the house.
- If house prices continued to rise, homeowners would have greater equity.
- But if prices *fell*, homeowners would have less equity – perhaps even *negative* equity!

Example

- Suppose a homeowner took out a $180,000 mortgage to buy a $200,000 house.
- Then suppose the price of the house fell to $170,000.
- Then the homeowner's equity is _____.
- The mortgage is said to be "underwater"!

House price bubble burst

- In 2006, house prices stopped rising.
- Expectations flipped.
- Demand shifted left, and house prices began to fall faster.
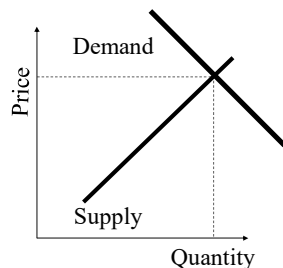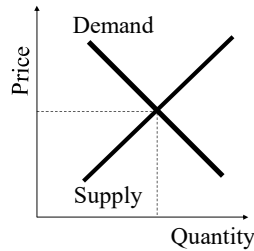

House prices fell faster

Source: FRED (http://research.stlouisfed.org/fred2/) downloaded 7/13/13.
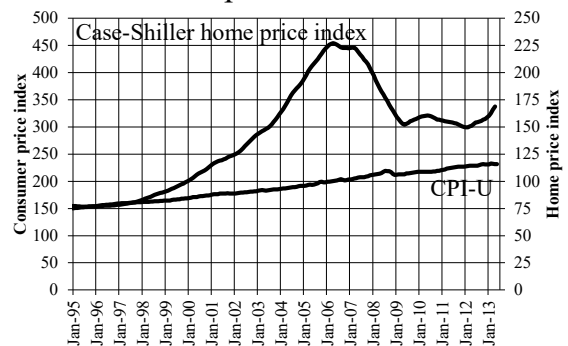
THE GREAT RECESSION OF 2007-2009
### Page 3

Foreclosures

- Homeowners with negative equity had little incentive to keep paying their mortgages.
- Banks began to foreclose, and then try to sell houses.
- Supply shifted right.
- Prices fell faster.

Delinquencies rose sharply

Delinquency Rate On Single-Family Residential Mortgages, Booked In Domestic Offices, All Commercial Banks (DRSFRMACBS)
Source: Board of Governors of the Federal Reserve System

FRED 2013 research.stlouisfed.org
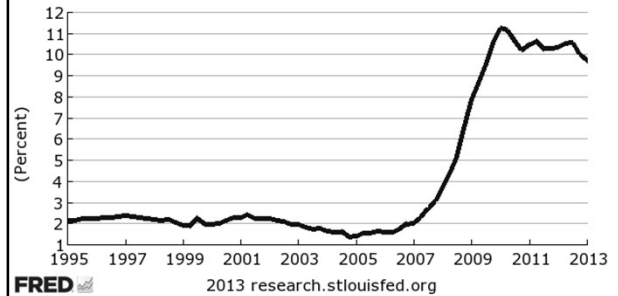
Construction of new homes nearly stopped

Housing Starts: Total: New Privately Owned Housing Units Started (HOUST)
Source: U.S. Department of Commerce: Census Bureau

FRED 2013 research.stlouisfed.org

First effects of bursting bubble

- Home construction industry collapsed.
- Construction workers unemployed.
- Construction companies failed.
- Aggregate demand began to fall.

Bursting bubble: how the recession began
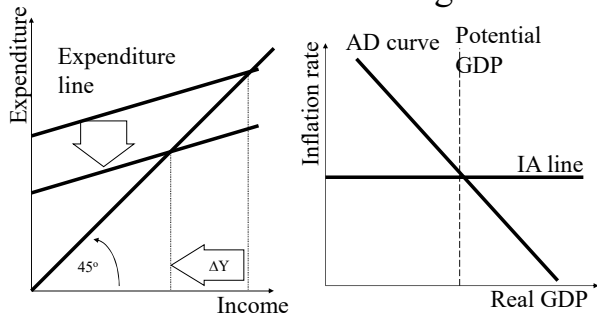
Further effects of bursting bubble

- Many banks did not keep the mortgages.
- They sold the mortgages to other companies, who resold them in packages called "mortgage-backed securities."
- These MBSs were initially viewed as safe because they pooled many mortgages together to reduce risk.
- A few homeowners might default, but most would surely pay.

THE GREAT RECESSION OF 2007-2009
## Page 4

Problems spread to financial sector

- But many did default, so MBSs were riskier and less valuable than expected.
- Moreover, MBSs were so complicated, no one knew how risky they really were.
- MBSs plummeted in price.
- Banks and financial companies' equity fell.
- Banks and financial companies reduced lending, especially to each other.

Aggregate demand fell further

- Banks, anxious to reduce risk, stopped lending, causing a _____.
- The stock market fell in 2008.
- Consumers became cautious, reduced spending.
- Businesses became cautious, reduced investment spending.

Investment (I) and consumption (C) dropped
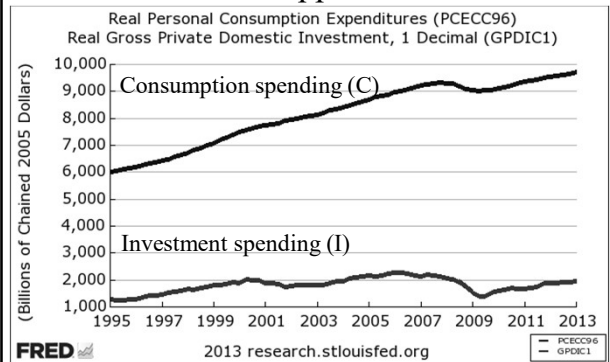
A role for government

- When the AD curve shifts left, how might government shift it back to the right?
- Fiscal policy: tax cuts or increases in spending.
- Monetary policy: shift to a new monetary policy rule, with lower interest rates.
- Called "_____" policy.

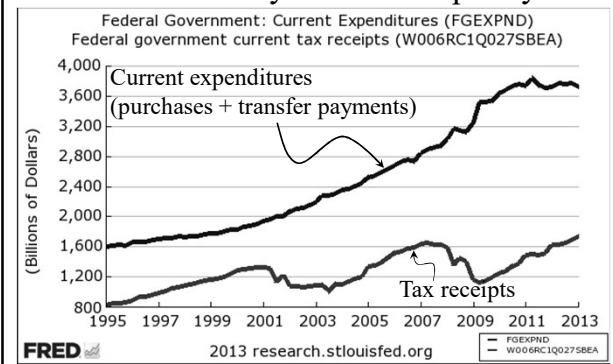### Federal Reserve responded with countercyclical monetary policy
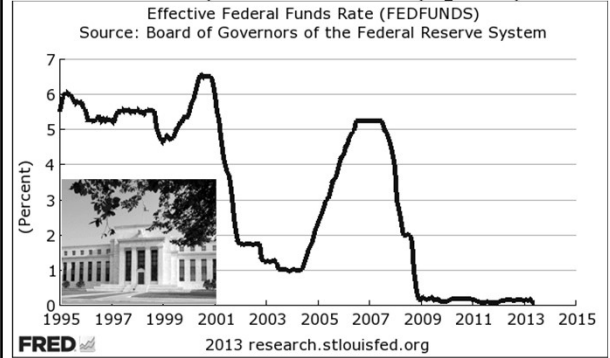
"Quantitative easing"

- Fed pushed interest rate close to zero.
- In addition, Fed began massive purchases of bonds (paying for them with reserves).
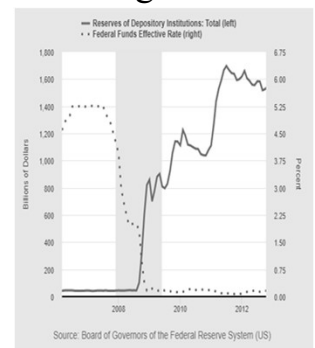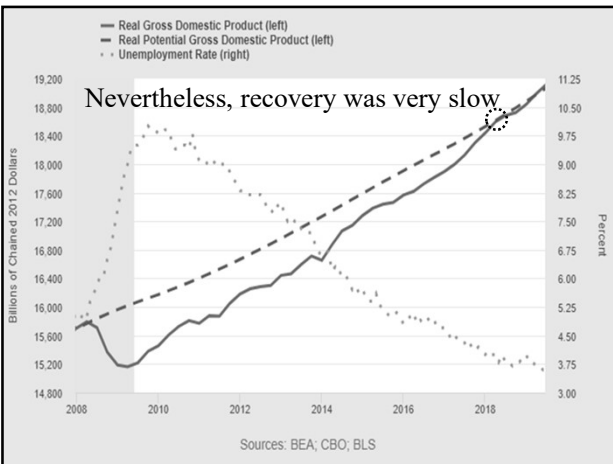
THE GREAT RECESSION OF 2007-2009
Page 5

Congress and President responded with countercyclical fiscal policy

Federal Government: Current Expenditures (FGEXPND)
Federal government current tax receipts (W006RC1Q027SBEA)

Current expenditures
(purchases + transfer payments)

Tax receipts

FRED   2013 research.stlouisfed.org

— FGEXPND
— W006RC1Q027SBEA

Federal Reserve intervened in financial markets

- Throughout 2007 and 2008, Federal Reserve intervened as "lender of last resort."
- It even purchased private-sector bonds to keep lending flowing.
- In November 2008, Troubled Asset Relief Program (TARP), approved by Congress, allowed Treasury Dept. to purchase MBSs and other debt from banks and financial companies.

— Real Gross Domestic Product (left)
— Real Potential Gross Domestic Product (left)
··· Unemployment Rate (right)

Nevertheless, recovery was very slow

Sources: BEA; CBO; BLS

Why was the recovery so slow?

- Monetary policy was hobbled because interest rates were already close to zero.
- Fiscal policy was hobbled because of political resistance to large budget deficits.
- It took time to sell foreclosed houses.
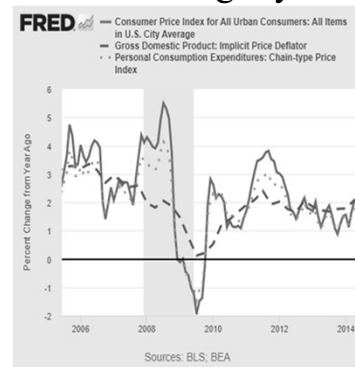- Some unemployed workers gave up looking for work.

What about inflation?

- Economic fluctuations model says that when GDP < potential GDP, IA curve slowly moves _____.
- Inflation rate should be lower after recession.

