

**ECNS 202-01**  
**Principles of Macroeconomics**

**Fall 2017 Course Packet**  
**Dr. Gilpin**

**Course Schedule**

Week	Date	Topic	Pre-lecture Quiz	Homework Guide Date	Homework Due Date	Reading
1	Aug 29	Syllabus & Lecture 1		HW A & B		
1	31	Lecture 1 con. & Lecture 2	PL 1	HW 1		Ch. 2
2	Sep 5	Lecture 2 con.	PL 2	HW 2		
2	7	Lecture 3	PL 3			Ch. 3
3	12	Lecture 3 con. & Lecture 4	PL 4	HW 3		Ch. 4
3	14	Lecture 4 con.		HW 4		
4	19	Lecture 5	PL 5			Ch. 5
4	21	Lecture 5 con. & Lecture 6	PL 6	HW 5		Ch. 7
5	26	Lecture 6 con.				
5	28	Lecture 6 con. & Lecture 7	PL 7	HW 6		Ch. 6
6	Oct 3	Lecture 7 con.		HW 7		
6	5	Catch-up / review				
7	10	<b>Exam I: Lectures 1-7</b>		<b>HW A, B, 1-7, Sample Exams I: A-C</b>		
7	12	Lecture 8	PL 8	HW 8		Ch. 10
8	17	Lecture 9	PL 9			Ch. 8
8	19	Lecture 9 con.		HW 9		
9	24	Lecture 10	PL 10			Ch. 11
9	26	Lecture 10 con.		HW 10		
10	31	Lecture 11	PL 11			Ch. 12
10	Nov 2	Lecture 11 con. / review		HW 11		
11	7	No class – election day				
11	9	<b>Exam II: Lectures 8-11</b>		<b>HW 8 – 11, Sample Exams II: A-C</b>		
12	14	Lecture 12	PL 12	HW 12		Ch. 13
12	16	Lecture 12 con. & 13	PL 13			Ch. 14
13	21	Lecture 13 con.		HW 13		
13	23	No class – thanksgiving				
14	28	Lecture 14	PL 14			Ch. 15
14	30	Lecture 14 con.		HW 14		
15	Dec 5	Lecture 15	PL 15			Ch. 16
15	7	Lecture 15 con.		HW 15		
16	15	<b>Final Exam: Lectures 1-15 / 12:00-1:50 pm</b>		<b>HW 12 – 15, Sample Exams III: A-C</b>		

**Montana State University – Depart. of Ag. Econ. & Econ.**



# ECNS 202 Principles of Macroeconomics

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All lectures correspond to the chapters in the textbook except where noted above.

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**ECNS 202-01 Principles of Macroeconomics (3 credits)**  
**CRN Number 22000, Fall 2017**  
**Montana State University – Depart. of Ag. Econ. & Econ.**

<b>Instructor:</b> Dr. Gilpin	<b>Office:</b> 307A Linfield Hall
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<b>Office Hours:</b> M/W: 9–10 am, T/R: 1:30-2:30 pm	<b>Class Website:</b> d2l

### **Course Description**

Macroeconomics studies the performance of the economy as a whole in the short- and long-run. The five pillars of modern macroeconomics that will be introduced are:

1. Output: the production of goods and services.
2. Prices: the cost of purchasing inputs and outputs over time.
3. Employment: the utilization of economies' key resource.
4. Finance: how credit markets create economic efficiency and improved wellbeing.
5. Government policy: how government policies effect the economy.

### **Student Learning Objectives**

Upon completion of this course, students should be able to:

- Compute measures of macroeconomic activity, such as the national income accounts, inflation, and unemployment, and evaluate the shortcomings of traditional economic measures.
- Describe the contemporary banking and monetary system and be able to assess current monetary policy of the Federal Reserve System.
- Identify and analyze factors that affect economic growth.
- Analyze the influences on the aggregate economic activity and the business cycle.

### **Prerequisite**

The prerequisite for this course is a passing grade in ECNS 101 (or equivalent). Students requiring an exemption from this policy will need to file their petition with the DAEE certification officer, who evaluates the petition in conjunction with the DAEE Resident Instruction Committee.

### **Required Materials**

Course packet: *ECNS 202 Principle of Macroeconomics Course Packet*

In-class response device: iClicker (Original or V2) or iClicker REEF app on smart device.

Calculator / colored pencils or pens / straight edge

### **Recommended Material**

Textbook: N. Gregory Mankiw, *Brief Principles of Macroeconomics*

6th edition: ISBN: 13: 9780538453073

7th edition: ISBN: 13: 9781285165929

Study Guide: Brief Principles of Macroeconomics, 6th edition. ISBN: 9780538477062.

## Teaching Method

The class is comprised of pre-lecture videos and assessment, lecturing, question & answer, open discussion, and post-lecture homework. I encourage student participation as it is effective in solidifying concepts. If you have any questions, please ask in class, or during office hours. Reading the textbook chapters before we cover them in class will help you to better understand the lectures and improve your ability to participate in discussions. Accordingly, you should come to class having read the assigned chapter, watched the pre-lecture videos, and checkpoint assessments, and be prepared to discuss and answer questions.

## Homework

The homework assignments will be posted on d2l. Using a web browser, log onto d2l and complete the homework at your own pace. Homework assignments have equal weight when calculating the final grade. To account for any individual unanticipated occurrences, the lowest two homework scores will be automatically dropped. Each homework has three attempts.

Homework guide dates are suggestions of when you should do your homework. Missing a homework guide date will not affect your homework score. There are three homework due dates. After each due date, previous homework may not be submitted.

Homework A, B, 1-7, and Sample Exams I: A-C are due date at the beginning of Exam I.

Homework 8-11, and Sample Exams II: A-C are due date at the beginning of Exam II.

Homework 12-15, and Sample Exams III: A-C are due date at the beginning of the final exam.

## Pre-lecture Quizzes

The pre-lecture quizzes will be posted on d2l. Using a web browser, log onto d2l and complete the quiz at your own pace. Quizzes have equal weight when calculating the final grade. To account for any individual unanticipated occurrences, the lowest two quiz scores will be automatically dropped. Quizzes are always due at the beginning of class on the date specified on the course schedule and on d2l. After the due date, quizzes may not be submitted. Each quiz has two attempts.

## In-class Responses

I will illicit feedback from students during class through the iClicker student response system. Students are required to register their i-Clicker: <https://www1.iclicker.com/register-clicker/> and to test that the clicker is on frequency AA at the start of each class. If students use the i-clicker 'REEF' polling app on their smartphone, tablet, or laptop, then they must register this device at <https://app.reef-education.com/#/login>. Enter your information exactly as provide to the university on MyInfo.

Students receive points for inputting a response (participation grade) of 50 points as well as a performance-based grade of 50 points based on the accuracy of students' answers. Questions asked in class will be either a poll, where students are asked for their evaluation and will receive credit for participating, or an accuracy question, where students are asked for their objective evaluation and will receive credit for both participating and accuracy. To account for any individual unanticipated occurrences, the lowest two in-class response score days will be automatically dropped when final grades are computed.

## Exams

There are two midterm exams and a comprehensive final exam. As specified by Student Code 310.D of the [MSU Student Conduct Code](#), students must take exams when scheduled. If an unavoidable scheduling conflict arises, students should inform me one week prior to the exam to take it early. Midterm make-up exams will not be given. If a midterm exam is missed for any reason, the percent score you earn on the final will replace the missing exam score. The percent score on the final exam will also automatically replace a lower midterm exam score when calculating your final grade earned in the course. If a student's final exam percent is lower than both midterms, then no adjustment will be made.

## Grades

Grades will be assigned based on the following:

Pre-lecture Assignments (drop two lowest)	50 Points
Homework Assignments (drop two lowest)	50 Points
In-class responses (drop two lowest)	100 Points
Two midterm exams at 100 Points each	200 Points
Comprehensive final exam	175 Points
<b>TOTAL</b>	<b>575 Points</b>

There is no extra credit.

## Grading Scale

A (93-100), A- (90-92), B+ (87-89), B (83-86), B- (80-82), C+ (77-79), C (73-76), C- (70-72), D+ (67-69), D (63-66), D- (60-62), F (<60). All grades rounded up from .45, e.g., 89.45 = 90.

## Optional ECNS 206 Study Lab Session, Undergraduate Econ Study Rooms, and Tutors

Study Lab Sessions: Students can enroll in an optional 1-credit study lab class, *ECNS 206 Study Principles of Macroeconomics*. The study lab will count as elective credit in the economics major/minor and university. In study lab, students receive additional problems, get help with their homework, ask questions on course content that they don't understand, and receive help to prepare for exams. If you would like your lab instructor to go over a specific problem, email it to him/her one day in advance. There is a lab manual that accompanies the class, which is included at the end of this packet.

Undergraduate Study Rooms: There is an undergraduate economics study room in Linfield Hall 404 and a computer room in Linfield Hall Room 409A. They are open Monday - Friday from 8 am to 5 pm.

Smartycat tutoring: The office of student success provides lowest cost and free tutoring sessions by former ECNS 202 students. Visit SUB 177 or go online at [msusmartycats.com](http://msusmartycats.com).

## **Additional Information**

- 1.** If you desire classroom/testing accommodations for a disability, please contact me outside of class to present the written supporting memorandum of accommodation from the office of [\*Disability Student Services\*](#). Requests for accommodations for disability must be received and authorized by me in written form no less than two weeks in advance of need in order to allow adequate time to review and make appropriate arrangements. No accommodation should be assumed until authorized.
- 2.** I follow the policies in the [\*MUS Policy and Procedure Manual\*](#) with regard to cheating, plagiarism, and academic dishonesty. A grade of zero will be given for any assignment or examination on which the student is in violation of a policy, and the incident will be reported to the Office of the Dean of Students. I reserve the right to refuse to sign a drop form if cheating has been committed on an examination.
- 3.** I expect you to follow the [\*MSU Student Conduct Code\*](#). No form of harassment is tolerated. I do not tolerate disruptions in class. This includes, but is not limited to, cell phones (including texting), reading of newspapers, doing other classes' assignments, or private conversations with your classmates.
- 4.** I adhere to the policies in the [\*MSU Catalog\*](#) on assigning grades of incomplete. I only award a grade of incomplete upon the student proving there was such a hardship that would render it unjust to hold the student to the time limits previously fixed for the completion of his/her work.
- 5.** Any student desiring to observe a religious holiday must contact me before the absence. Regarding assignments due on a religious holiday, it is preferable that they be submitted before observance; however, the due date will be extended to the next school day following the holiday if the student chooses.
- 6.** I adhere to the policies in the [\*MSU Catalog\*](#) on change of grades. Final grades will not be changed except in the case of clerical error on my part or if it was fraudulently obtained. A change of final grade does not mean allowing additional time to complete the work of a course or allowing the student to submit work or to take or to retake examinations after the conclusion of the semester.
- 7.** I encourage students to come to my office hours and get assistances on understanding various concepts. Please keep me informed of any extraordinary circumstances that may hinder your academic success in this course. If you cannot attend my office hours due to scheduling conflicts, please email me to set a time that is convenient for you.
- 8.** The information in this syllabus, including the schedule and grading information is not concrete. Any changes to the syllabus will be discussed in class.
- 9.** The Final Examination for this course will take place during the time period identified in the Schedule of Finals Week Exams published by the Registrar.

## **Lecture 1: Introduction to Macroeconomics (NO CORRESPONDENCE WITH CHAPTER 1)**

### **1. Modern macroeconomics**

Macroeconomics is the study of the performance of the economy as a whole. There are five pillars of modern macroeconomics:

1. Output: the production of goods and services.
2. Prices: the cost of purchasing inputs and outputs over time.
3. Employment: the utilization of economies' key resource.
4. Finance: how credit markets create economic efficiency and improve wellbeing.
5. Government policy: how government policies effect the economy.

These five pillars are typically analyzed over three different time periods:

1. Short run: year to year changes in the economy.
2. Medium run: referring to the business cycle (recessions and expansions).
3. Long run: decade to decade changes in the economy.

Due to changing prices (inflation), macroeconomic variables are categorized into by whether they net out price changes.

1. Real: Variables that net out price changes.
2. Nominal: Variables that are not adjusted for changes in price.

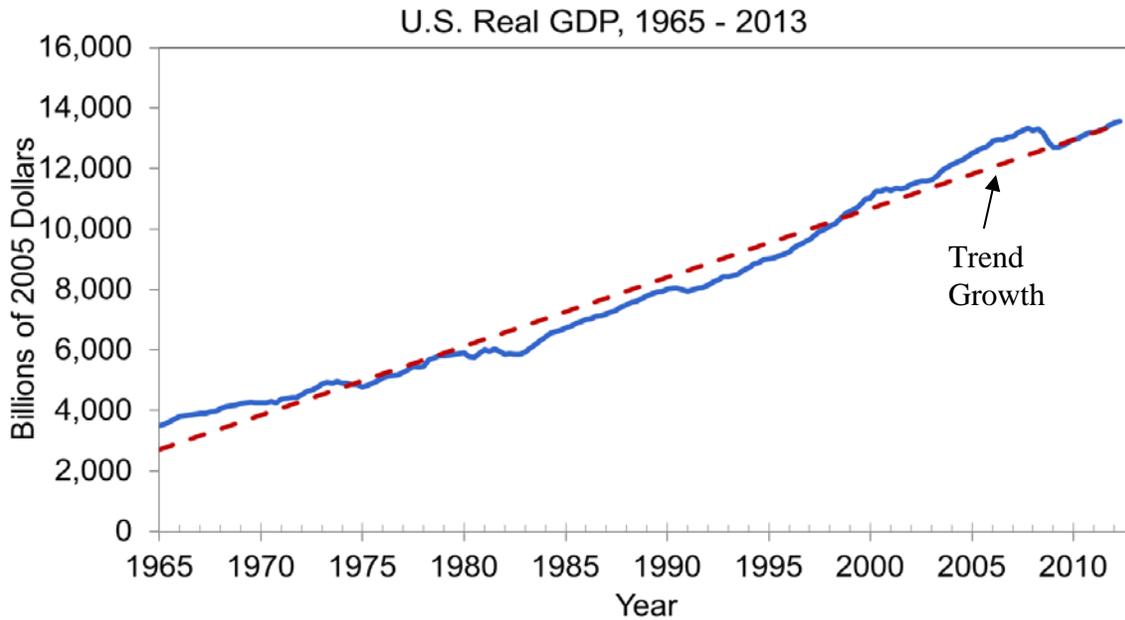
### **1.1 Aggregate output**

Aggregate output is the total quantity of goods and services produced in an economy during a particular time period.

**The main measures of aggregate output are Real Gross Domestic Product (RGDP or Real GDP) and Real Gross Domestic Product per Capita (RGDPP or Real GDPP).**

Between 1929 and 2015:

1. U.S. RGDP has grown by 3.2% annually.
2. U.S. RGDPP has grown by 2.1% annually.



### 1.1.1. Relevant questions on aggregate output

Some questions that arise when studying aggregate output are:

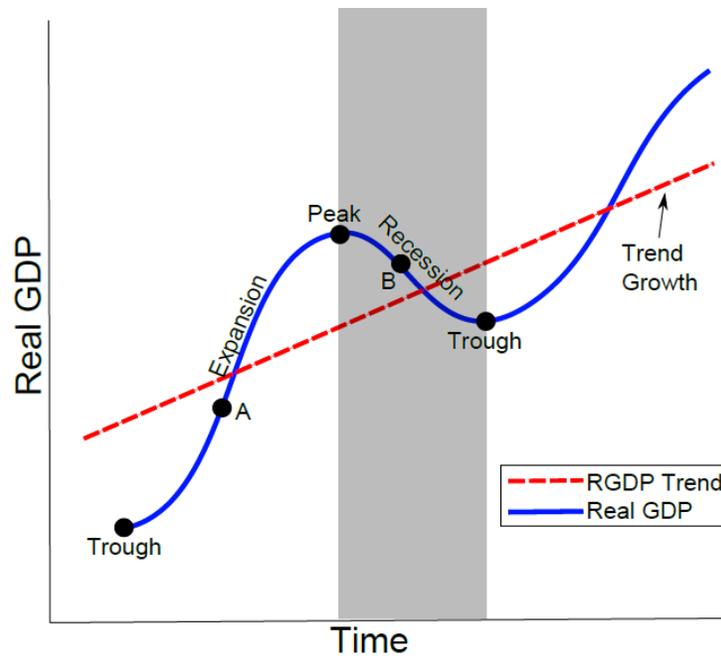
1. What factors allow sustained growth?
2. What government actions assist in sparking or sustaining growth?
3. What causes business cycles?
4. What government policies smooth the business cycle? Should they attempt to do so?

### 1.2. The business cycle

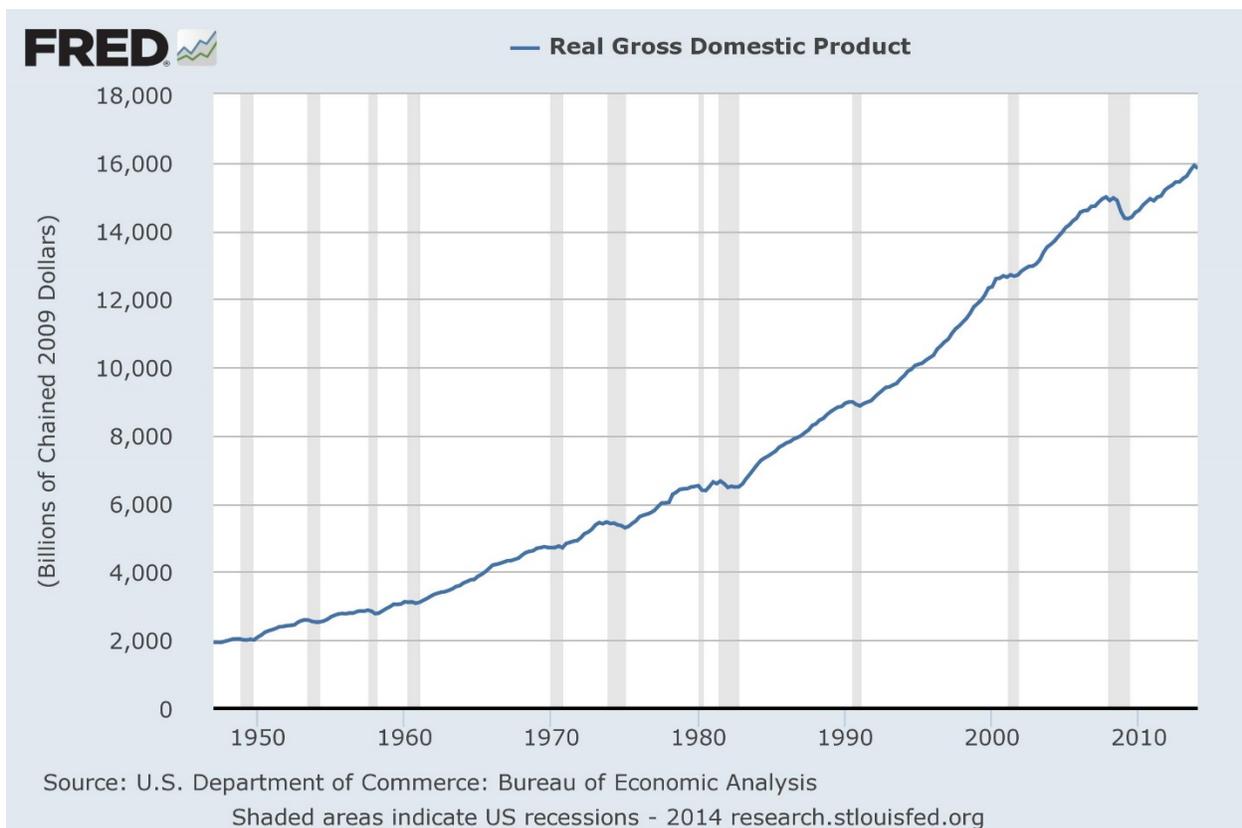
During the short-run, many of the indicators of the economy move together and form a pattern. That is, when the economy is doing well, economic growth occurs, unemployment is low, prices seem to be stable and not rising too fast, the financial system is sound, and government policies assist the economy. These co-movements in macroeconomic indicators are called the *business cycle*.

There are four distinct phases of the business cycle:

1. Expansion (or boom): Relatively rapid economic growth.
2. Peak: Period in which economic growth plateaus.
3. Recession (or contraction): Period of relative stagnation or decline in economic growth.
4. Trough: Lowest point in decline of economic growth.

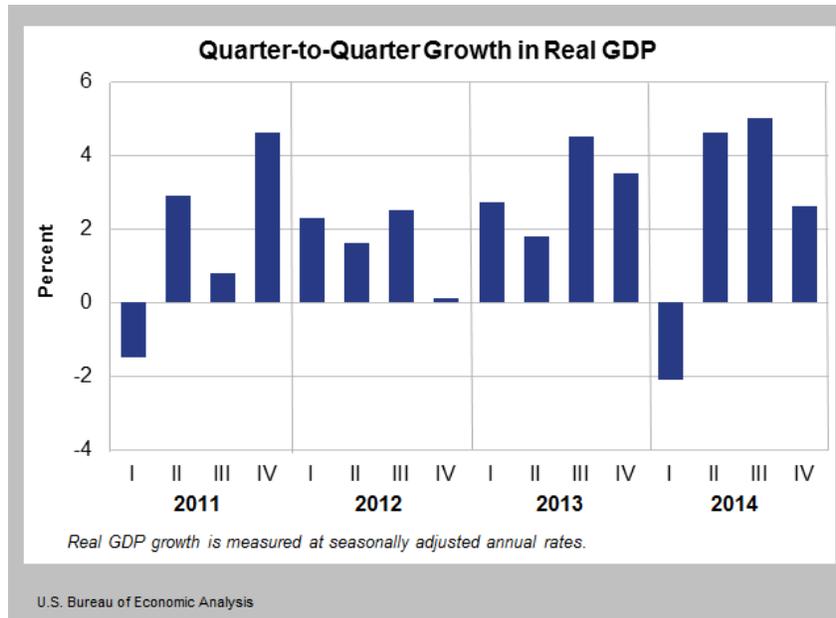


- Fluctuations are often measured using the change in RGDP.
- Despite being labeled a cycle, most fluctuations in economic activity do not follow a mechanical or predictable frequency.



An expansion or downturn is identified using RGDP growth rates, labelled  $g(RGDP)$ .

- $g(RGDP) > 0$ , economy is growing.
- $g(RGDP) < 0$ , economy is contracting.
  - 2 quarters of negative growth defines a recession.

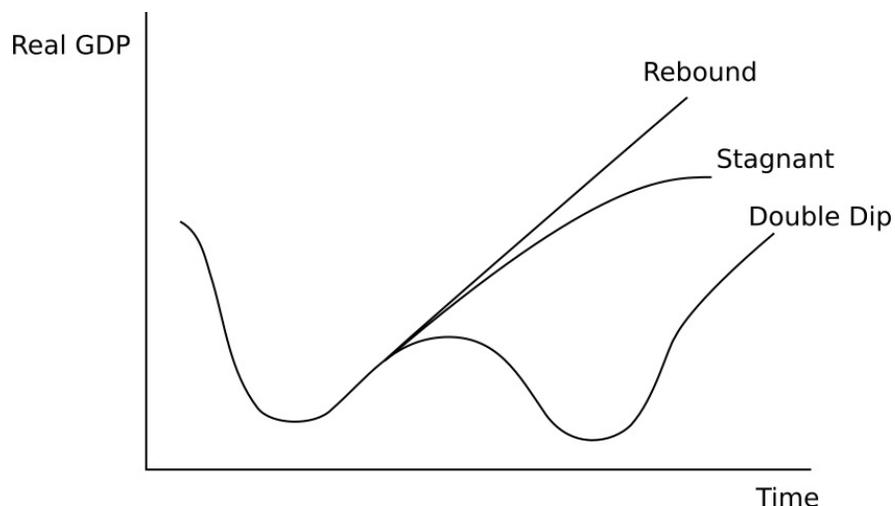


- Prior to the 2008 recession, recent U.S. recessions were not severe.
- Over the last 30 years, U.S. recessions have occurred less frequently.
- In a recession, most seek to know when the economy has entered the trough.

### 1.2.1. Recovering from Recessions

There are three ways economies typically recover from recessions.

1. Rebound: Time path of RGDP looks V-shaped.
2. Stagnant: Time path of RGDP after recession is flattened.
3. Double dip: Time path of RGDP after recession is another downturn.

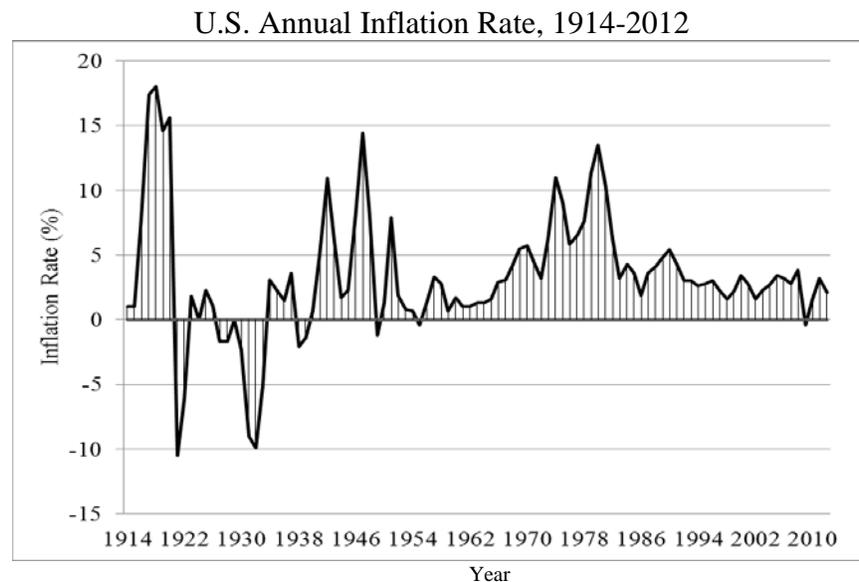


### 1.3. Inflation

Many consumers understand inflation as an overall increase in prices. Most economists view infrequent or one-time increases in prices as moot since economies adjust quite well to them. Most often economists discuss persistent inflation, which is continual increase in the price level.

Some definitions that aid in understanding inflation are:

1. Inflation: an increase in the overall price level (prices on all goods increase).
2. Price level: a measure of the average price to buy a basket of goods and services.
3. Inflation rate: the percentage increase in the price level from one year to the next.
4. Deflation rate: the percentage decrease in the price level from one year to the next.



- Inflation is not inevitable, it is man-made.
- Fluctuations in inflation have decreased as a result of better monetary policy.