Inflation rate

AD curve

Potential GDP

IA line

Real GDP
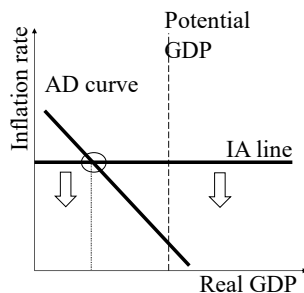
Inflation did decrease slightly

- But not as much as one would expect, given depth of Great Recession.

FRED — Consumer Price Index for All Urban Consumers: All Items in U.S. City Average
— Gross Domestic Product: Implicit Price Deflator
··· Personal Consumption Expenditures: Chain-type Price Index

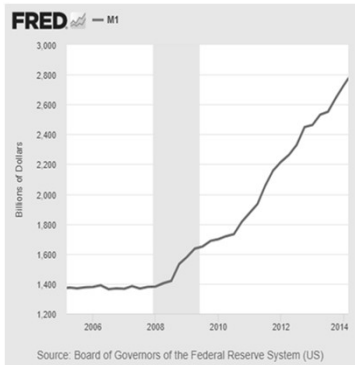Sources: BLS; BEA

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THE GREAT RECESSION OF 2007-2009
Page 6

Why inflation did not decrease more

- Reason was probably rapid growth of money supply.
- Much faster than growth of real GDP.
- Part of Fed's countercyclical monetary policy.

Conclusions

- The Great Recession was mainly triggered by a bursting _____ in the housing market.
- This led to mortgage defaults and a crisis in the financial sector.
- _____ fiscal and monetary policy was used to try to shorten the recession.
- Nevertheless, the recovery was very slow.

THE COVID19 PANDEMIC RECESSION
Page 1

THE COVID19 PANDEMIC RECESSION

- How did the recession start?
- How did it end?

The COVID19 pandemic recession


Sources: BEA; CBO
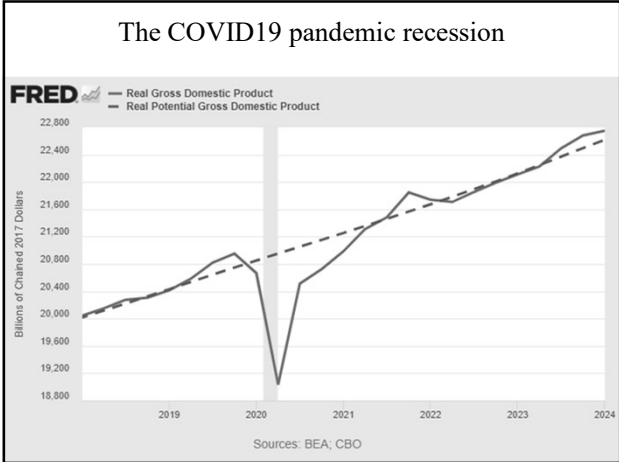
How did the recession start?

- In mid-March 2020, large numbers of people became sick with COVID19.
- Many businesses shut down either under government orders or voluntarily.
- Retail and food were especially affected.

Sources: U.S. Bureau of Labor Statistics; U.S. Census Bureau
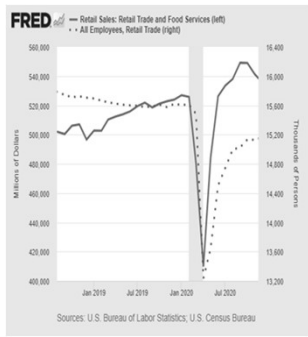
First effects of pandemic

- Spending on restaurant meals and travel plummeted.
- Businesses, facing uncertainty, laid off workers and decreased investment spending.
- Consumers, also facing uncertainty, reduced spending on new homes.
- Stock market fell.
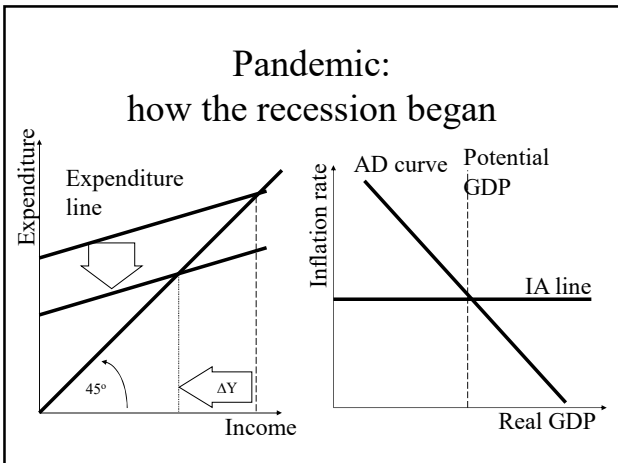
### Pandemic: how the recession began

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A role for government

- When the AD curve shifts left, how might government shift it back to the right?
- Monetary policy: shift to a new monetary policy rule, with lower interest rates.
- Fiscal policy: tax cuts or increases in spending.
- Called "_____" policy.

THE COVID19 PANDEMIC RECESSION
Page 2

Federal Reserve responded with countercyclical monetary policy

In two emergency meetings in March 2020, Fed lowered interest rate nearly to zero, and resumed "quantitative easing"—that is, massive purchases of bonds.
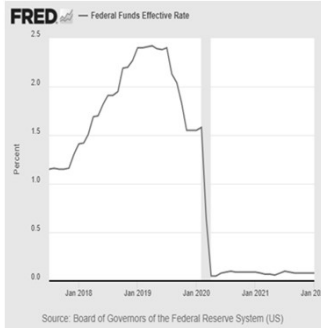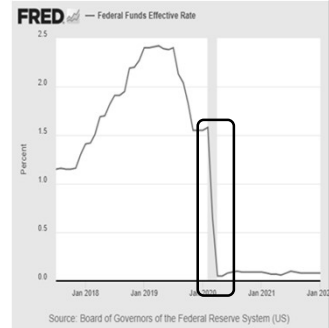

Federal Reserve responded with countercyclical monetary policy

In two emergency meetings in March 2020, Fed lowered interest rate nearly to zero, and resumed "quantitative easing"—that is, massive purchases of bonds.

Congress and President responded with countercyclical fiscal policy

- CARES Act ($2 trillion) cut taxes, sent rebates to families in April, offered loans to businesses to help them keep paying workers, and expanded unemployment benefits.
- American Rescue Plan ($1.9 trillion) sent more payments to low-income families and extended unemployment benefits.

Government spending rose rapidly in 2020 (mostly transfers, not G)
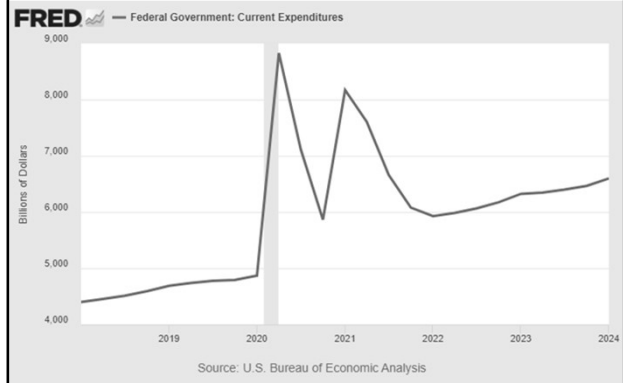
Aggregate demand recovered quickly
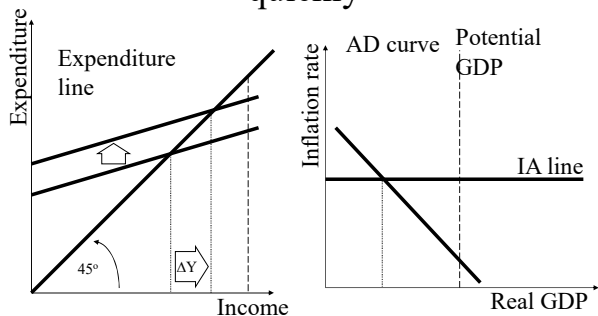
Unemployment fell and job openings rose

THE COVID19 PANDEMIC RECESSION
Page 3

But inflation rose. Why?
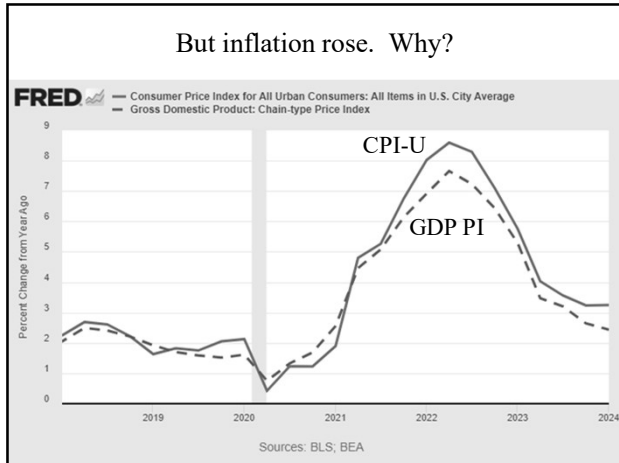
Explanation (1): countercyclical policy was too strong

- Perhaps government spending was too large.
- In the short run, this would produce a boom.
- In the long run, the IA line would shift up, raising inflation.

Explanation (1) cont'd

- If this was the cause, then government should follow *contractionary policy* to reduce inflation.
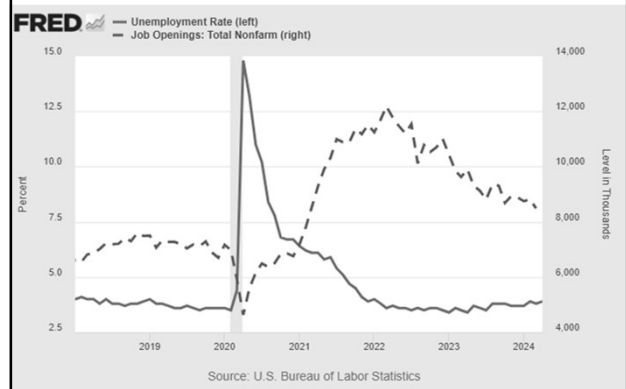- But this might cause a long recession.
- Many people worried about this.

To reduce aggregate demand, Federal Reserve raised interest rates rapidly
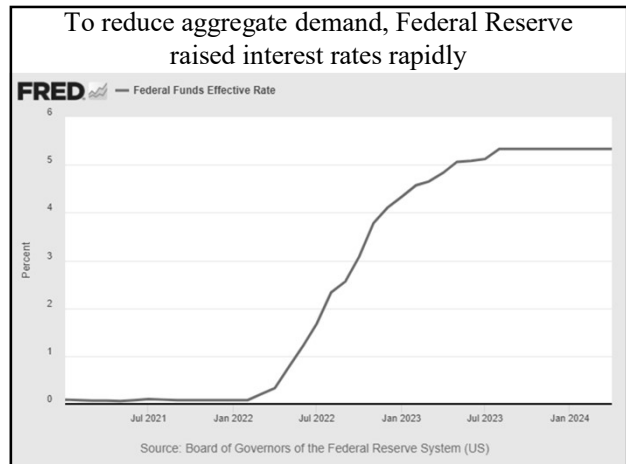
Explanation (2): a temporary price shock

Alternatively, the IA curve might have shifted up spontaneously because of
- War in Ukraine.
- COVID-related supply shortages.