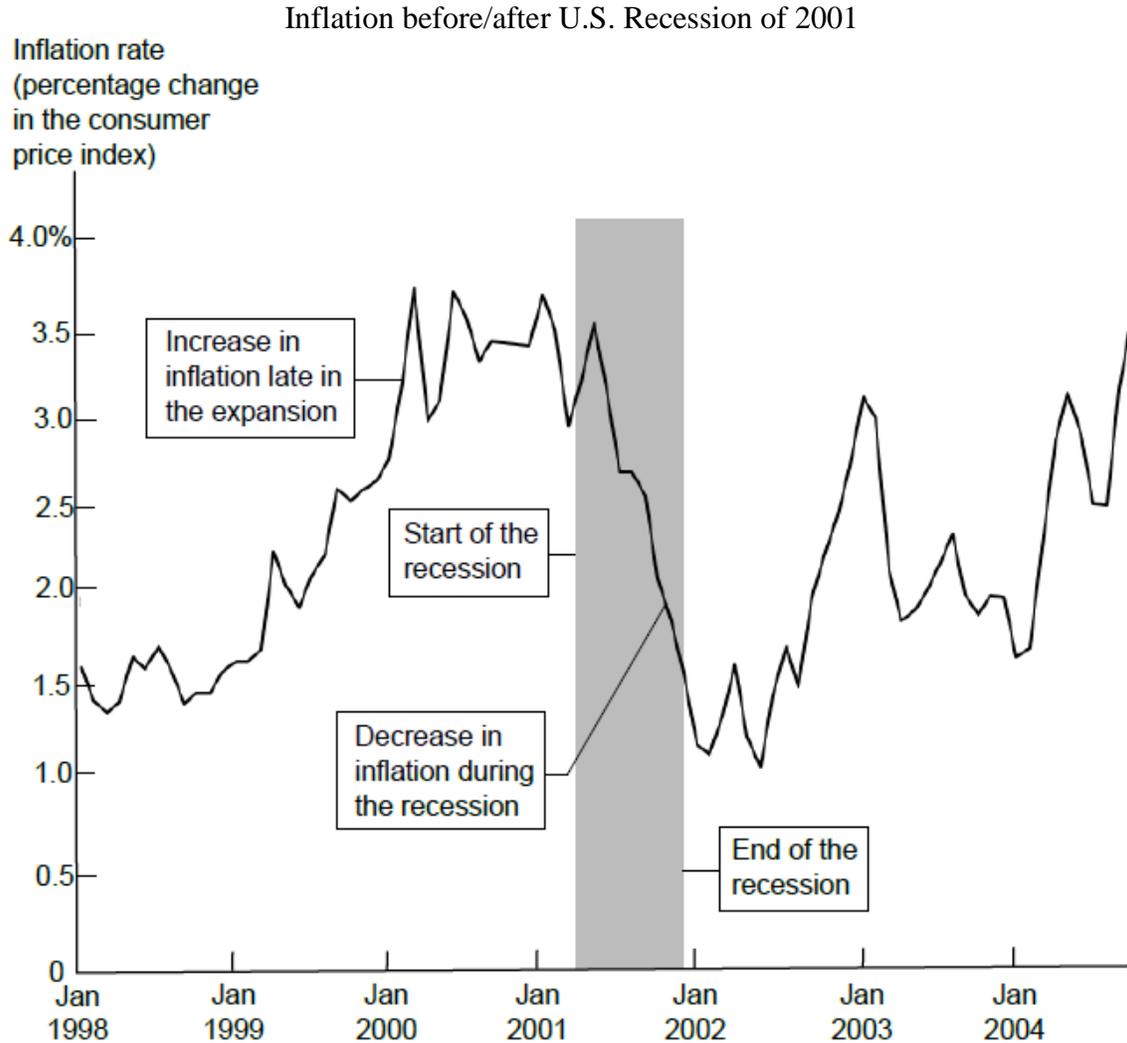
#### 1.3.1. Relevant questions on inflation

Some questions that arise when studying inflation are:

1. How does inflation affect the income distribution?
2. What problems are caused by anticipated inflation?
3. What problems are caused by unanticipated inflation?
4. How can governments control inflationary pressures?

### 1.3.2. Inflation and the business cycle

The data on inflation and aggregate output reveal that inflation and output tend to be procyclical – both increasing during expansions and decreasing during recessions. As an economy expands, prices tend to rise and cause inflation, and as it contracts, prices tend to decline leading to deflation.



Source: U.S. Department of Commerce

## 1.4. Unemployment

Unemployment occurs when a person is available and willing to work, but is currently without work. The prevalence of unemployment is measured using the unemployment rate, which is defined as the percent of those in the labor force that are unemployed.

Some definitions that aid in understanding unemployment are:

1. Labor force: the sum of employed and unemployed workers in the economy.
2. Unemployment rate: percentage of the labor force that is unemployed.
3. Discourage worker: individual available for work, but not currently looking.



### 1.4.1. The relationship between unemployment and output

Output, as measured by GDP, and the unemployment rate have an inverse relationship – when output is low, as measured by the deviation from the trend, unemployment is high, and when output is high, unemployment is low.

## 1.5. The financial system and government policies

The financial system plays a vital role in the macroeconomy. In any given economy, the financial sector is typically four times the size of RGDP. We will explore this in-depth later on in the semester. In addition, government policies have profound effects on production capabilities, employment, and individuals' well-being.

## **2. The macroeconomy circular flow diagram**

The circular flow diagram of a macroeconomy assists in understanding how the pillars of macroeconomics relate. This model assumes a closed economy (no imports or exports). There are households and firms in this economy. There are three markets, one for goods, one for factors of production, and one for lending.

The purpose of the circular flow is to show the flow of dollars and the flow of factors and goods through the economy.

The two players in the economy have the following actions.

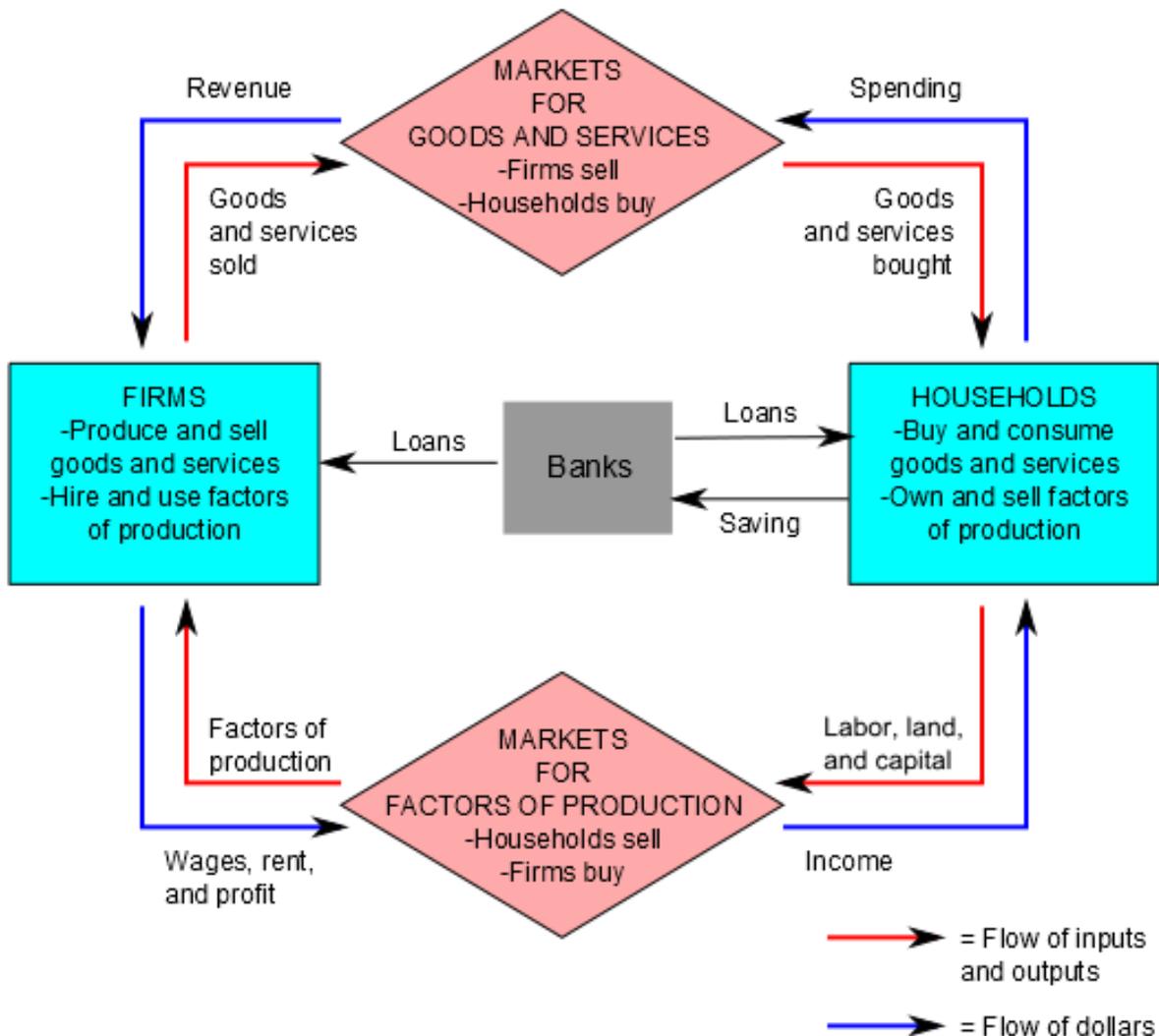
### Households' actions

1. Buy goods.
2. Rent their capital and work for firms.
3. Own stock.
4. Save and sometimes borrow.

### Firms' actions

1. Sell goods.
2. Rent capital and land from households and employ laborers.
3. Provide dividends back to stockholders.
4. Borrow as needed.

The financial system, mostly banks, provide funds between firms and households.



- The dark arrows along the inside point to where physical items flow.
  - Labor, land, capital, and goods flow from households to firms through the factors markets.
  - Goods flow from firms to households through the goods market.
- The light arrows along the outside point to where dollars flow.
  - Wages, rent and profit flow from firms through the factor's market and is in turn income for households.
  - Revenue from households' expenditures flow through the goods' market to firms.

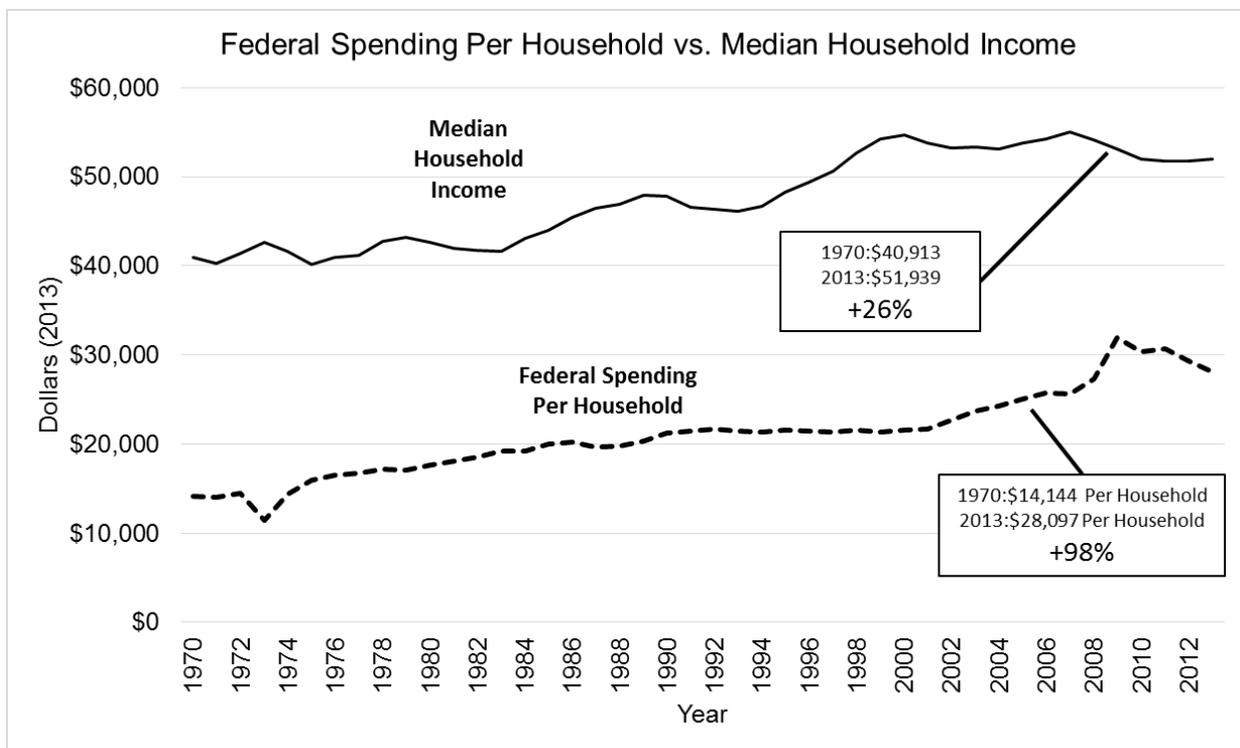
This simple circular flow diagram can be extended to include the government and the rest of the world. A financial market can also be extended to permit the government to borrow.

## 4. The U.S. Federal budget

U.S. Federal government spending comprises 20% of GDP even though just under 18% of GDP is raised in taxes. This implies that the government must borrow 2%, on average, every year. Fiscal policies are policymakers' decisions on how much and on whom to tax and on how much and on what to buy. While much of economics is positive, studying the way things are, much of fiscal policy is normative, being decided based on achieving some social goal.

### 4.1. U.S. Federal spending

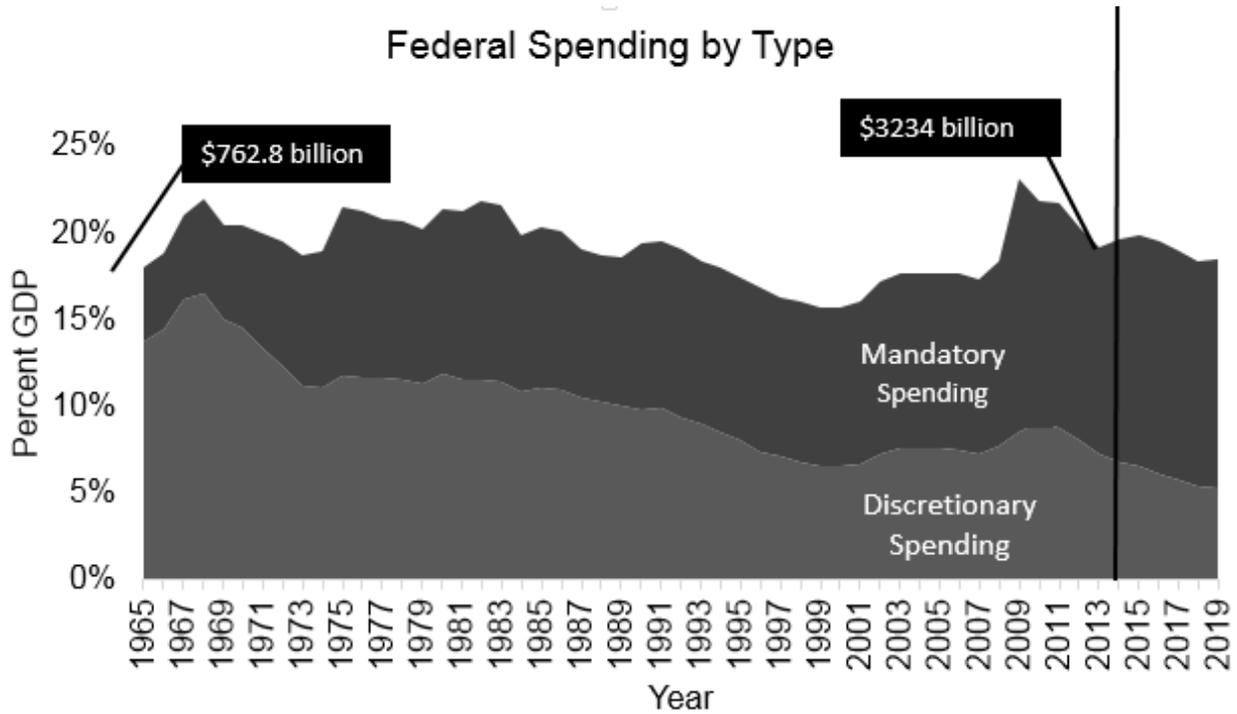
The U.S. Federal government spends approximately 3.5 trillion dollars a year. Recently, policymakers have suggested spending be cut by 2.4 trillion over 10 years. This amounts to a reduction in spending of about a quarter of a trillion dollars per year. Even with these cuts, federal spending has risen substantially more than household income over the last 40 years. The table below provides the percentage change in Federal spending per household and median household income. While median household income has only risen by 26%, total government spending per household has increased by 98%.



Source: U.S. Census Bureau, White House Office of Management and Budget, and Congressional Budget Office

One way to classify government spending is by whether the expenditure is 'discretionary' or 'mandatory'. Even though politicians choose mandatory spending items at some point, these are expenditures that run on autopilot and do not require yearly congressional approval once initiated. Discretionary spending is subject to annual budgets and accounts one-third of the

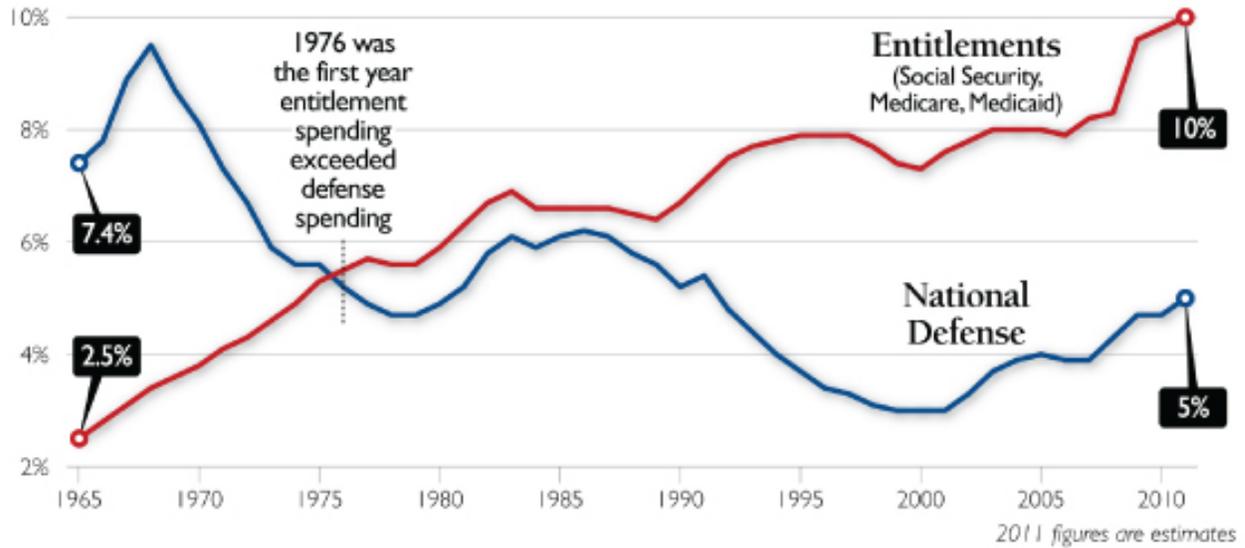
federal budget. As the figure below demonstrates, mandatory spending has increased more than five times faster than discretionary spending.



Source: White House Office of Management and Budget

National defense has always been an important line item of the federal budget even though it is not mandatory spending. Interestingly, defense spending has declined significantly over time, despite the recent wars in Iraq and Afghanistan. Spending on the three major mandatory spending items—Social Security, Medicare, and Medicaid—has more than tripled since 1965.

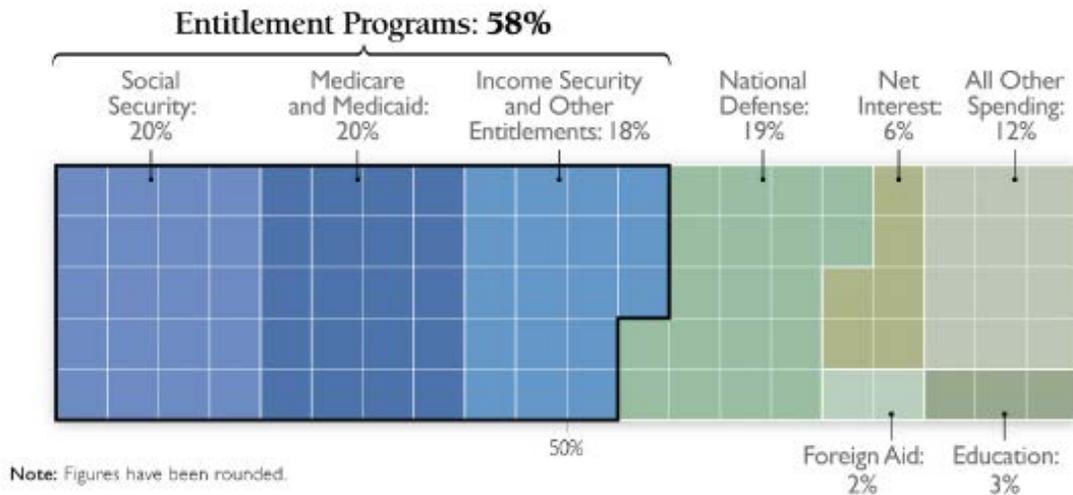
**PERCENTAGE OF GDP**



Source: White House Office of Management and Budget.

In combination with other entitlements, such as food stamps, unemployment insurance, and housing assistance, Medicare, Medicaid, and Social Security constituted 58% of the President’s 2012 budget. In contrast, spending on foreign aid represents only 2%.

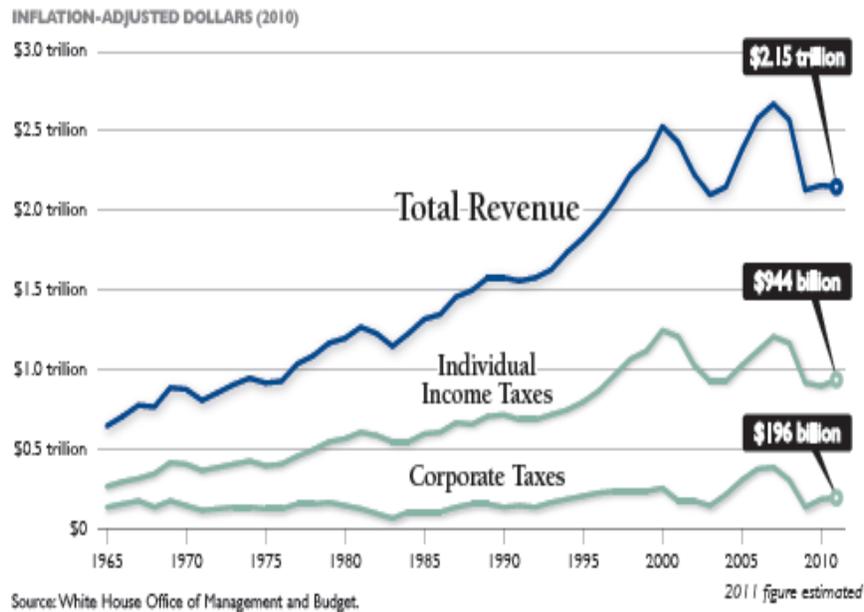
**PERCENTAGE OF THE PRESIDENT’S FY2012 BUDGET**



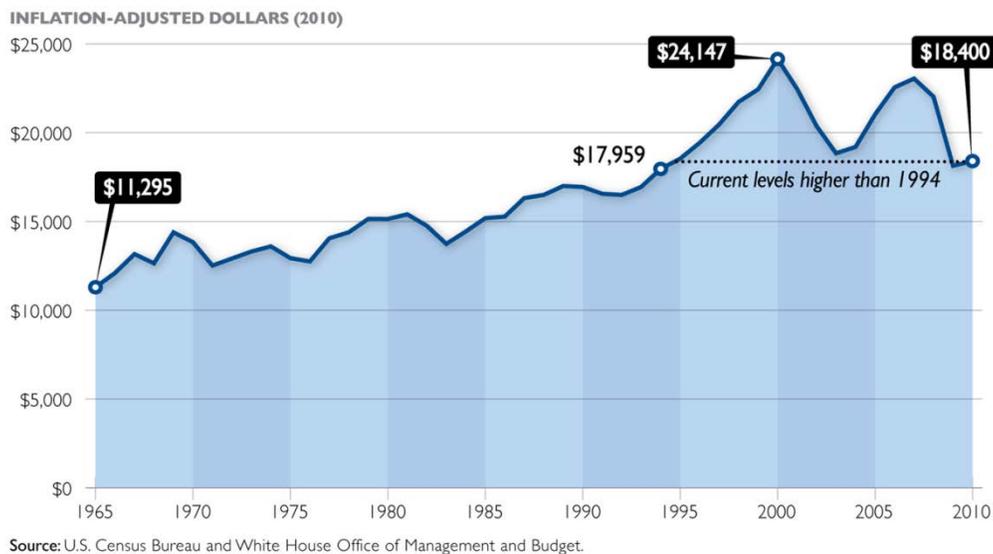
Source: White House Office of Management and Budget.

## 4.2. U.S. Federal revenue

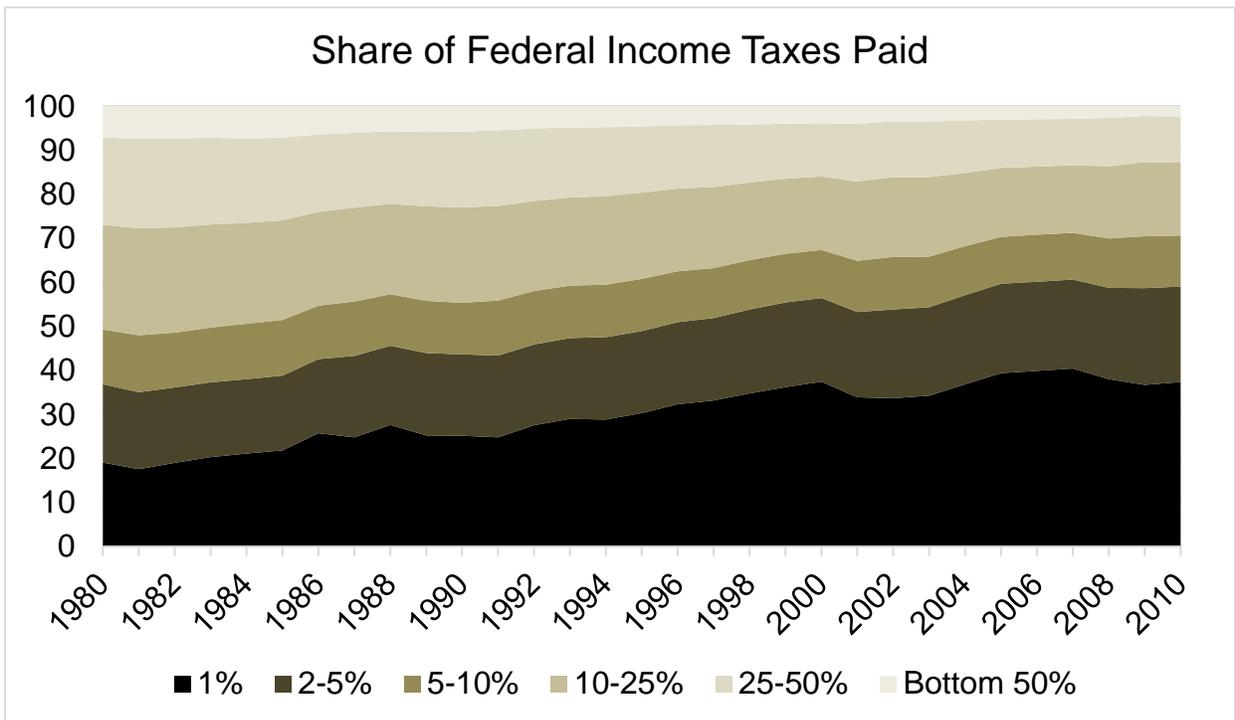
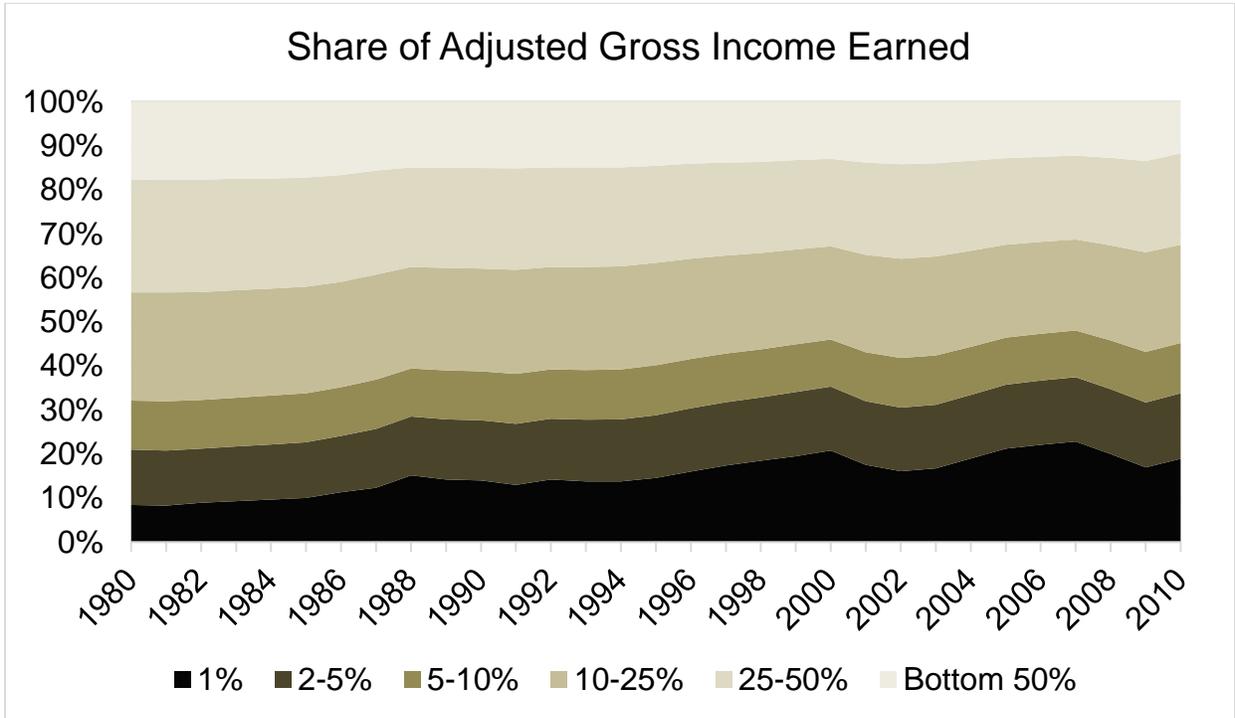
Total tax revenue has increase significantly over the last 45 years. The majority (82%) of tax revenue is from individual and payroll taxes. The Bush-era tax cuts dropped total revenue in the beginning of 2000.