Explanation (2) cont'd

- If this was the cause, then inflation would eventually decrease by itself, without a recession.
- Government *should increase* spending temporarily to avoid a recession.

THE COVID19 PANDEMIC RECESSION
Page 4

In fact, inflation fell without a rise in unemployment (whew!)

FRED — Consumer Price Index for All Urban Consumers: All Items in U.S. City Average
— Unemployment Rate

Source: U.S. Bureau of Labor Statistics
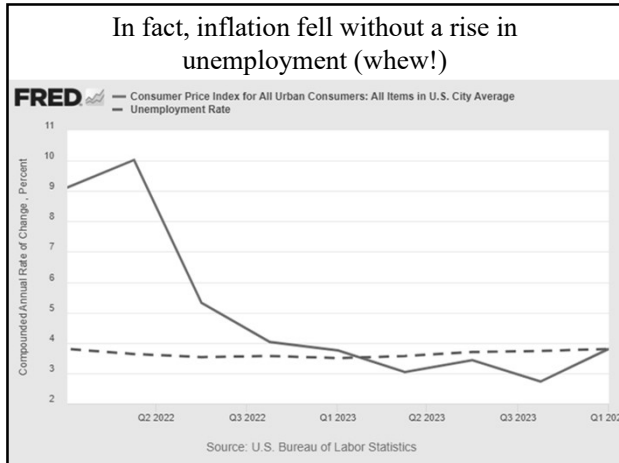
Conclusions

- The COVID19 recession began in March 2020 as the pandemic shut down businesses.
- Quick responses from fiscal and monetary policy helped end the recession quickly.
- But in late 2021 and 2022, inflation rose quickly, possibly because of too much _____ or possibly because of a temporary _____.

PART 5

Public Goods and Externalities

Big ideas: Fiscal policy (taxing and spending) and monetary policy (money supply and interest rates) can potentially be used to dampen business cycles.

BUDGET DEFICITS AND THE DEBT
Page 1

BUDGET DEFICITS AND THE DEBT

- What makes up the U.S. federal budget?
- What is the difference between the deficit and the debt?

The federal budget cycle

- Federal government's fiscal year runs from October 1 to September 30.
- President usually submits proposed budget to Congress in January, including proposed taxes and spending.

Proposal versus reality

- Congress modifies president's proposals before passing a budget.
- Supplementals (mid-fiscal-year changes) are added by Congress as well.
- Booms and recessions can affect tax receipts and spending.

Federal government revenues (or "receipts")

- Payroll taxes
- Personal income taxes
- Corporate income taxes
- Other (mostly indirect business taxes—i.e. sales taxes)

Federal revenues: breakdown
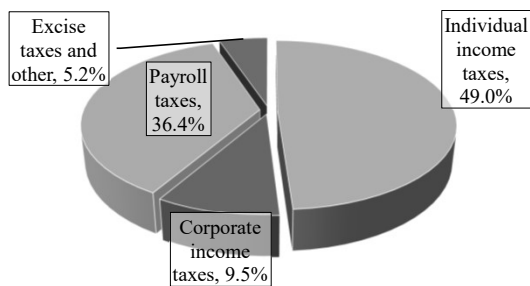
Excise taxes and other, 5.2%
Payroll taxes, 36.4%
Corporate income taxes, 9.5%
Individual income taxes, 49.0%

Source: Office of Management & Budget, *Budget of the United States Government, Fiscal Year 2025*, p. 144, table S-3.

Federal spending (or "outlays")

Government purchases
- National defense
- Health
- Medicare
- International Affairs
- Other

Transfers
- Income security
- Social security

Interest payments

BUDGET DEFICITS AND THE DEBT
Page 2

Federal spending: breakdown

- Defense, 13.1%
- Non-defense discretionary, 14.9%
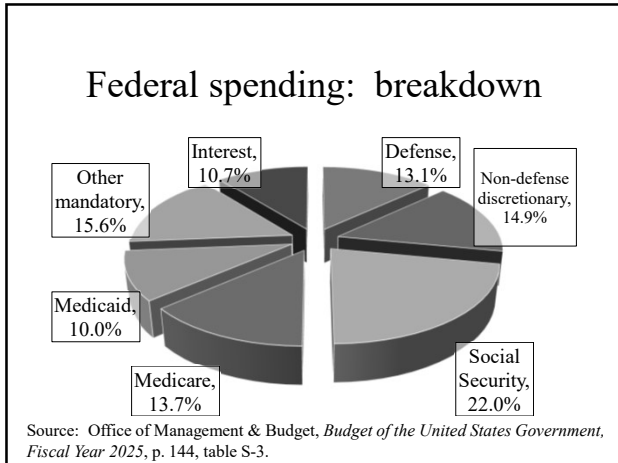- Interest, 10.7%
- Other mandatory, 15.6%
- Medicaid, 10.0%
- Medicare, 13.7%
- Social Security, 22.0%

Source: Office of Management & Budget, *Budget of the United States Government, Fiscal Year 2025*, p. 144, table S-3.

Deficit or surplus?

- Spending > taxes: _____.
- Spending = taxes: _____.
- Spending < taxes: _____.

Federal government last ran a budget surplus in _____.

Budget deficit in 2023 was about $_____ trillion.
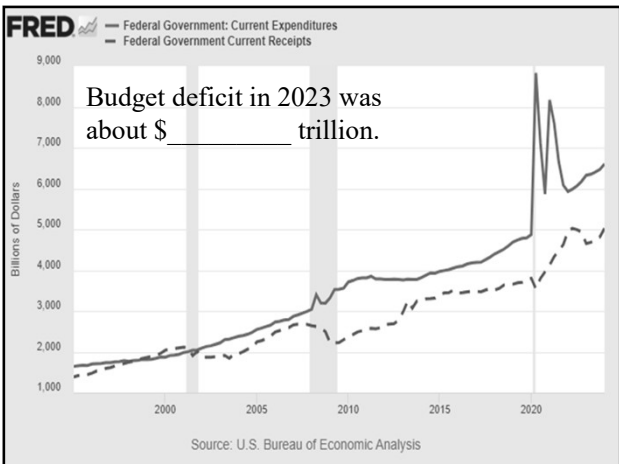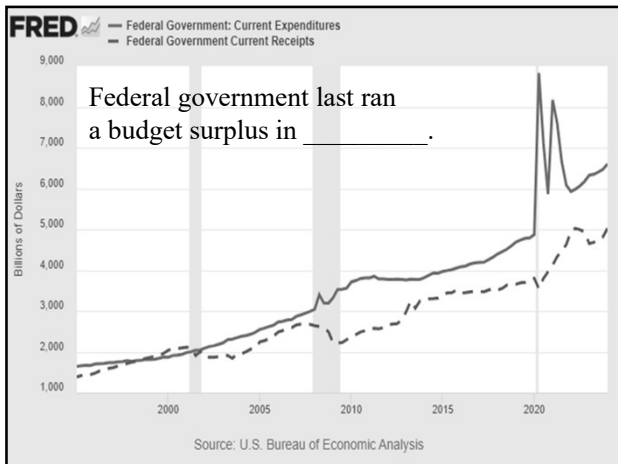
Debt versus deficit

- *Deficit* = spending minus revenues in any particular year.
- *Debt* = total outstanding loans (actually bonds) owed by federal government.
- Debt = total _____ deficits and surpluses since American Revolution.

What does the federal debt consist of?

- Government borrows by selling bonds of varying maturity.
- Longest maturity: 30-year bonds.
- Shortest maturity: under 1 year.
  - Also called "_____."

BUDGET DEFICITS AND THE DEBT
Page 3

Who holds the federal debt?

Federal Reserve

Foreigners

Other

Source: U.S. Department of the Treasury. Fiscal Service

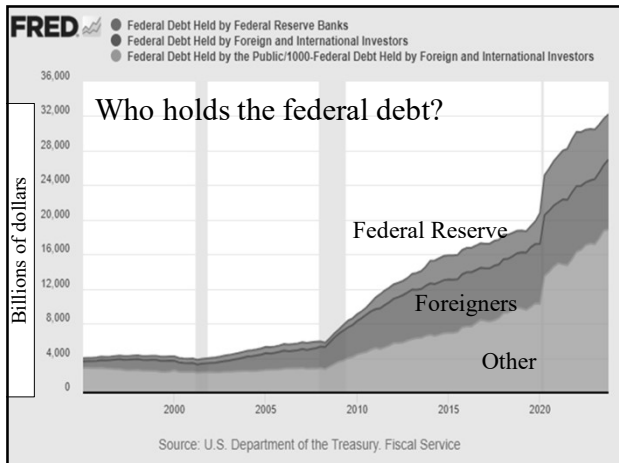## Ratio of debt to GDP

- If GDP is growing and deficit is small, then *ratio* of federal debt to GDP need not grow.
- Ratio decreased 1945-1975 and late 1990s.
- But ratio has grown rapidly since 2007.
- Ratio of federal debt held by public to GDP was about _____% at end of 2023.

Source: Office of Management & Budget, *Budget of the United States Government, Fiscal Year 2025*, p. 174, table S-10.

Federal debt as percent of GDP

Sources: OMB; St. Louis Fed
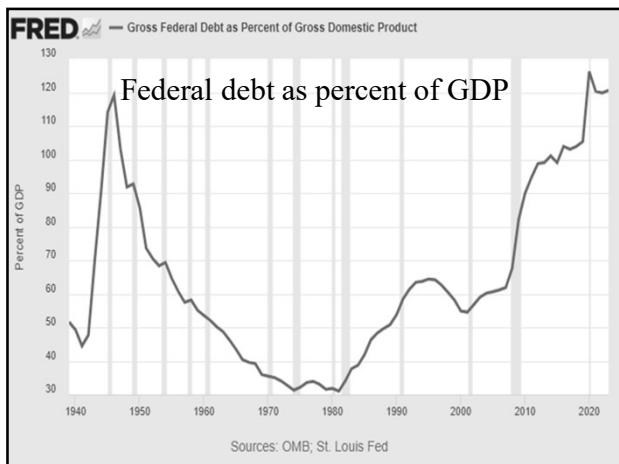
Conclusions

- If government spending (purchases + transfers) exceeds taxes, the difference is called the budget _____.
- If taxes exceed spending, the difference is called the budget _____.
- The government _____ equals accumulated deficits and surpluses.