Similar to total government expenditures, total tax revenue does not take into consideration population growth. On a per household basis, total revenue has increased, but not at the same rate as expenditures. In fact, there has only been a 100% increase in per household tax revenue. Currently, average tax revenue per household has remained the same as they were in 1994.

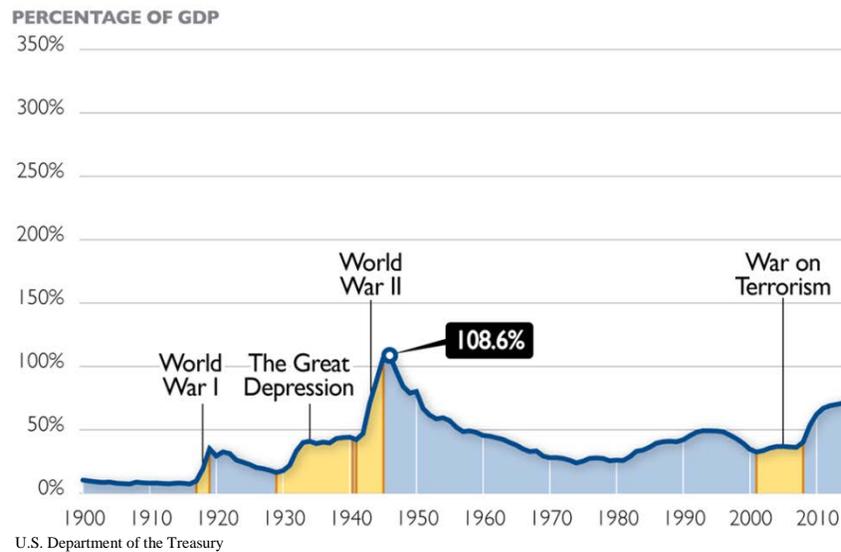


The tax burden is not shared equally across income brackets. In fact, the bottom 50% of U.S. taxpayers earn 20% of the nation's income, but only pay 2% of all U.S. Federal income tax. On the other hand, the top 1% earn 15% of the nation's income, and pay 37% of all U.S. Federal income tax.



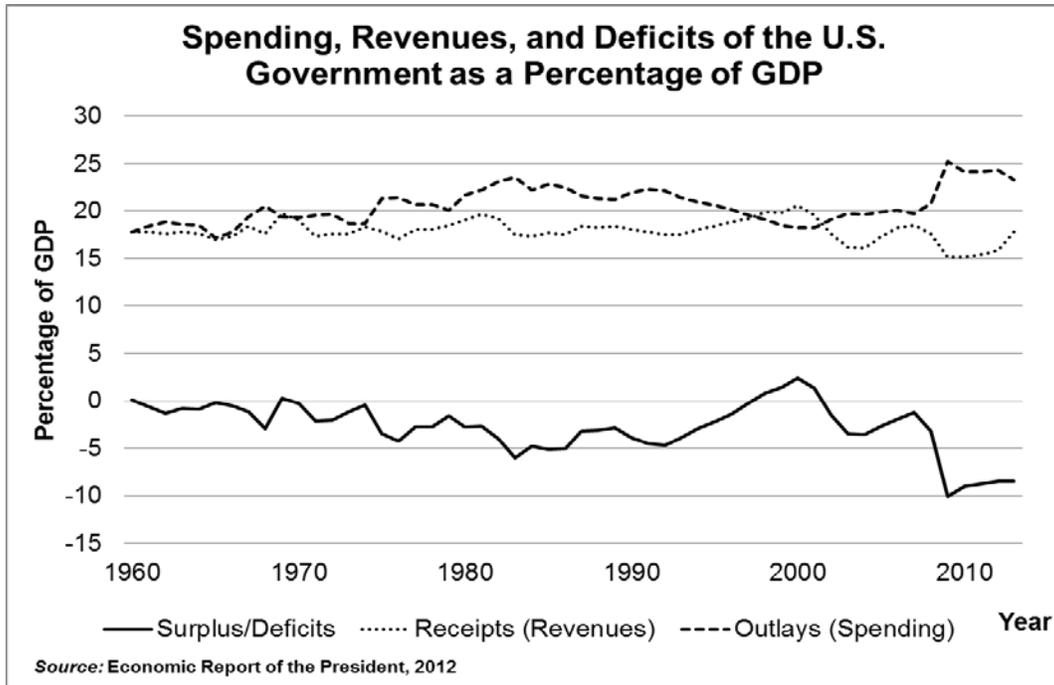
### 4.3. Debt and deficits

There are two ways to measure debt: overall debt and net debt. The overall debt measures how much a country owes its debtors regardless of how it is financed. Net debt subtracts off debt a country owes itself, and measures how much debt a country owes external debtors. Most economists are more interested in net debt metrics as countries can always pay themselves with another “IOU” or default. The figure below displays U.S. net debt as a percentage of GDP for the last 100 years. In the past, wars and recessions contributed to rapid but temporary increases in U.S. debt.

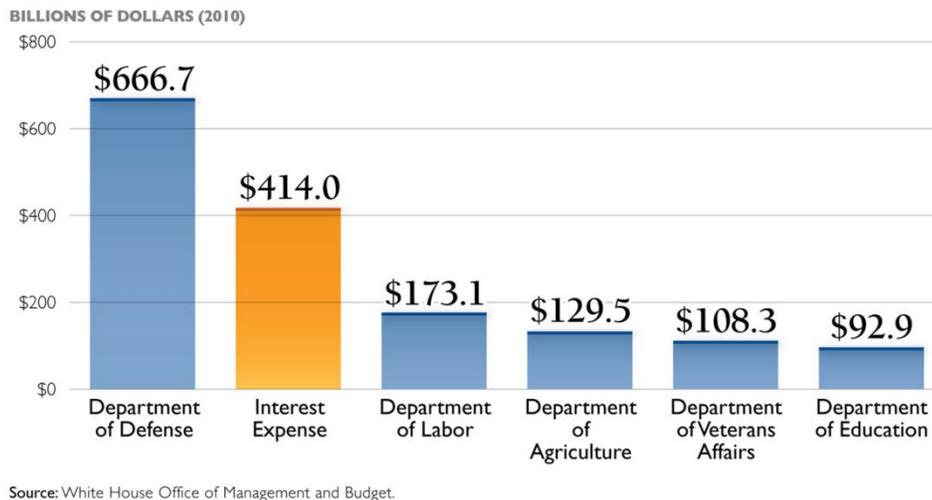


If debt levels remain the same, then over time the debt-to-GDP ratio shrinks if a country’s economy is growing. For example, the large drop in the U.S. debt-to-GDP after World War II can be partly attributed to the launching of a stalled economy.

Debt accumulates from continual government budget deficits. As the figure below demonstrates, revenue has been more constant than spending. Large gaps due to enormous increases in spending have had long-term consequences.



One consequence of mounting debt is the interest that must be paid on the debt. In 2010, the U.S. spent more on interest on the national debt than it spent on many Federal departments, including Education and Veterans Affairs.



When comparing U.S. net debt to other nations, the United States still has a very low net debt relative to the size of its GDP.

Country	Net Public Debt as a Percentage of GDP
Japan	200%
Euro Area	75%
Portugal	75%
Italy	115%
Ireland	66%
Greece	110%
Spain	52%
United Kingdom	66%
United States	66%

Sources: European Commission; U.S. Office of Management and Budget

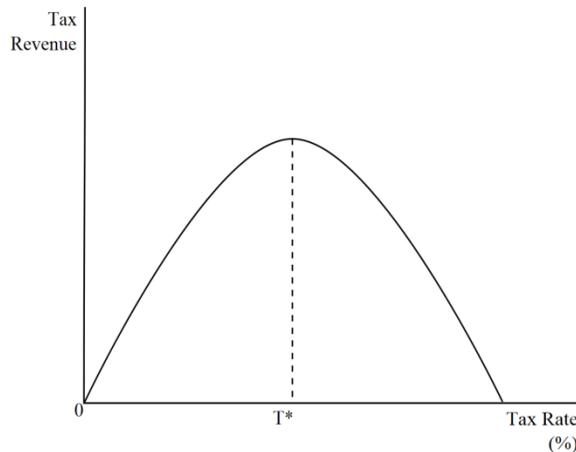
Unlike businesses and households, the government does not have to *balance its budget* or be constrained by profit considerations. There are three main ways the government can finance its purchases:

- 1) Taxation
- 2) Print money
- 3) Borrow funds

For businesses and households, only (1) above is available when expenses exceed income. Since the government can always lower expenditures, raise taxes, and/or print money, defaulting on government debt is a choice, not a consequence.

There are some reasons why defaulting of debt seems to be the only option for some countries. First, a government may have maxed out its ability to increase tax revenue. This is illustrated by using the Laffer curve (see below). The tax rate ( $T^*$ ) provides the maximum amount of tax revenue. Beyond  $T^*$ , all future increases in the tax rate lowers the total amount of tax revenue as individuals choose more leisure time and less time working to lower their tax bill.

Laffer Taxation Curve

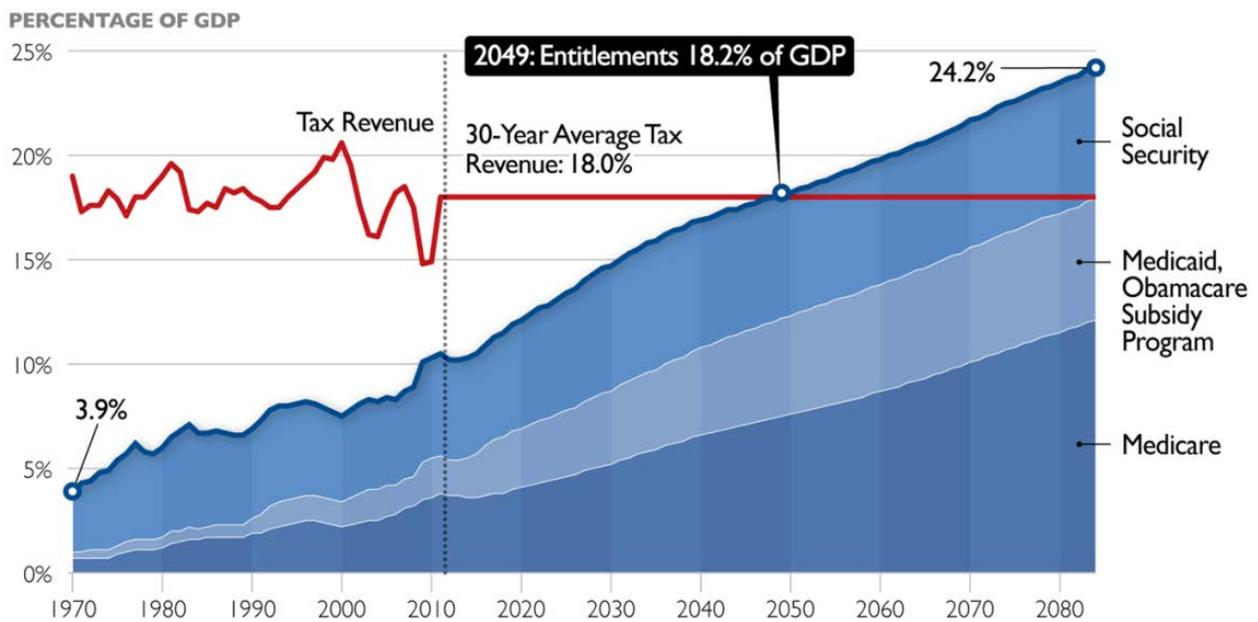


Second, cutting spending may cut into jobs or certain individuals' livelihoods that the government or society may desire to protect. Some countries' economies are comprised of up to 60% government spending. Economies with large government sectors have a hard time cutting spending as the government is doing the majority of the work in the economy. Furthermore, no one wants to see grandma suffer because we don't want to take care of her.

Third, a government may not be able to raise money through printing money. In high inflation economies, these countries produce little seigniorage off of printing money as inflation erodes the currency's value prior to it being spent. Other countries may not be able to print money if the central bank is independent of fiscal policymakers.

#### 4.4. Entitlements

The majority of the U.S. Federal budget issues stem from future mandatory obligations promised to citizens. For example, Medicare and Medicaid are expanding rapidly. If the average historical level of tax revenue is extended into the future at the historical average of 18%, then spending on Medicare, Medicaid, the Obamacare subsidy program, and Social Security will consume all government revenues by 2049. Because entitlement spending is funded on autopilot, no revenue will be left to pay for other government spending.



## Lecture 2: Resource Allocation and Opportunity Cost

### 1. Resource Allocation and Opportunity Cost

*U.S.:*     \$30 trillion worth of capital }  
              158 million workers        }  $\Rightarrow$  \$17 trillion of goods and services

*China:*     \$15 trillion worth of capital }  
              1.35 billion workers       }  $\Rightarrow$  \$10.4 trillion of goods and services

*World :*     \$100 trillion worth of capital }  
              3.1 billion workers       }  $\Rightarrow$  \$100 trillion of goods and services

Source: IMF Worldbank Economic Outlook. Note that China produces \$17 trillion worth of goods and services in PPP.

Although production capabilities are enormous, they are limited by our available resources and technology. At any given time, we have a fixed quantity of factors of production and a fixed state of technology. The production possibilities model summarizes these constraints.

#### 1.1. The production possibilities frontier model

The production possibilities frontier (PPF) model illustrates resource allocation and opportunity cost for an economy that produces two goods. The model demonstrates how much a society can produce and at what cost.

Assumptions on the model:

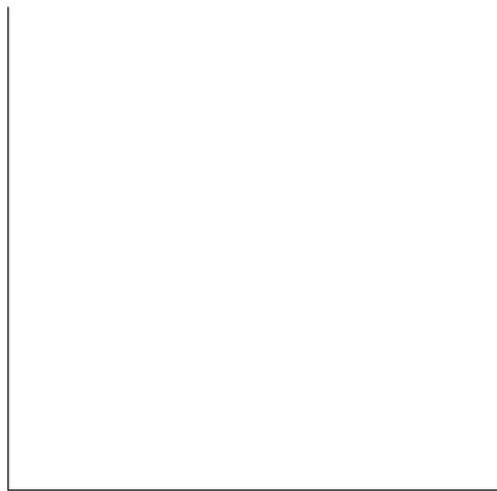
- Fixed resources in quantity/quality.
- Fixed technology.

**The production possibility frontier indicates the maximum quantities of goods that society can produce given its fixed resources.**

Exercise 1: Suppose that Montana produces two goods: guns and wheat. The maximum output using all available resources and technology for this economy is:

	Production Possibilities						Desired Production
	A	B	C	D	E	F	G
Wheat	0	1	2	3	4	1	3
Guns	10	9	7	4	0	5	10

- ❖ Draw the production possibilities frontier with the quantity of wheat on the horizontal axis and the quantity of guns on the vertical axis (unlike the supply and demand model, goods can interchange across axes).



- Connecting points A-E creates a line representing the Production Possibilities Frontier (PPF). It constrains society's output because no more resources are currently available to produce more output.
- All points along the PPF are efficient and attainable.
- All points down and to the left of points A-E are attainable by the society.
- Point F is inefficient since it underutilizes some resources. To gain more wheat, no guns have to be given up.
- Point G is unattainable by the society since current technology and fixed resources are unable to produce this combination of goods.

- ❖ What economic principles are illustrated by the PPF graph?

## 1.2. Opportunity cost

Opportunity cost represents what must be given up when taking an action. In the PPF model, it is the cost of switching resources from one production activity to another. These costs might be quite minimal (e.g., producing sweatshirts instead of t-shirts) or quite large (e.g., producing services instead of manufacturing goods). Resources by their very nature are typically better suited to some productions than others.

- Opportunity cost includes both explicit and implicit costs.
- For individuals, the opportunity cost of a choice is the greatest utility level from the alternative choices.

The opportunity cost can be expressed using the following formulas:

$$OC_{Good_1} = \frac{\text{loss in quantity of good}_2}{\text{gain in quantity of good}_1} \text{ and } OC_{good_2} = \frac{1}{OC_{Good_1}}$$

Exercise 2: What is the cost of producing more wheat?

Movement Along PPF	Change in Quantity		Opportunity Cost		Opportunity Cost of Producing an Additional Wheat
	Wheat	Guns	Wheat	Guns	
A to B					1 wheat costs __ gun(s)
B to C					1 wheat costs __ gun(s)
C to D					1 wheat costs __ gun(s)
D to E					1 wheat costs __ gun(s)

- ❖ Is opportunity cost of wheat marginally increasing? How can this be displayed graphically?

- ❖ What is the relationship between the slope of the PPF and opportunity cost?

- ❖ Suppose a linear PPF for guns on the vertical axis and wheat on the horizontal axis has a slope equal to -2. What is the opportunity cost of 1 gun?

### 1.3. Technological progress

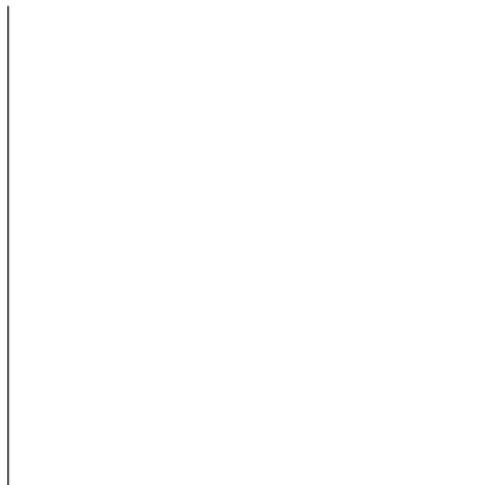
The production possibilities frontier model can demonstrate economic growth. There are a few types of economic growth that can be considered. In this lecture, we will discuss two specific forms: economy-wide increases in technology and sector-specific increases in technology.

#### 1.3.1 Economy-wide increases in technology

An economy-wide increase in technology refers to an increase in technology in which all sectors in the economy benefit (e.g., the printing press, electricity, combustible engines). This is demonstrated in the PPF model as a shift of the entire PPF outward.

Exercise 3: Use the following data to graph an economy-wide increase in technology using the PPF model.

Year		Production Possibilities				
		A	B	C	D	E
1950	Wheat	0	1	2	3	4
	Guns	10	9	7	4	0
2000	Wheat	0	2	3	4	5
	Guns	12	11	9	6	0

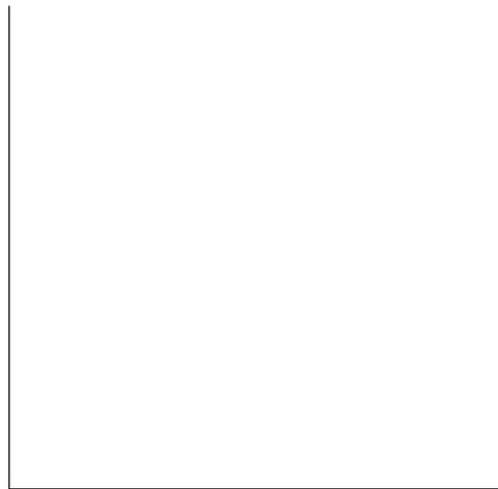


### 1.3.2. Sector-specific increase in technology

A sector-specific increase in technology refers to an increase in technology for only a particular sector – for some reason the increase in technology is nontransferable to other production processes (e.g., the cotton-gin).

Exercise 4: Use the following data below to graph a sector-specific increase in technology in wheat using the PPF model.

Year		Production Possibilities				
		A	B	C	D	E
1950	Wheat	0	1	2	3	4
	Guns	10	9	7	4	0
2000	Wheat	0	2	3	4	5
	Guns	10	9	7	4	0



- ❖ Explain why an economy-wide increase in technology is not required to produce more of both goods? Show on a PPF how a sector-specific increase in technology can result an increase in production of both goods.

### **1.3.3. The agricultural and goods manufacturing sectors demise**

The last 150 years have brought substantial increases in sector-specific technological progress in the agricultural sector. 150 years ago, 70% to 80% of the population was employed in agriculture while only 2% to 3% of the population is employed in agriculture today.

❖ How can we feed ourselves? Are we eating less?

Tremendous technological progress in agriculture has allowed us to reallocate labor out of agriculture and into producing other goods and services. Thus, production can increase substantially in the same sector in which employment falls.

This is the same story of goods manufacturing in the United States over the last 70 years. Post World War II, 39% of the population was employed in manufacturing. Today, 9% are in manufacturing. Some of these jobs went overseas, but the majority of the jobs have declined due to substantial increases in technology of goods production. Automation has increased production as well as refined production processes. That is, total production in goods manufacturing has risen while employment in the sector has fallen due to higher productivity.

The great lesson for you to take away from this lecture is that employment can decline in sectors with the greatest productivity. Many have argued that the United States has lost its competitive edge in manufacturing. This is hardly the case. We produce more goods per capita than we ever have in the past. We have chosen to give up manufacturing some goods that we do not have a comparative advantage in: those of low technology that require a tremendous amount of manual labor, and invested more in industries that we have a comparative advantage in: those of high technology that require little manual labor.

## 2. Resource efficiency

Efficiency refers to not being able to produce more of a good or service without giving up some of another good or service.

There are two types of efficiency:

- Production efficiency: producing at a point on the PPF
- Allocative efficiency: producing the combination of goods that we value the most

While the basic PPF model shows the set of productive efficiency points, it is mute on allocative efficiency. To find the allocative efficient point along the PPF requires an understanding of society's preferences - how much of one good they prefer to another. If the marginal benefit from consuming an additional unit of a good, i.e., how much additional benefit is received from consuming an additional unit of a good, then the allocative efficient point is where marginal benefit is equal to the opportunity cost.

Another way to view marginal benefit is how much of a good is one willing to give up for an additional unit of another good.

- ❖ How does society get to the allocative efficient point?

### 3. Resource ownerships and allocations

In this course we will discuss mostly market economies where there is private ownership and allocation of resources. This is, for the most part, the U.S. economy. This type of economy is only one of an array of economies with different types of ownership and allocations of resources.

#### 3.1. Resource ownership

Resources can be owned three different ways:

1. Communism: most resources are owned in common.
  - a. Only works if individuals have no conflict over how resources are allocated.
  - b. Most homes operate under communism.
  - c. Sidewalks, streets, and public benches are communally owned.
2. Socialism: most resources are owned by the state.
  - a. May own labor as well if the sole employer.
  - b. National parks, state highway system, military bases, public colleges are all state owned.
  - c. 1/3 of all land in the United States is federally owned.
3. Capitalism: resources are own privately.

#### 3.2. Resource allocation

There is a difference between ownership and allocation of resources. Just because one owns a resource does not mean that they will decide how it is allocated. Resources can be allocated three different ways:

1. Command: According to explicit instructions from central authority.
  - a. Command economies are also called *centrally planned economies*.
  - b. Cuba and North Korea are centrally planned but occasionally depart to other types of resource allocation.
2. Market: According to individual decision making of those who own the resource.
3. Traditional: According to long-lived practice from the past.
  - a. Stable and predictable output but low growth.

### 3.3. Types of economic systems

An economic system is composed of two features: a mechanism for allocating resources and a mode of resource ownership.

		Resource Allocation	
		Market	Command
Resource Ownership	Private	Market Capitalism	Centrally Planned Capitalism
	State	Market Socialism	Centrally Planned Socialism

- Most nations have market capitalist economies.
- Centrally planned socialism was the predominant economic system for many countries that were a part of the Soviet Union as well as Eastern European countries in the 20<sup>th</sup> century. China is still considered a centrally planned socialist nation.
- Sweden and Japan have at times pushed centrally planned capitalism. The United States during World War II was a centrally planned capitalist nation.
- Market socialism appears idealistic, but has an apparent contraction. For example, in the 1950s and 1960s, Hungary and the former Yugoslavia experimented with this type of economy with dismal success.

### 3.4. Role of prices

The prices of goods are determined quite differently across economic systems.

Centrally planned economies: Prices are determined by a central planner.

Market economies: Prices are free to adjust (free-market) without interference. Prices adjust if demand does not equal supply.

The price also allocates resources.

- Positive price changes can lead to higher profits and attract investment.
- Negative price changes can cause losses and lead to disinvestment.

### 3.5. Government intervention

Market capitalism assumes no government involvement in the economy. This is sometimes referred to as laissez-faire economics. Government involvement usually consists of trade policies, government franchise licenses, as well as the issuance of currency and other interference to the market economy.

#### 4. In-class exercises

Assume that Cody and Wyatt can switch between producing corn and producing pork at a constant rate.

	Minutes Needed to Make	
	1 bu. of corn	1 lb. of Pork
Cody	20 minutes	12 minutes
Wyatt	15 minutes	10 minutes

1. Which of the following combinations of corn and pork could Cody produce in one 8-hour day?
  - a. 6 bushels of corn and 35 pounds of pork
  - b. 9 bushels of corn and 25 pounds of pork
  - c. 15 bushels of corn and 20 pounds of pork
  - d. 24 bushels of corn and 40 pounds of pork
  
2. Assume that Cody and Wyatt each have 360 minutes available. If each person divides his time equally between the production of corn and pork, then total production is
  - a. 10.5 bushels of corn and 16.5 pounds of pork.
  - b. 21 bushels of corn and 33 pounds of pork.
  - c. 35 bushels of corn and 22 pounds of pork.
  - d. 42 bushels of corn and 66 pounds of pork.

3. What is Cody's opportunity cost of producing one bushel of corn?
- a. 3/5 pound of pork
  - b. 6/5 pounds of pork
  - c. 4/3 pounds of pork
  - d. 5/3 pounds of pork

*Hint:* Use  $\frac{\text{Output of good}_1}{\text{Input of good}_1} = \frac{\text{Output of good}_2}{\text{Input of good}_2}$ .