FISCAL POLICY AND SHORT-RUN BUSINESS CYCLES
Page 1

USING FISCAL POLICY TO DAMPEN SHORT-RUN BUSINESS CYCLES

- What is "discretionary fiscal policy"?
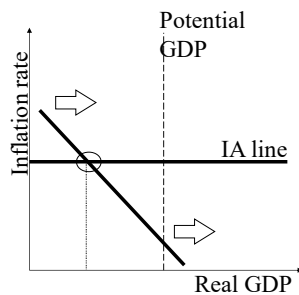- What are "automatic stabilizers"?

Instruments of fiscal policy

- Government spending (or outlays):
  - Government purchases (G)
  - Transfers
- Taxes

Fiscal policies that stimulate the economy

Fiscal policies that shift the AD curve to the right include:

- _____ in government purchases.
- _____ in transfers.
- _____ in taxes.

Fiscal policies that slow down the economy

Fiscal policies that shift the AD curve to the left include:

- _____ in government purchases.
- _____ in transfers.
- _____ in taxes.
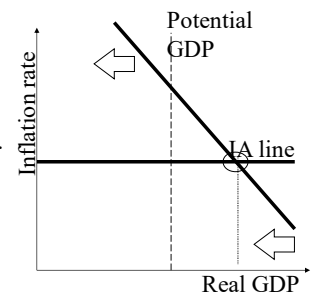
Countercyclical fiscal policy

- Well-timed changes can offset other shifts in AD curve, reducing the size of booms and recessions.
- This is called "countercyclical policy" or "_____ policy."

A short-run tool

- Note that countercyclical policy is useful only in the short run.
- In the long run, the IA line moves down and recovery occurs automatically.

FISCAL POLICY AND SHORT-RUN BUSINESS CYCLES
Page 2

Danger of late response

- However, if fiscal policy comes too late, it can _____ a business cycle, deepening recessions and strengthening booms.

Types of fiscal stabilization policy

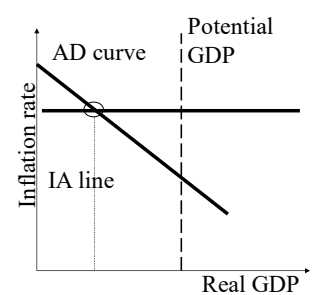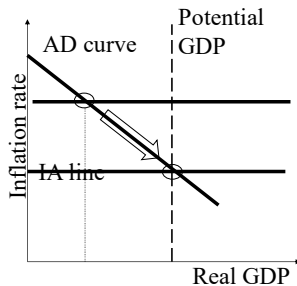- _____ *fiscal policy* = changes in government purchases, taxes, or transfers that require changes in laws.
- _____ = changes in government purchases, taxes, or transfers that happen without changes in laws or administration rules.

Discretionary fiscal policy

- Requires specific response by Congress and/or administration.
- Examples:
  - Kennedy-Johnson tax cut (early 1960s).
  - Johnson temporary 10% income tax surcharge (1968).
  - Reagan tax cut (early 1980s).

Recent examples of discretionary fiscal policy

- Bush 2001 tax cuts, to fight recession of 2000-2001.
- Obama 2009 stimulus package, to fight Great Recession of 2007-2009.
- CARES Act of 2020, to fight COVID19 Recession.

Perils of discretionary fiscal policy

1. Because discretionary policies require government approval, they can easily come too late.
2. Tax cuts or tax rebates that are announced as temporary will mostly be saved, if people smooth their consumption.

Consumption smoothing in the Great Recession

- Great Recession began at the end of 2007.
- A one-time tax cut in 2008 sharply increased consumers' disposable income.
- But consumption spending hardly budged.
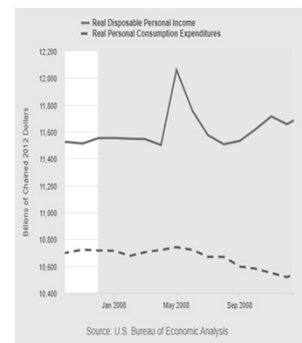
FISCAL POLICY AND SHORT-RUN BUSINESS CYCLES
Page 3

Automatic stabilizers

- Welfare, social security, and unemployment insurance payments tend to _____ during booms and _____ during recessions.
- Tax revenues always _____ during booms and _____ during recessions.
- All without any change in laws.

Tax revenues increase or decrease more than proportionally with GDP

- *Progressive tax* = tax such that payments rise more than proportionately with income.
- Federal income tax is now moderately progressive.
  - Current marginal tax rates rise with income from 0% to 37%.
- Tax system was much more progressive before Reagan tax cuts of early 1980s.

Marginal and average tax rates

- Average tax rate = tax owed / income.
- Marginal tax rate = Δ tax owed / Δ income.
- Example: Suppose a person has $10,000 income and owes $1000 in tax.
- Average tax rate = _____%
- Suppose if income increased to $11,000, same person would owe $1200 in tax.
- Marginal tax rate = $200 / $1000 = _____%

Discretionary policy versus automatic stabilizers

- Advantages of _____ policy:
  - Size and timing can in principle be adjusted to suit particular circumstances.
- Advantages of _____ stabilizers:
  - Quicker response.
  - Stronger likelihood that deficits will decline when recession ends.

Conclusions

- Fiscal policy includes government purchases, taxes, and transfers.
- Fiscal policy can, in principle, be used to moderate business cycles.
- Countercyclical fiscal policies include
  - _____ policies, requiring action by President and Congress.
  - _____ built into current law.

THE DEFICIT OR SURPLUS OVER THE BUSINESS CYCLE
Page 1

THE DEFICIT OR SURPLUS OVER THE BUSINESS CYCLE

- How is the federal budget affected by the business cycle?

Why the business cycle affects the budget

- In a boom, more people are working and businesses are making higher profits.
- So they pay _____ in taxes.
- In a recession, they pay _____ in taxes.
- Also in a recession, the government spends more on transfers like unemployment insurance benefits, welfare benefits, and social security benefits.

"Automatic stabilizers"

- In short run, the budget deficit _____ during recessions and _____ during expansions.
- If there is a budget surplus, it falls during recessions and rises during expansions.
- Taxes and transfers are therefore called _____.

Automatic stabilizers in the 1974-75 recession

Source: Bureau of Economic Analysis, NIPA tables 1.1.1 and 3.2 (accessed 8/22/06).
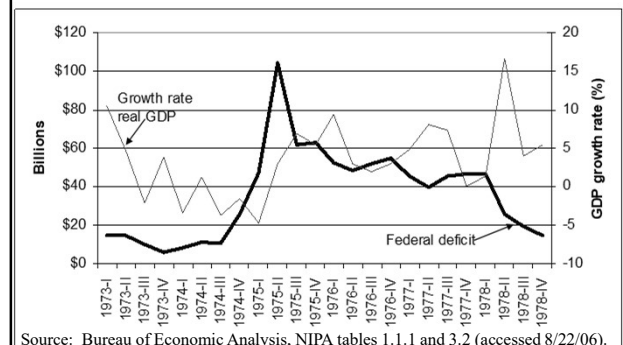
Relation between the federal budget and GDP

- Automatic stabilizers create a _____ relationship between real GDP and the federal budget.
- The position of the curve depends on tax laws and spending programs.
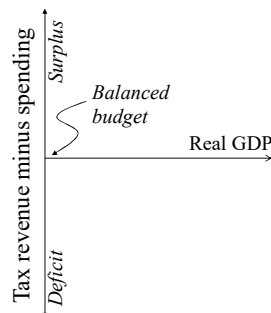
Removing impact of business cycle

- In the short run, the actual budget deficit or surplus is affected temporarily by booms and recessions.
- To get a true picture of the long-run budget situation, we should remove the part of the budget deficit that is caused by the business cycle.

THE DEFICIT OR SURPLUS OVER THE BUSINESS CYCLE
Page 2

Actual versus structural budget deficit (or surplus)

- *Actual deficit or surplus* = current deficit or surplus at actual real GDP.
- *Structural deficit or surplus* = deficit or surplus if, hypothetically, real GDP were equal to potential GDP.
  - Also called the "full-employment deficit or surplus."

Example: Suppose potential GDP = $15,500 billion

- Then structural deficit = -$_____ billion.
- If actual real GDP = $14,500 b, economy is in _____ and actual deficit = -$_____ billion.
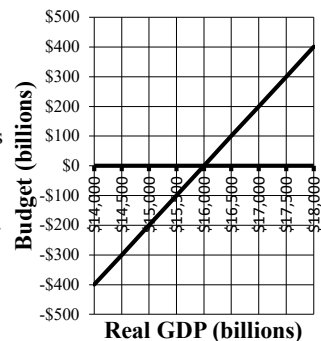
Example: Suppose potential GDP = $15,500 billion (cont'd)

- If actual real GDP = $16,000 b, economy is in _____ and budget is balanced.
- If actual real GDP = $16,500 b, economy is in _____ and actual surplus = $_____ billion.
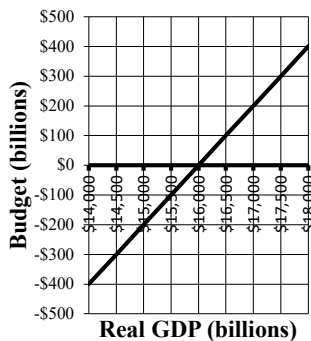
Conclusions

- Deficits _____ during recessions and _____ during booms, without any changes in tax or spending laws.
- Similarly, surpluses _____ during recessions and _____ during booms.
- The _____ deficit or surplus is the deficit or surplus that would exist if GDP were equal to potential GDP.

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THE FEDERAL RESERVE
Page 1

THE FEDERAL RESERVE

- What is the Federal Reserve System?
- How is it organized?
- What does it do?

What is a central bank?

- *Central bank* = government agency responsible for conducting monetary policy—basically, controlling the money supply and interest rates.
- Central banks also function as "lenders of last resort," able to lend extra money to banks in case of crisis.

Central banks in various countries

- Japan: _____
- United Kingdom: _____
- Euro Zone: _____
- China: _____
- United States: _____

The U.S. Central Bank: The Federal Reserve System

- Established by Federal Reserve Act of 1913.
- Three important parts:
  - Board of Governors
  - District Federal Reserve Banks
  - Federal Open Market Committee

Federal Reserve Board of Governors

- Functions:
  - takes lead in setting monetary policy.
  - supervises most commercial banks. Located in Washington D.C.
- 7 people appointed to 14-year terms by President and confirmed by Senate.

Chairman of the Federal Reserve Board of Governors

- One Board member is appointed to 4-year term as Chairman by President and confirmed by Senate.
- Cannot be removed by President.
- Term overlaps two Presidential terms.
- Current chairman is _____.