4. What is Cody's opportunity cost of producing one pound of pork?
- a. 3/5 bushel of corn
  - b. 6/5 bushels of corn
  - c. 4/3 bushels of corn
  - d. 5/3 bushels of corn

5. Fill in the following output table.

	<b>For 1 Hour of Work</b>	
	<b>Bushels of Corn</b>	<b>Pounds of Pork</b>
<b>Cody</b>		
<b>Wyatt</b>		

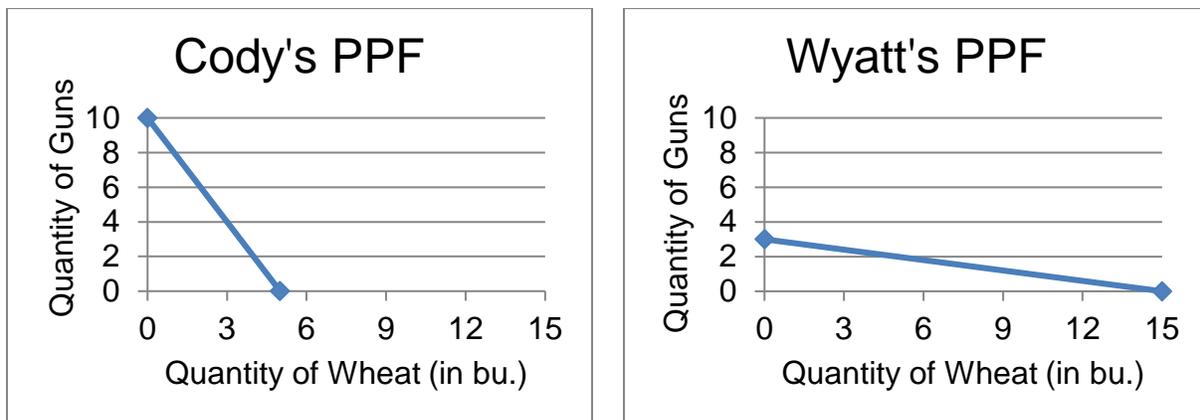
6. Using the output table from question 5, solve for the opportunity costs of producing 1 bushel of corn for both Cody and Wyatt, respectively.

## Lecture 3: Specialization and Gains from Trade

### 1. The inefficiency of not coordinating production

In the last lecture, we learned that when society produces on their production possibility frontier, they achieve production efficiency. In this lecture, we will explore what happens when society has the ability to trade with others. The trade model demonstrates that even if individual societies have production efficiency, collectively they are inefficient unless they specialize and trade with each other based on the economic principle of comparative advantage.

Exercise 1: Suppose there are two individuals, Cody and Wyatt. These two individuals live on the same state, but on opposite ends and have never seen each other. Their PPFs are graphed below.



- Cody's allocation efficiency is at 3 bu. of wheat and 4 guns.
  - Wyatt's allocation efficiency is at 5 bu. of wheat and 2 guns.
- ❖ How much is total consumption of both individuals?

	Wheat	Guns
Cody		
Wyatt		
<b>Total</b>		

- ❖ What is the opportunity cost of producing 1 bushel of wheat for Cody and for Wyatt?
- ❖ What is the opportunity cost of producing 1 gun for Cody and for Wyatt?

Suppose one day that they meet each other and decide that they should form an alliance and trade outputs. Wyatt notes that he is really good at growing wheat compared to Cody, and Cody is a better gunsmith compared to Wyatt.

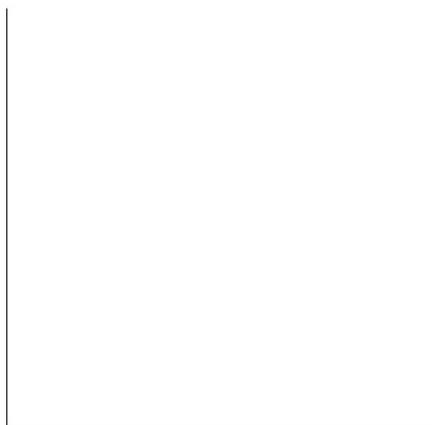
**Specialization is based on comparative advantage – an individual (or a society) has a comparative advantage in a good if they can produce it at the lowest opportunity cost.**

❖ What are the specializations of Cody and Wyatt based on comparative advantage?

❖ How much is total output in the alliance given that each produces the good for which they have a comparative advantage?

	Wheat	Guns
Cody		
Wyatt		
Total		

❖ Draw the alliance PPF and mark Cody and Wyatt’s total output when they trade.



• Notice that total output without specialization is inside the alliance PPF.

❖ Suppose that they decide to trade equal shares of guns and wheat. Draw the consumption point on their PPFs on the previous page. What does this teach you about trade?

This model is quite profound. It tells us that even if individuals (or society) have production efficiency by themselves, when they coordinate their production activities based on comparative advantage, they can produce more. That is, they can reach a point outside their own PPF in the unattainable region through trade. It also tells us that unless they engage in specialization based on comparative advantage, world output is inefficient since they are not collectively utilizing their resources efficiently in production.

## 2. Absolute vs. comparative advantage

In Exercise 1, coordination of activities benefited both individuals as Wyatt is relatively better at producing wheat and Cody is relative better at producing guns. In this section, we explore trade between two countries when one country can produce more of both goods and investigate if this country should engage in trade with the lesser able country.

Exercise 2: Suppose two countries, Japan and the United States, would like to trade with each other. However, the United States is better at producing all goods. The amount of time it takes to produce its goods is listed in the table below.

	1 Computer	1 Suit
Japan	625 hrs.	125 hrs.
U.S.	100 hrs.	50 hrs.

- The United States has an absolute advantage in producing suits because it can produce suits at a lower cost than Japan.
- The United States has an absolute advantage in producing computers because it can produce computers at a lower cost than Japan.
- ❖ What is the opportunity cost of producing 1 computer for the U.S. and for Japan?
  
- ❖ Based on comparative advantage, i.e., lowest opportunity cost, which country should produce what?

Suppose that each country produces along its PPF and that they have contracted that Japan produces 10 more suits and the U.S. produces 4 more computers.

- ❖ What is the cost to the United States and to Japan for producing more of these goods? What is the change in output produced for each country and for the both countries together?

	Japan		U.S.	
	Computers	Suits	Computers	Suits
Change in production		+10	+4	

- Even with one country having an absolute advantage in producing both goods, both countries can benefit from specialization based on comparative advantage.
- Similar to Exercise 1, using the same resources, the world can produce more output without decreasing the output of any other goods even when one country has the absolute advantage in producing all goods.
- Without trade, world output of goods and services is at an inefficient point inside the world PPF.
- ❖ What combination of imports/exports allows both countries to be made better off in both goods?

	Japan		U.S.	
	Computers	Suits	Computers	Suits
Change in production		+10	+4	
Exports (-)				
Imports (+)				
Net Change	+1	+1	+1	+1

- The country that has the comparative advantage in a good is the exporter of that good.

### 3. Terms of trade

The terms of trade is the ratio at which a country can trade domestically-produced products for foreign-produced products. In other words, the terms of trade is how much of one good is given up for another. The distribution of gains is based on the terms of trade.

Exercise 3: Given the quantities of imports and exports, what is the *terms of trade* between Japan and the U.S. for suits?

Exercise 4: What is the maximum Japan is willing to give up to import 1 computer? What is the minimum the U.S. is willing to accept to export 1 computer? What is the rule of thumb that countries follow when trading with others?

**4. Coordinate of production without government intervention**

Up to this point, it would seem that a benevolent social planner has decreed Japan to produce suits and the U.S. to produce computers. Some may feel that this is injustice and that the market should dictate who produces what. The exercise below demonstrates that the market provides countries with sufficient incentives to produce goods in which they have a comparative advantage.

Exercise 5: Continuing on with the United States and Japan, suppose that labor in Japan costs \$16 Yen, labor in the United States costs \$10, and the exchange rate is 8 Yen per \$1.

- ❖ What is the cost of producing goods for both countries?

	1 Computer	1 Suit
Japan		
U.S.		

- ❖ Using the exchange rate, what is the cost of the goods in each currency?

	1 Computer		1 Suit	
	USD	YEN	USD	YEN
Japan				
U.S.				

- ❖ Based on prices, what goods will consumers buy from whom? How do producers respond?

- ❖ How can a country manipulate its comparative advantage?

## 5. Gains and losses from trade

While the model predicts that there are substantial gains from trade in terms of total output produced, there are sector specific losses that cannot be ignored.

- ❖ Who gains and who loses from trade?

**Those that suffer from trade, i.e., those that have lost their jobs due to outsourcing, have influence on trade policies than those who gain.**

- Consumers benefit the most but do not organize themselves to express support.
- Owners/employees that have lost from trade collect together with the loudest voices and will oppose trade
- Since those for trade are not heard, this causes a bias that trade hurts individuals more than it helps.

## 6. Trade in practice

### 6.1. Limitations to trade

There are a few limitations that inhibit trade. These are:

1. Cost of trade: high transportation costs, i.e., perishable goods, and high negotiation costs both reduce the gains from trade.
  - a. 90% of the population of Canada lives 100 miles from the U.S. border. It would seem that goods produced in Canada should have a low cost to send to the U.S. and vice versa. However, Canadian provinces are 10 times more likely to do inter-provincial trade than cross border trade.
2. Size of country: Small countries cannot produce all that is needed for a large country. Large countries can only partially specialize.
3. Increasing opportunity cost: we have assumed that the opportunity cost is constant but, in reality, it increases. This may inhibit full specialization.
4. Government barriers: the government may want to protect fragile or infantile industry of national security or importance.
  - a. Tariffs: tax on imports change the terms of trade.
  - b. Quota: limits the quantity of imports and drives up the import price.

## 6.2. Comparative advantage

The origins of comparative advantage of production of a good or service are broken down as follows:

1. A country with relatively large amounts of a particular resource will tend to have a comparative advantage in goods that use that resource.
2. Natural resources or climate are not necessary for a country to have a comparative advantage. Natural resources can be imported. Facilities can be constructed to simulate the climate necessary for production.
3. Even if two goods/services are extremely related, a country may only have a comparative advantage in one of them.
4. Countries often develop strong comparative advantages in the goods they have produced in the past.

## 6.3. Trade myths

There are many myths about trade that tend to persist. These are:

1. Trade is a zero-sum game: what one country gains, another loses.  
The reality is both countries can gain from trade.
2. Countries with low labor productivity cannot benefit from trade as they cannot compete.  
The reality is that trade depends on comparative advantage, not absolute. Think of brain surgeons who also know the fastest way to mow their lawns. Should they take the time to mow their lawn or perform another surgery?
3. High wage countries cannot compete with low wage countries.  
The reality is that
  - a. Wages reflect productivity
  - b. Comparative advantage demonstrates that both can be better-off with trade.
4. Trade causes unemployment.  
The reality is that trade changes employment across sectors, but has no effect on total employment.

## 7. In-class exercises

1. American and Japanese workers can each produce 4 cars a year. An American worker can produce 10 tons of grain a year, whereas a Japanese worker can produce 5 tons of grain a year. To keep things simple, assume that each country has 100 million workers.

- Which country has an absolute advantage in producing cars? In producing grain?
- Construct an output production table corresponding to each country's PPF (in millions).

	Cars	Grain
Japan		
U.S.		

- Graph the production possibilities frontier for both economies on one graph (in millions).



- What are the opportunity costs of a car and grain for both countries (in millions)?
- Which country has a comparative advantage in producing cars? In producing grain?

- f) Without trade, half of each country's workers produce cars and half produce grain. What quantities of cars and grain does each country produce?

	Cars	Grain
Japan		
U.S.		

- g) Starting from a position without trade, give an example in which trade makes each country better off (in millions).

	Japan		U.S.	
	Cars	Grain	Cars	Grain
Change in production	+4			+10
Exports (-)				
Imports (+)				
Net Change				

2. Pat and Kris are roommates. They spend most of their time studying (of course), but they leave some time for their favorite activities: making pizza and brewing root beer. Pat takes 2 hours to make a pizza and 4 hours to brew a gallon of root beer. Kris takes 4 hours to make a pizza and 6 hours to brew a gallon of root beer.

- a. Who has the absolute advantage in making pizza?
  
- b. What is each roommate's opportunity cost of making a pizza? Who has the comparative advantage in making pizza?
  
- c. If Pat and Kris trade foods with each other, who will trade away pizza in exchange for root beer?
  
- d. The price of pizza can be expressed in terms of gallons of root beer. What is the highest price at which pizza can be traded that would make both roommates better off? What is the lowest price?

	Minutes Needed to Make 1	
	Bushel of Corn	Pound of Pork
<b>Cody</b>	20	12
<b>Wyatt</b>	15	10

3. Assume that Cody and Wyatt can switch between producing corn and producing pork at a constant rate. At which of the following prices would both Cody and Wyatt gain from trade with each other?

- 6 bushels of corn for 10.5 pounds of pork
- 12 bushels of corn for 19 pounds of pork
- 24 bushels of corn for 34 pounds of pork
- Cody and Wyatt could not both gain from trade with each other at any price.

4. Suppose there are two countries, Boatland and Farmland with production capabilities:

- Boatland can produce 250 fish or 50 wheat.
- Farmland can produce 30 fish or 280 wheat.

If neither engages in trade, then production is:

- Boatland consumes 125 fish and 25 wheat.
- Farmland consumes 45 fish and 150 wheat.

If trade were to occur with complete specialization based on comparative advantage, then the combined output of the two countries would increase by

- 75 units of fish and 75 units of wheat.
- 325 units of fish and 430 units of wheat.
- 125 units of fish and 130 units of wheat.
- 80 units of fish and 105 units of wheat.

Production without Trade		
	Fish	Wheat
<b>Boatland</b>		
<b>Farmland</b>		
<b>Total</b>		

Production with Trade		
	Fish	Wheat
<b>Boatland</b>		
<b>Farmland</b>		
<b>Total</b>		

Production Comparison		
	Fish	Wheat
<b>With Trade</b>		
<b>Without Trade</b>		
<b>Difference</b>		

## Lecture 4: Supply and Demand

The supply and demand model is a general purpose model to conceptualize the market, i.e., it models the behavior of consumers and producers. Usually one good is explained but interactions with another good can be included to understand the effects of one market on another. The purpose of the model is to explain the prices and quantities of goods and services observed in the market. It also predicts what happens to price and quantity when various influences that affect demand and/or supply change. This model is used quite broadly to help understand the effects of government policy, such as price controls and taxes, as well as externalities.

### 1. Model setup

The model consists of consumers and producers.

- A market is anywhere there is a potential to trade with one another, i.e., anywhere consumers and producers meet.
- Consumers are a group of individuals that buy goods and services. These individuals demand goods and services in various markets.
- Producers are a group of individuals that sell goods and services. These individuals supply goods and services in various markets.

There are many assumptions that help to simplify the dynamics observed in the world.

1. Prices cannot be manipulated by any one individual, i.e., price taking.
2. Market size is set to accommodate the purpose of the analysis.
3. Households are typically designated solely as buyers.
4. Firms are typically designated solely as sellers.

#### 1.1. Markets

Markets take many forms. Sometimes markets are highly organized, and other times markets are less organized.