THE FEDERAL RESERVE
Page 2

The District Federal Reserve Banks

- Functions:
  - monitor local economy.
  - clear payments between banks.
- 12 District banks, each with own territory.
- Each headed by a president chosen by commercial bankers in the district and approved by Board of Governors.

Federal Reserve Districts
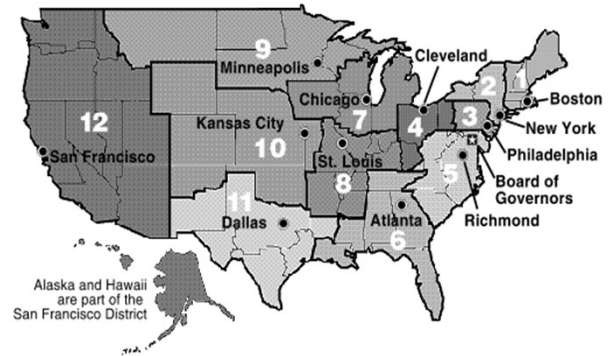
The Federal Open Market Committee (FOMC)

Members are:
- 7 governors
- 12 district bank presidents (but only 5 can vote in any year).

Board Chair also chairs FOMC.

What the FOMC does

- Functions: Sets monetary policy.
- Meets at least 8 times per year.
- Schedule and briefing materials ("Beige Book") are available on web.*
- Meetings are closed, but decisions are announced immediately afterward in press conference.

* https://www.federalreserve.gov/monetarypolicy.htm

The Fed's mandate

"The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of **maximum employment, stable prices, and moderate long-term interest rates.**"

                    --Section 2A of the Federal Reserve Act

Source: https://www.federalreserve.gov/aboutthefed/section2a.htm

Conclusions

- A country's monetary policy is conducted by its central bank.
- The U.S. central bank is the
  _____ System.
- In the U.S., the _____
  _____ sets monetary policy.

HOW THE FED CONTROLS THE MONEY SUPPLY
Page 1


HOW THE FED CONTROLS THE MONEY SUPPLY

- What is the Fed's balance sheet?
- What are "open market operations"?
- How does the Fed control the money supply?

The Fed's balance sheet

Assets	Liabilities
Government securities	Currency
Private securities	Reserves
Loans to banks	
Loans to other financial institutions	

The Fed's liabilities

- *Currency* = dollar bills in circulation. Only a small part of money supply.
- *Reserves* = deposits by banks with the Fed.
- *Monetary base* = currency+reserves.
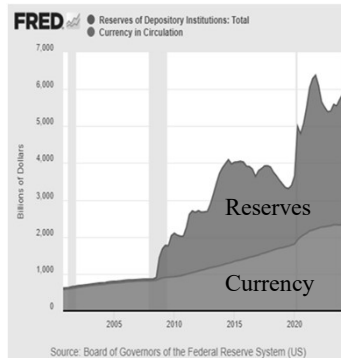
The Fed's assets: government securities

- Government securities = mostly U.S. Treasury bonds and Treasury bills, but also bonds of other government agencies.
- Fed buys or sells these bonds in *open market operations,* and pays for them (or is paid) with reserves.

The Fed's assets: private securities

- Private securities = bonds issued by private firms, not government agencies.
- During the financial crisis in 2007-2008, Fed bought massive amounts of private securities, including
  - commercial paper (short-term bonds).
  - mortgage-backed securities.

The Fed's assets: loans to banks

- Fed also functions as "lender of last resort" to solvent banks facing a run on deposits.
- Bank runs ruined many banks in early 1930s and aggravated Great Depression.*
- *Discount rate* = interest rate charged to banks.

*Bernanke, B. S. (1983). Nonmonetary effects of the financial crisis in the propagation of the Great Depression. *American Economic Review, 73*(3), 257-276.

HOW THE FED CONTROLS THE MONEY SUPPLY
Page 2

The Fed's assets:
### loans to other financial institutions

- Non-banks, such as insurance companies.
- During the financial crisis in 2007-2008, Fed made loans to other financial institutions, in order to stabilize the financial system.

Controlling the money supply

- Recall: Banks create money by accepting deposits and making loans.
- *Both original deposits and loans are money.*
- Fed controls only the monetary base (currency + _____).
- So Fed cannot control the money supply (currency + _____) directly.

Controlling the money supply (cont'd)

- But Fed can increase bank reserves by buying bonds and paying for them with reserves ("open market operations").
- Reserves are safer than loans, but loans pay a higher rate of interest.
- So banks may want to withdraw some reserves to make new loans.
- New loans are new money, available to use for transactions.

Money creation following the Great Recession
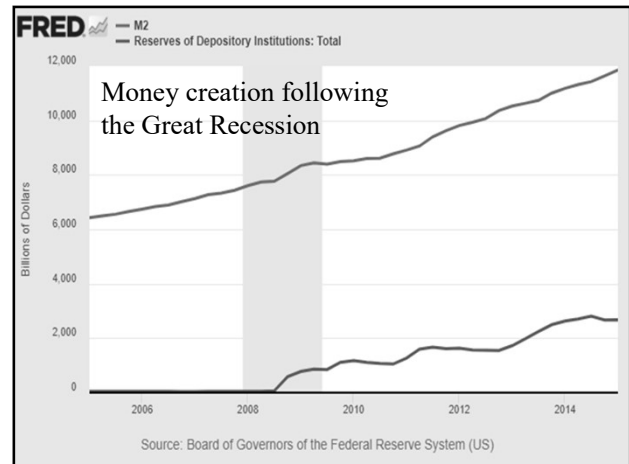
Conclusions

- The Fed's liabilities are mostly currency and reserves—the _____ .
- The Fed's traditional assets are government bonds and loans to banks, whose interest rate is called the _____ .
- The Fed increases the money supply by buying bonds and paying for them with reserves—that is, _____ . This encourages banks to make more loans.
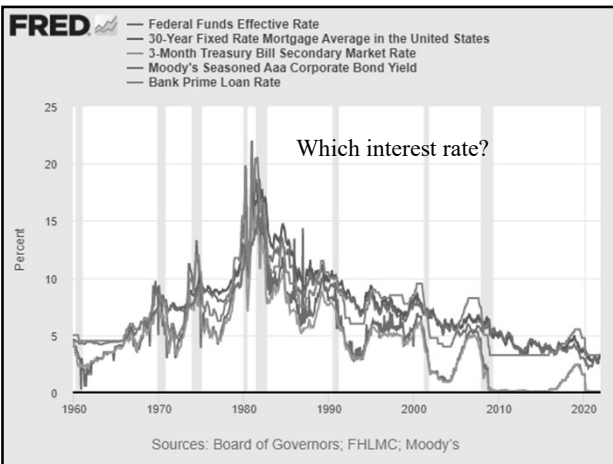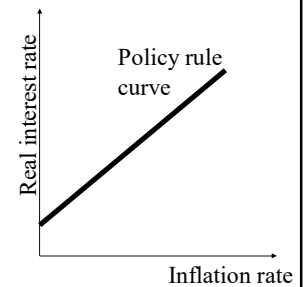
HOW THE FED CONTROLS THE INTEREST RATE
Page 1

HOW THE FED CONTROLS THE INTEREST RATE

- Which interest rate does the Fed focus on?
- How does the Fed control it?

The monetary policy rule curve

Earlier, we said that central banks, including the Fed, generally follow a policy rule.

- Raise real interest rate when inflation is high.
- Lower real interest rate when inflation is low.

Which interest rate?

- Interest rates generally move together (except for differences in risk).
- If they did not, someone would start borrowing at the low rate and lending at the high rate.
- Borrowing at a low rate and lending at a high rate is called _____.*

*Buying anything at a low price and selling at a high price is called *arbitrage*.

The federal funds rate

- Fed focuses on so-called *federal funds rate* (FFR), the interest rate that banks charge each other for overnight loans of reserves.
- This interest rate is not dictated by the Fed. It is freely determined in a market—the federal funds market.
- But the Fed can influence that market.

Demand for reserves

- Banks use reserves to clear financial transactions with other banks and financial institutions.
- But demand for reserves is negatively related to the price.

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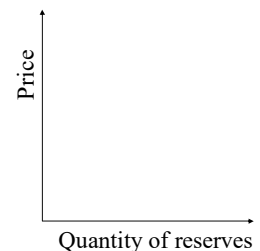
HOW THE FED CONTROLS THE INTEREST RATE
Page 2

The price of reserves

- Banks can obtain more reserves several ways.
  - Borrow from the Fed at the "discount rate" set by the Fed
 - Borrow from other banks at the federal funds interest rate (FFR).
- The "price" of borrowing is the rate of interest.
- Formerly, banks were discouraged from borrowing from the "discount window," but now they are encouraged to do so.

Discount rate puts ceiling on demand curve for federal funds

Since borrowing from the "discount window" is always an option, banks will not **borrow** reserves from each other at any interest rate higher than the discount rate.
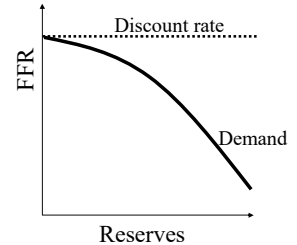
Before the Financial Crisis of 2007-2009

- Fed controlled the total quantity of reserves, so supply was vertical.
- Fed could increase or decrease quantity of reserves by buying or selling bonds: "open market operations."
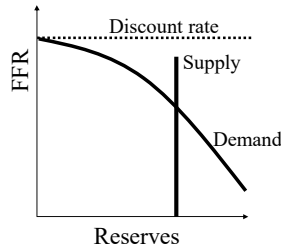
Before the Financial Crisis of 2007-2009 (cont'd)

- By shifting the supply of reserves, the Fed could then increase or decrease the interest rate.

Before the Financial Crisis, Fed manipulated FFR through open market operations
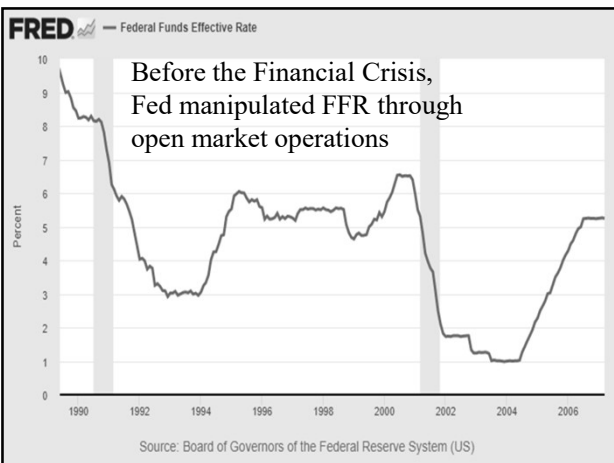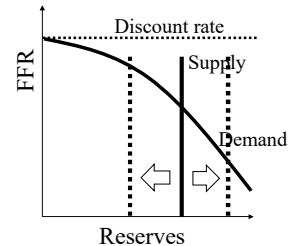
During and after the Financial Crisis of 2007-2009

- Fed greatly increased reserves and FFR fell to zero, but no further.
- (Interest rate cannot go below zero because no one would lend money at a negative interest rate.)
- So-called "liquidity trap."

HOW THE FED CONTROLS THE INTEREST RATE
Page 3

During and after Financial Crisis, FFR hits zero lower bound
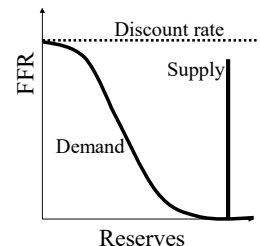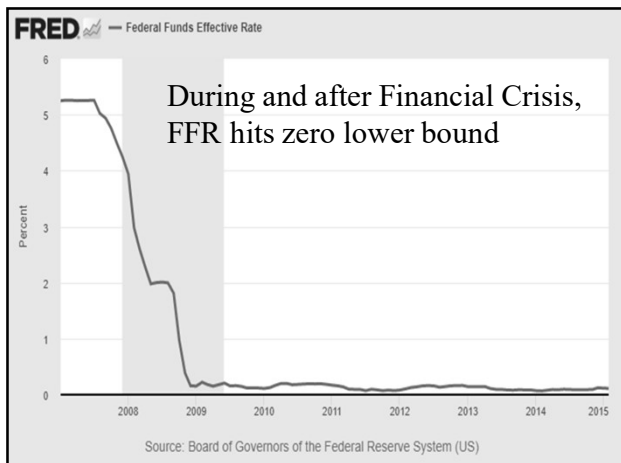
Interest on reserve balances

- Fed chose to maintain "ample reserves" but created a new tool to control FFR.
- In 2008, Fed began paying interest on reserve balances (IORB).
- Fed periodically changes IORB rate at the same time it changes the discount rate.

Raising the lower bound

- Since earning interest is always an option, no bank will **lend** reserves to another bank for less than IORB rate.
- So the IORB rate forms a lower bound for the FFR.

Now the FFR tracks IORB closely, and is always below the discount rate.
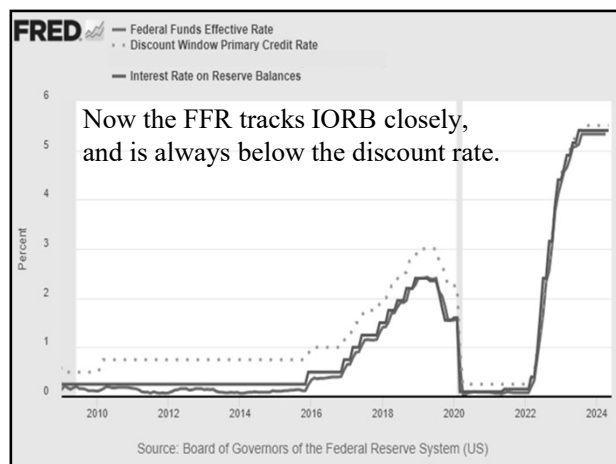
Not just banks

- Some nonbank financial institutions do a lot of lending, but either are not allowed to have reserves or are not allowed to earn interest on reserves.
- So Fed also created program for nonbank financial institutions to earn interest from the Fed on overnight loans.
- Called "Overnight Reverse Repurchase Agreements Program" (ON RRA).
- ON RRA rate is set slightly below IORB.

FFR also tracks ON RRA rate closely.
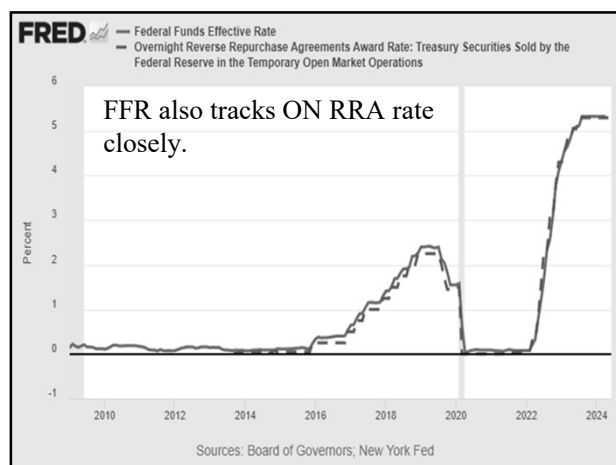
HOW THE FED CONTROLS THE INTEREST RATE
Page 4

Conclusions

- In setting interest rates, the Fed focuses on the rate banks charge each other for overnight loans of reserves, the _____.

- Formerly, the Fed controlled the FFR by changing the supply of reserves through _____ _____.

- Now the Fed controls the FFR by paying interest on bank _____ and overnight reverse repurchase agreements.

USING MONETARY POLICY
Page 1

USING MONETARY POLICY TO DAMPEN SHORT-RUN BUSINESS CYCLES

- What specific monetary policy rules are used by central banks?

Review: the monetary policy rule curve

- Central banks raise the real interest rate if inflation rises and lower it if inflation falls.
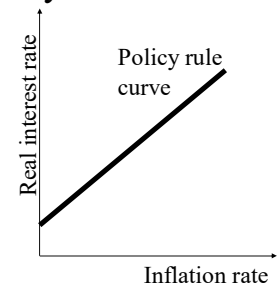
Review: the aggregate demand curve

- Central bank's policy rule curve leads to downward-sloping AD curve.
- When inflation rises, the central bank raises real interest rate, which decreases C, I, and X and thus GDP.
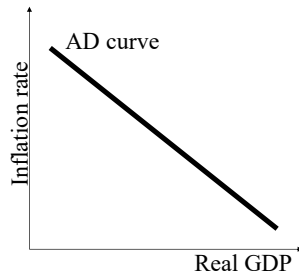
Review: recessions

- A leftward shift in the AD curve due to fiscal policy or other change causes a recession, initially.
- But the recession *eventually* ends as the IA line shifts down.
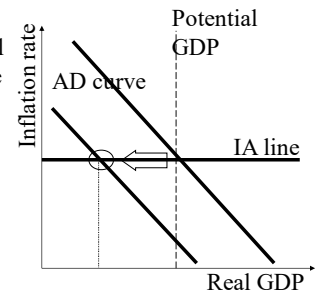
Review: booms

- A rightward shift in the AD curve due to fiscal policy or other change causes a boom, initially.
- But the boom *eventually* ends as the IA line shifts up.
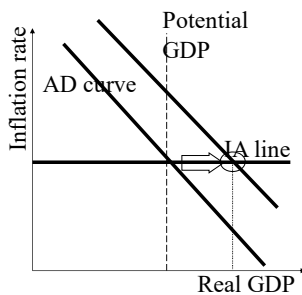
Room for improvement?

- So the simple monetary policy rule curve *eventually* brings GDP back to potential GDP.
- Business cycles end by themselves.
- But is there a faster way?

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USING MONETARY POLICY
Page 2

Countercyclical monetary policy in recessions

- In case of recession, central bank should lower real interest rate *even before* inflation falls.
- This would shift the AD curve to the _____.

Countercyclical monetary policy in booms

- In case of boom, central bank should raise real interest rate *even before* inflation rises.
- This would shift the AD curve to the _____.
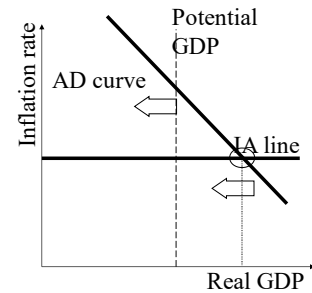
A more sophisticated policy rule

- Real interest rate should depend on both the inflation rate and the output gap (GDP – potential GDP).
- If inflation is above target *or* GDP exceeds potential GDP, then ___raise___ real interest rate.
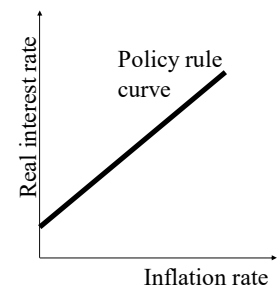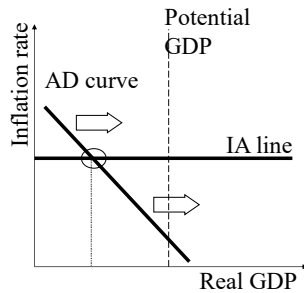- If inflation is below target *or* GDP is less than potential GDP, then ___lower___ real interest rate.

Example of sophisticated policy rule

- Set real interest rate
  = (actual inflation – 2%) × 0.5
  + (% output gap) × 0.5
  + 3%
- So if actual inflation is 4% and real GDP is 3% more than potential GDP, set real interest rate at
  (2%)×0.5 + (3%)×0.5 + 3% = _____%.

Example of sophisticated policy rule (cont'd)

- Again, set real interest rate
  = (actual inflation – 2%) × 0.5
  + (% output gap) × 0.5
  + 3%
- Now if actual inflation is 1% and real GDP is 2% less than potential GDP, set real interest rate at
  (-1%)×0.5 + (-2%)×0.5 + 3% = _____%.

The sophisticated policy rule is more realistic

- Actual central banks do pay attention to unemployment and the output gap.
- In the U.S., the Fed's legal mandate is to promote "**maximum employment**, stable prices, and moderate long-term interest rates."*

*Section 2A of the Federal Reserve Act

USING MONETARY POLICY
Page 3

Conclusions

- Booms and recessions would eventually end if the central bank used a simple policy rule based only on inflation.
- But actual central banks want to avoid booms and recessions.
- So actual central banks set interest rates based on both inflation and the

  _____.

CENTRAL BANK INDEPENDENCE
Page 1

CENTRAL BANK INDEPENDENCE

- What political pressures do central banks face?

Political pressures on central banks

1. Governments that want to run large budget deficits, but cannot finance them by borrowing, may pressure the central bank to create the money required.
   - Examples: _____ .
2. Governments worried about reelection may pressure the central bank to stimulate the economy, reducing unemployment just long enough for the election.

The "Phillips curve"

A.W. Phillips (1958) claimed that inflation and unemployment were negatively related in British data.
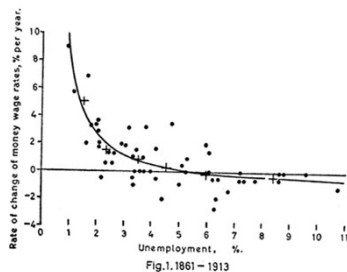
A. W. Phillips, "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957," *Economica*, New Series, Vol. 25, No. 100 (Nov. 1958), pp. 283-299 .

A tradeoff?

Phillips's article led many economists to believe there was a long-run tradeoff between inflation and unemployment.

- Higher inflation ⟺ lower unemployment.
- Lower inflation ⟺ higher unemployment.
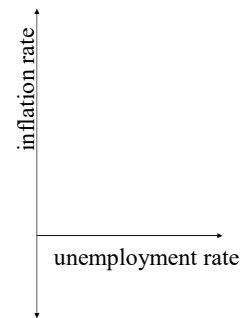
What do recent U.S. data show?
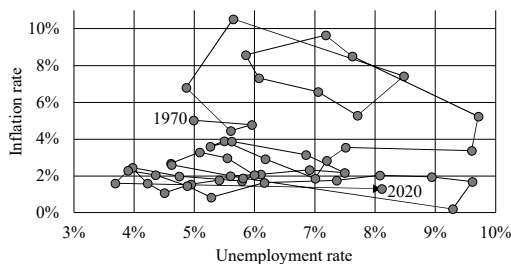
Source: FRED. Annual data. Inflation is % change in GDP deflator.

The simple Phillips curve does not fit the facts

- It is hard to see any overall downward-sloping curve in recent U.S. data.
- But taking a few adjacent years sometimes gives a downward sloping curve.
- Conclude: no long-run relationship, but maybe (?) a series of short-run relationships.

CENTRAL BANK INDEPENDENCE
Page 2

Short-run gain from monetary policy change

Policy rule curve

Real interest rate

Inflation rate

Inflation rate

AD curve

Potential GDP

IA line

Inflation rate

Real GDP

Long-run pain from monetary policy change

In the short run,
- GDP pushed above potential GDP.
- Unemployment < natural rate.

But in the long run
- Inflation rate
  _____.

Inflation rate

AD curve

Potential GDP

IA line

Real GDP

Election pressures

- A central bank worried about an election might create:
  - Short-run gain (lower _____)
  - Long-run pain (higher _____)
- This might create a "political business cycle": a business cycle caused by political pressures.

Is there a political business cycle in the U.S.?

Source: FRED—unemployment rate

— Unemployment rate   O Incumbent party wins   X Incumbent party loses
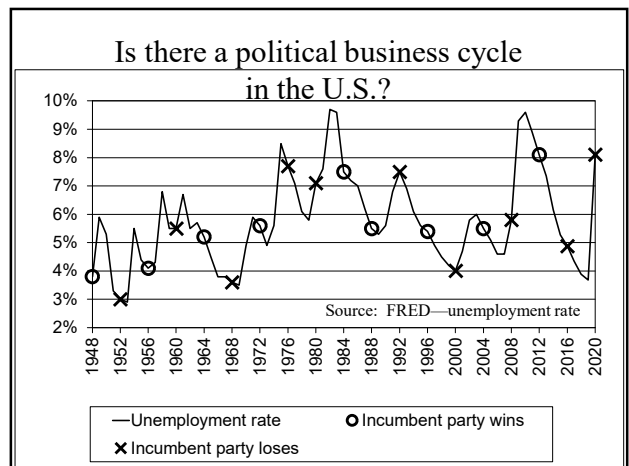
Little evidence of political business cycle in U.S.

- If there were a political business cycle, then unemployment would (miraculously!) drop just before elections.
- This happened a few times after World War II, but not much recently.
- Why not much recently? The Fed enjoys some _____ from elected officials. It does not have to worry about elections.

Central bank independence

- Some central banks are controlled directly by elected governments.
- Others are partly independent.
- *Independence* helps a central bank resist political pressures for policies that lower unemployment in the short run but raise inflation in the long run.

CENTRAL BANK INDEPENDENCE
Page 3

Independence helps keep inflation lower

Source: Alesina, A. and L. H. Summers (1993). "Central bank independence and macroeconomic performance." *Journal of Money, Credit, and Banking* 25(2): 151-162.
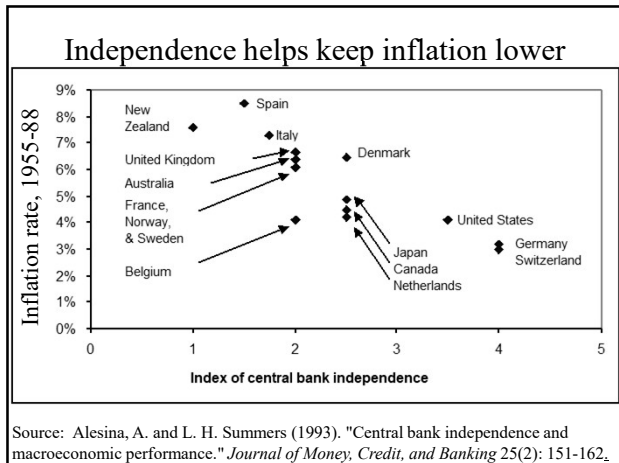
Independence makes monetary policy more credible

- A history of succumbing to political pressure tends to undermine *credibility* of policy.
- Any announcement of tighter policy is less likely to be _____.
- People will _____ central bank policy announcements in forming their expectations of inflation.

Central bank independence in the United Kingdom

- Head of Bank of England formerly reported to Chancellor of the Exchequer, an elected official.
- But in 1997, the new Labor government granted it substantial independence.
- This has probably helped keep inflation low.

Inflation in UK

Sources: ERP 2010, table 108; ERP 2000, table 106.
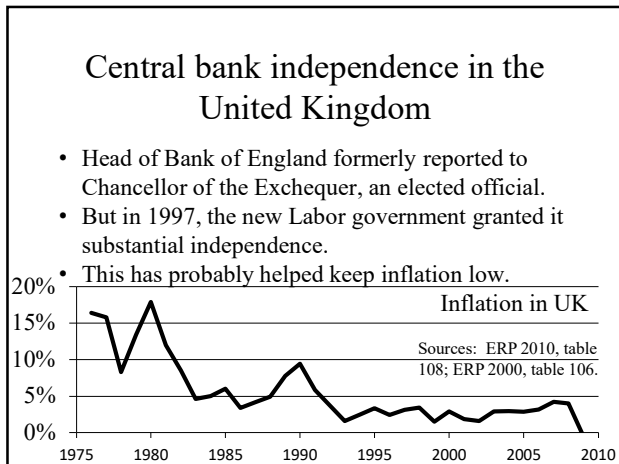
Conclusions

- Central banks can face pressure to lower unemployment in the short run to help the party in power: "short-run gain."
- But such actions bring inflation in the long run: "long-run pain."
- Central bank _____ is important to insulate monetary policy from short-run political pressures.

EXCHANGE RATE DETERMINATION
Page 1

EXCHANGE RATE DETERMINATION

- What determines exchange rates?
- How can governments control exchange rates?

Who wants foreign exchange?

- Importers need to convert the dollars they receive from their U.S. customers into euros, so they can pay their suppliers in Europe.
- They want to _____ euros and _____ dollars.
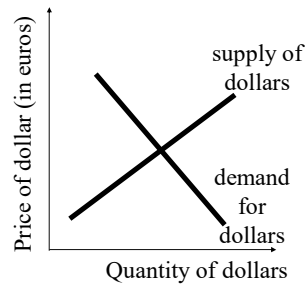- Exporters need to convert the euros they receive from their foreign customers into dollars, so they can pay their employees in the U.S.
- They want to _____ euros and _____ dollars.

Markets for foreign exchange

- So _____ demand dollars (and supply foreign currencies).
- _____ supply dollars (and demand foreign currencies).

Exchange rates are prices

- *Market exchange rate = price* of one currency in terms of another, determined in the *market* for foreign exchange.
- Two ways to express exchange rates:
  - Price of dollar in terms of foreign currency.
  - Price of foreign currency in terms of dollars.

Equilibrium in foreign exchange markets

- Exchange rates are determined by supply and demand.
- However, more useful to focus on *law of one price.*
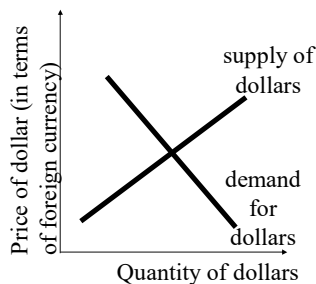
"Law of one price"

- If transport costs are low and no restrictions on buying and selling, then the same good must sell for roughly the _____ price everywhere.
- If not, then people would buy where good were cheap and resell where good were expensive.
- This activity is called _____.

EXCHANGE RATE DETERMINATION
Page 2

Limits of arbitrage

- Arbitrage is only feasible for *tradable* goods (easy to transport).
  - Examples: _____
    _____
- Arbitrage is not feasible for *nontradable* goods.
  - Examples: _____
    _____

Exchange rates in the long run: absolute purchasing power parity

- In the *long run*, exchange rates must adjust so that the prices of _____ goods in different currencies are equal.

Exchange rates in the long run : example

- Suppose a case of wine costs:
  - $ 800 in San Francisco.
  - £ 500 London.
- Since wine is tradable, in the long run these two prices must be equal.

Exchange rates in the long run : example (cont'd)

- To find long-run exchange rate, set:
  - $ 800 = £ 500.
- Then divide both sides by 800 to get
  $ 1 = £ 500 / 800 = £ _____.
- Or divide both sides by 500 to get
  £ 1 = $ 800 / 500 = $ _____.

Exchange rates in the long run: absolute purchasing power parity

- Thus in the long run, there is a tendency for the exchange rate to equate the price of tradable goods:

$$\frac{\text{Exchange}}{\text{rate}} = \frac{\text{price of goods in Country A}}{\text{price of goods in Country B}}$$

- where "exchange rate" = price of Country B's currency in terms of Country A's currency.

Changes in exchange rates: relative purchasing power parity

- Since the percent change of a ratio is the difference of the percent changes, we have:

% change in exchange rate

= % change in price of goods in Country A
  - % change in price of goods in Country B

= inflation rate in Country A
  - inflation rate in Country B.

EXCHANGE RATE DETERMINATION
Page 3

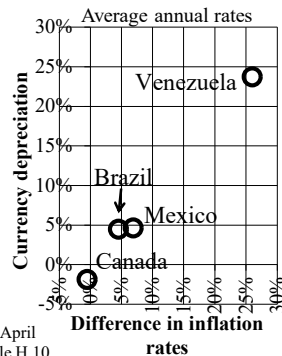### "Appreciation" and "depreciation" of currencies

- If the exchange rate (foreign currency per U.S. dollar) decreases,
  - foreign currency *appreciates* relative to dollar.
- If the exchange rate (foreign currency per U.S. dollar) increases,
  - foreign currency *depreciates* relative to the dollar.

Exchange rates in the long run: the role of inflation

- If inflation in one country is higher than another, exchange rate adjusts to keep prices of tradable goods equal.
- Currency of country with higher inflation _____ relative to the currency of the other.

Relative inflation and currency appreciation: 1995-2010

- Brazil, Mexico, and Venezuela had higher inflation than U.S.
- Their currencies _____ relative to U.S. dollar.

SOURCE: Inflation—IMF WEO Database, April 2012. Exchange rates—Federal Reserve table H.10.

Relative inflation and currency appreciation: 1995-2010 (cont'd)

- Canada had slightly lower inflation than U.S.
- Its currency _____ slightly relative to U.S. dollar.
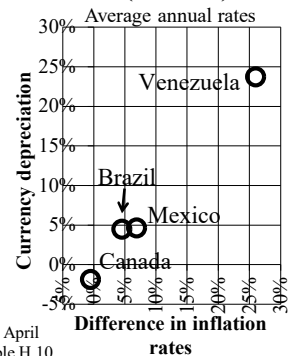
SOURCE: Inflation—IMF WEO Database, April 2012. Exchange rates—Federal Reserve table H.10.

Exchange rates in the short run: interest rates (review)

- International investors move funds quickly to get the highest return.
- If interest rates rise in U.S. compared to other countries, demand for dollars will increase in the short run.
- Exchange rate (price of a dollar in terms of foreign currency) will _____.

Exchange rates in the short run: government intervention

- Governments can also affect exchange rates by buying and selling currencies.
- To increase value of own currency, _____ own currency by _____ reserves of other currencies.
- To decrease value of own currency, _____ own currency by _____ other currencies.

EXCHANGE RATE DETERMINATION
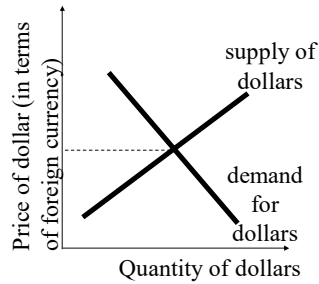Page 4

Government intervention in foreign exchange markets: example

• To increase value of the dollar, the government could _____ dollars and _____ reserves of other currencies.

(graph: vertical axis "Price of dollar (in terms of foreign currency)", horizontal axis "Quantity of dollars", with upward-sloping "supply of dollars" and downward-sloping "demand for dollars")

Does government intervention in foreign exchange markets work?

• In practice, it can be difficult to increase the value of a country's own currency.
• Suppose a country buys its own currency by selling its reserves of other currencies.
• What happens when it runs out of reserves?
• Exchange rate will fall anyway.
• Government loses *lots* of money by buying an asset whose price fell.

Currency controls

• Some governments control exchange rates by *currency controls*, restricting how much currency can be bought or sold.
• But the effect is a barrier to trade which can be as serious as tariffs or quotas.

Conclusions

• In the long run, exchange rates adjust to equate the prices of _____ goods.
• In the short run, differences in _____ _____ also affect exchange rates.
• Governments sometimes try to affect exchange rates by buying or selling foreign currency, but this tool is not very powerful and sometimes it is a disaster.

FIXED EXCHANGE RATES
Page 1

FIXED EXCHANGE RATES

- What are fixed exchange rates?
- What are the advantages?
- How do countries fix their exchange rates?
- What are the disadvantages?

Fixed exchange rates

- *Fixed exchange rate* = a government policy of keeping the exchange rate relative to some other currency constant.
- A country that does not keep a fixed exchange rate is said to have a _____ exchange rate.

Why fix exchange rates?
Advantage #1

- To facilitate trade by *reducing exchange rate risk.*
- Easier for businesses to operate internationally if can predict the price of their products in other currencies.

Why fix exchange rates?
Advantage #1: example

- Suppose you want to sell aircraft to a customer in Germany for delivery in two years.
- You need a price of at least $5 million to cover your costs.
- What price do you need in *euros*?
- Depends on what the _____ will be in two years.

Why fix exchange rates?
Advantage #1: example (cont'd)

- You could lose a lot of money if the euro _____!
- Planning would be easier if the exchange rate were fixed.
- Unfortunately, the exchange rate (euros per U.S. dollar) is _____ fixed.
- Fortunately, in the case of Germany, you have an alternative tool: currency futures.

Currency futures markets help cope with flexible exchange rates

- *Currency futures* = purchases of a foreign currency in the future at an exchange rate agreed to _____.
- Futures market allows one to lock in the exchange rate for a future transaction.
- Allows businesses in international trade to *hedge* against the risk of fluctuating exchange rates.

See http://www.cmegroup.com/trading/fx/index.html .

FIXED EXCHANGE RATES
Page 2

Why fix exchange rates? Advantage #2

- To gain credibility for central bank in *fighting inflation*.
- European currencies with history of rapid inflation (example: _____) can gain credibility for anti-inflation policies by tying their currency to another currency with history of low inflation (example: _____).

How do countries fix their exchange rates?

- Central bank can lower or raise interest rate.
- If exchange rate (price of domestic currency in terms of foreign currency) falls, can bring it back up by _____ interest rate.
- If exchange rate rises, can push it back down by _____ interest rate.

How do countries fix their exchange rates (cont'd)?

- Instead of a central bank, country can have a **currency board**.
- Currency board agrees to exchange domestic currency for foreign currency at constant rate.
  - Must keep big reserves of foreign currency.
- Example: Hong Kong monetary authority exchanges HK dollar for US dollar at rate HKD 7.80 = US$1 .

Systems of fixed exchange rates

- Gold standard (late 19th & early 20th centuries)
- Bretton Woods system (1944-1973)
- European Monetary System (1979-present)

The gold standard

- Widely used policy in late 19th, early 20th centuries.
- When 2 or more currencies are tied to gold, their exchange rates are implicitly fixed.
- Reason: gold is a highly _____ good.

Gold standard: example

- Suppose
  - British government agreed to buy and sell gold at £4 per ounce of gold.
  - U.S. government agreed to buy and sell gold at $20 per ounce of gold.
- So $20 = £ ____.
- So exchange rate would have to be $ ____ = £ 1.

FIXED EXCHANGE RATES
Page 3

The Bretton Woods system

- International conference at Bretton Woods, New Hampshire set up worldwide system of fixed exchange rates in _____.
- Under special circumstances, exchange rates could be decreased (devaluations) or increased (revaluations).
- However, Bretton Woods system fell apart in early _____.

The European Monetary System (EMS)

- A system of fixed (or nearly fixed) exchange rates used by most members of the European Union from 1979 until the common currency (euro) created in _____.

Exchange rates today

- World now operates on a mixture of fixed and flexible exchange rates.
- Flexible exchange rates: _____ _____.
- Fixed exchange rates: _____ _____.

Why NOT fix exchange rates?

- Major disadvantage: by fixing exchange rates, a country gives up to possibility of independent monetary policy.
- Its monetary policy must track the policy of its target country.

How fixed exchange rates restrict monetary policy

- If Country A wants to keep exchange rate with Country B constant, then:
  - in long run, rates of _____ must be similar.
  - in short run, _____ rates must be similar. This limits country A's ability to use monetary policy to fight booms and recessions.

How fixed exchange rates restrict monetary policy: Japan 1990

- Japan experienced boom in late 1980s.
- Could have been stopped by raising interest rate.
- However, Bank of Japan did not want the yen to appreciate against the dollar and so delayed raising interest rates.
- Boom grew out of control and was followed by long recession.

FIXED EXCHANGE RATES
Page 4

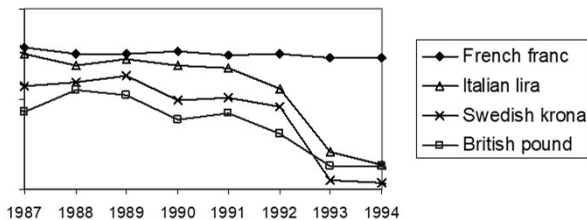### How fixed exchange rates restrict monetary policy: Europe 1992

- Bundesbank (Germany) raised interest rates in 1992 to stop a boom and rising inflation.
- Other countries faced an unpleasant choice:
  - raise interest rates too, and risk a recession, or
  - abandon fixed exchange rates.

How fixed exchange rates restrict monetary policy: Europe 1992 (cont'd)

- _____ raised its interest rate to maintain fixed exchange rate and suffered a major recession.
- _____ chose not to raise interest rates and pulled out of EMS, effectively devaluing its currency.
- _____ and Scandinavian countries formally devalued their currencies.

How fixed exchange rates restrict monetary policy: Europe 1992 (cont'd)

Value of currency relative to German Mark

- ◆ French franc
- △ Italian lira
- ✕ Swedish krona
- ☐ British pound

1987 1988 1989 1990 1991 1992 1993 1994

SOURCE: Computed from data in *Economic Report of the President*, 2003, table B110. Points are index numbers (1985=100).

How fixed exchange rates restrict monetary policy: Argentina 2000

- In 1991, Argentina began fixing its peso to U.S. dollar to fight hyperinflation.
- In 2000, U.S. began raising interest rates to reduce inflation in U.S. But Argentina had a different problem: a _____.
- At first, Argentina raised its _____ to maintain its fixed exchange rate. This made Argentina's recession much worse.
- Argentina abandoned fixed exchange rate in December 2001.

Currency union: an extreme form of fixed exchange rates

- Countries in dark blue all use the same currency: _____.
- Must have same monetary policy, same interest rate.

SOURCE: http://www.ecb.int/

How important is monetary policy independence?

- Important if governments want freedom to change _____ at will to control booms and fight recessions.
- Less important if countries' business cycles are in sync: recessions and booms at the same time.
  - All countries will want to raise and lower interest rates simultaneously.

FIXED EXCHANGE RATES
Page 5

Are these countries in sync?

Source: OECD "harmonized unemployment rate."
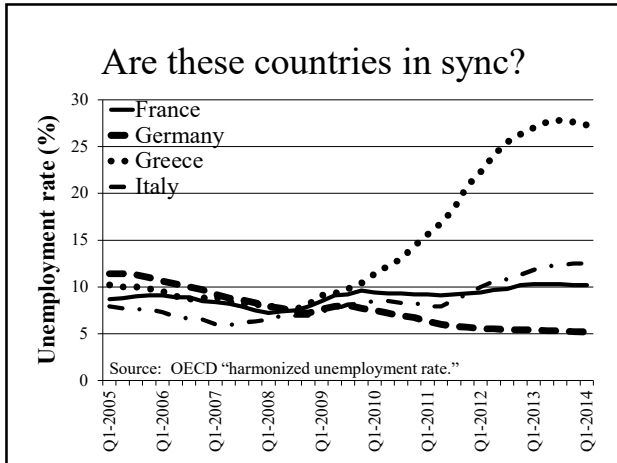
Conclusions

- Fixed exchange rates can
  - help businesses plan international activities by insuring stable exchange rates,
  - help commit a country to low _____.
- But fixed exchange rates require countries to keep same inflation rates & interest rates.
- This limits their ability to use _____ policy to fight booms and recessions.