- When no one individual or firm can manipulate the price or quantity for a good or service, we call this a perfectly competitive market (e.g., wheat market).
- When one individual or firm can manipulate the price or quantity for a good or service, we call this an imperfectly competitive market (e.g., pc software market).

## 2. Demand

There are three essential components to demand a good or service:

1. Want
2. Affordability
3. Plan to buy

Law of demand: The law of demand states that the quantity of a good or service that people are willing and able to buy is negatively related to its price, ceteris paribus.

### 2.1 Why does the law of demand hold?

There are two reasons why the law of demand holds:

1. Income effect
2. Substitution effect

#### 2.1.1. Income effect

The income effect is the effect on the purchasing power ability of consumers when there is a change in the price level of a good. What is important to recognize is that while consumers' income may not change, when prices change, their real income changes. For example, if houses become 50% more expensive, individuals that purchase a home either have to buy less home or buy fewer other goods and services.

- The law of demand states that price and quantity are inversely related. Thus, as price increases, individuals cannot buy as much of the good due to the income effect (and vice versa).

Another example is heating costs. As heating costs rise, individuals respond by reducing the temperature in the house. They compensate through wearing a sweater, using a woodstove, insulating their home, and/or moving to a smaller home.

#### 2.1.2. Substitution effect

The substitution effect refers to change in quantity of a good due to the change in the relative price of other goods. Individuals respond to a changing price by evaluating the relative price of other goods.

**Both the income and the substitution effects cause the quantity to decrease when price increases.**

## 2.2. Representations of the demand

There are three ways demand is represented: 1) equation, 2) table or schedule, and 3) graphically

A demand equation represents all influences on quantity demanded.

$$Q_d = -20P + .5Pop + 1.5P_{future} + 5Pref + 2P_{sub} - 3P_{comp} + .75I + .5W$$

where

$P$  is sale price of the good/service  
 $Pop$  is number of consumers  
 $P_{future}$  is future sale price of the good  
 $Pref$  is preferences for good

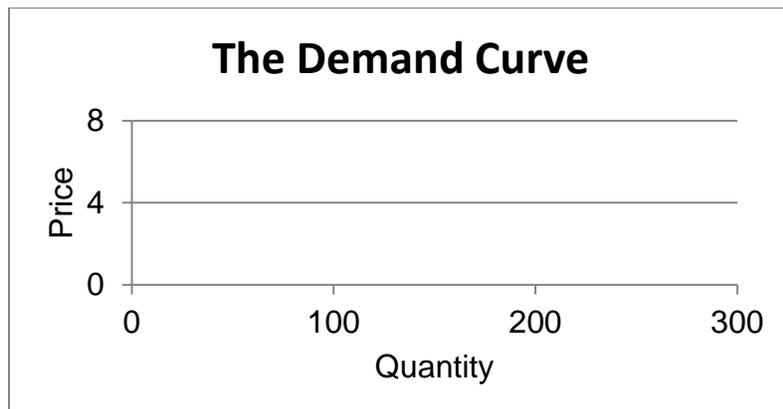
$P_{sub}$  is sale price of substitute goods/services  
 $P_{comp}$  is sale price of complementary goods/services  
 $I$  is consumer's income  
 $W$  is consumer's wealth

❖ **Where is the law of demand in the above equation?**

Exercise 1: Suppose that  $Pop = 80$ ,  $P_{future} = \$40$ ,  $Pref = 24$ ,  $P_{sub} = \$5$ ,  $P_{comp} = \$5$ ,  $I = \$20$ ,  $W = \$140$ . Use these values and the above demand equation to:

- 1) Simplify the demand equation.
- 2) Fill in the table.
- 3) Draw a graph to represent demand.

Price	Quantity
0	
1	
2	
3	
4	



- Typically graphing the reduced equation would have  $P$  on the horizontal axis. For demand curves, this is not the case as the inverse demand curve is graphed.
- The downward slope of the demand curve illustrates the law of demand.
  - Price and quantity demand are negatively (or inversely) related.

### 3. Supply

As discussed above, firms supply goods and services to markets. When producers are deciding to produce, they compare the extra cost of producing an additional unit of the goods or service to the price they can receive from selling it. Recall that as producers increase the quantity of a good, the opportunity cost increases.

This means that to increase the quantity supplied, the price must rise to make up for the additional opportunity cost to provide more. The flip side of that is if the price rises, suppliers are more enticed to increase the quantity they produce.

This leads to the law of supply.

- The law of supply states that price and quantity are positively related. Thus, as price increases, firms produce a higher quantity of the good or service (and vice versa).

#### 3.1. Representations of supply

There are three ways supply is represented: 1) equation, 2) table or schedule, and 3) graphically.

A supply equation represents all influences on quantity supplied.

$$Q_s = 130P - 2P_{input} + 3Tech - 1.5P_{future} - 2SP_{sub} + 3SP_{comp} + 5Sellers - 2Shock$$

where

$P$  is output price of the good/service

$P_{input}$  is input price to produce good/service

$Tech$  is amount of technology in production

$P_{future}$  is future output price of good/service

$SP_{sub}$  is output price of production substitutes

$SP_{comp}$  is output price of production complements

$Sellers$  is number of sellers

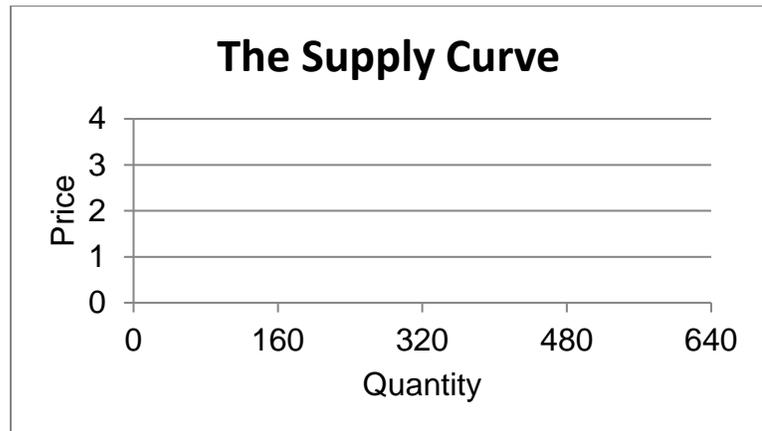
$Shock$  is events that affect production

❖ **Where is the law of supply in the above equation?**

Exercise 2: Suppose that  $P_{input} = \$20$ ,  $Tech = 15$ ,  $P_{future} = \$40$ ,  $SP_{sub} = \$5$ ,  $SP_{comp} = \$5$ ,  $Sellers = 34$ ,  $Shock = 60$ . Use these values and the above supply equation to:

- 1) Simplify the supply equation.
  
- 2) Fill in the table.
- 3) Draw a graph to represent supply.

Price	Quantity
0	
1	
2	
3	
4	



- Typically graphing this equation would have  $P$  on the horizontal axis. For supply curves, this is not the case as the inverse supply curve is graphed.
- The upward slope of the supply curve illustrates the law of supply.
  - Price and quantity supplied are positively (or directly) related.

#### 4. Determining price and quantity observed in the market

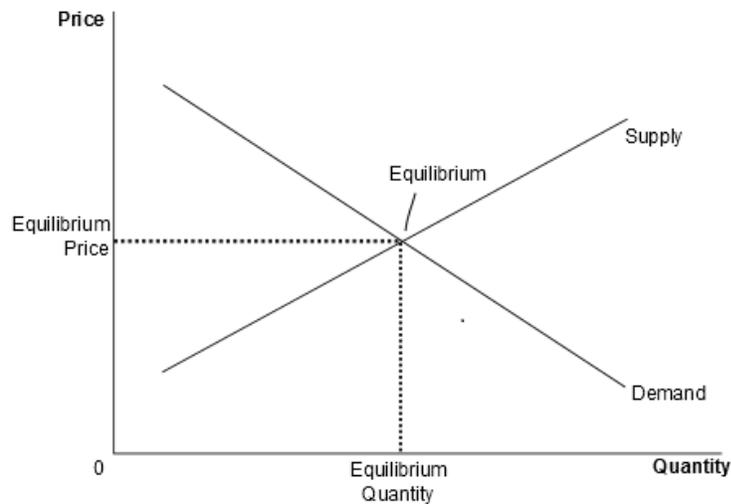
The price and quantity of a good or service observed in the market is determined by supply and demand. The intersection of demand and supply causes a stable price and quantity. This point is called the *equilibrium*; the price at this point is called the *equilibrium price*; the quantity at this point is called the *equilibrium quantity*.

An equilibrium is a situation in which various forces are in balance. At the equilibrium price, the quantity that buyers are willing and able to buy exactly balances the quantity that sellers are willing and able to sell. In other words, the quantity demand equals the quantity supplied.

The above is summarized as follows:

1.  $Q_s = Q_d = Q^*$
2. Price is constant at  $P^*$

Graphically, by overlapping the supply curve onto the demand curve graph, the equilibrium can be observed and the equilibrium price and quantity are located.



- Once the market is in equilibrium, it will stay in equilibrium regardless how much supply and/or demand there is for a good or service until
  - Something, other than price, changes supply
  - Something, other than price, changes demand
  - Government intervention (e.g., taxes, price controls, etc.)

Exercise 3: Given the demand and supply equations from Exercises 1 and 2, solve for the equilibrium price and quantity observed in the market.

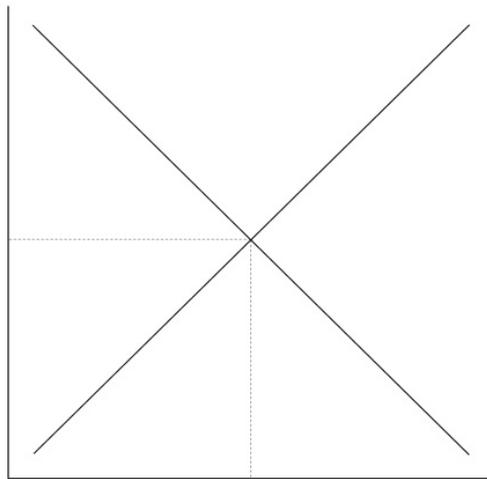
#### 4.1. Price is the automatic regulator

While it may seem that the market should not stay in equilibrium, it does. Price adjustments constantly force the quantity supplied and the quantity demanded to balance each other.

##### 4.1.1. Excess supply

Exercise 4: Suppose that the market is not in equilibrium and the price observed in the market of \$2.5 is above the equilibrium price of \$2.

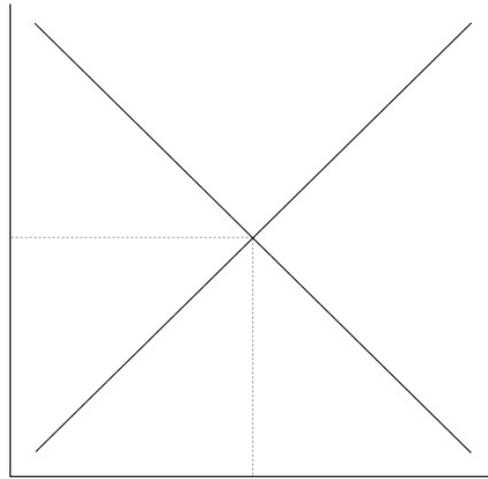
- ❖ Will the price remain above the equilibrium or will the market price decrease until it is equal to the equilibrium price? Draw a graph to illustrate your answer.



Exercise 5: Given the demand and supply equations in exercises 1 and 2, solve for the surplus if the market price is equal to \$2.5.

### 4.1.1. Excess demand

Exercise 6: Suppose that the market is not in equilibrium and the price observed in the market of \$1 is below the equilibrium price of \$2. Will the price remain below the equilibrium or will the market price increase until it is equal to the equilibrium price? Draw a graph to prove your answer.



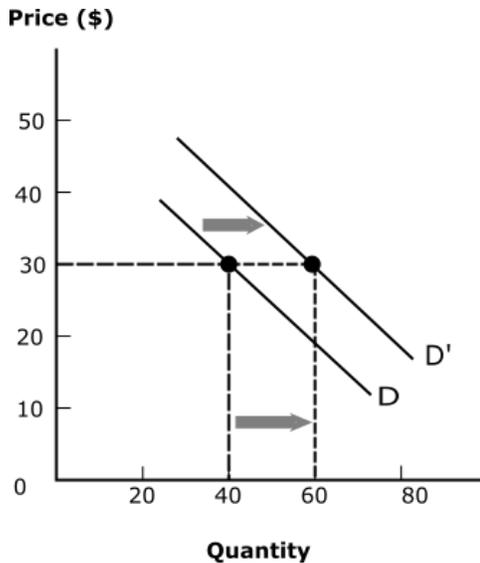
Exercise 7: Given the demand and supply equations in exercises 1 and 2, solve for the shortage if the market price is equal to \$1.

## 5. Changes in demand

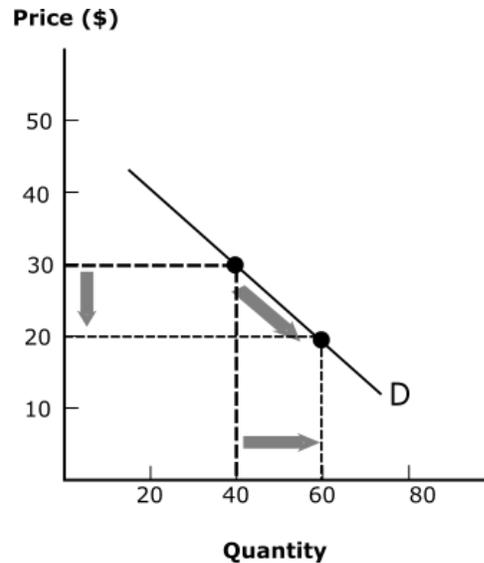
Because the demand curve holds other things constant, it need not be stable over time. If something happens to alter the quantity demanded at any given price, the demand curve shifts.

When the demand changes, the demand curve shifts. The demand can either increase or decrease.

- When demand increases, the entire demand curve shifts outward (right).
- When demand decreases, the entire demand curve shifts inward (left).



When demand changes, quantity demanded increases (price doesn't change).



Price changes cause quantity demanded to change.

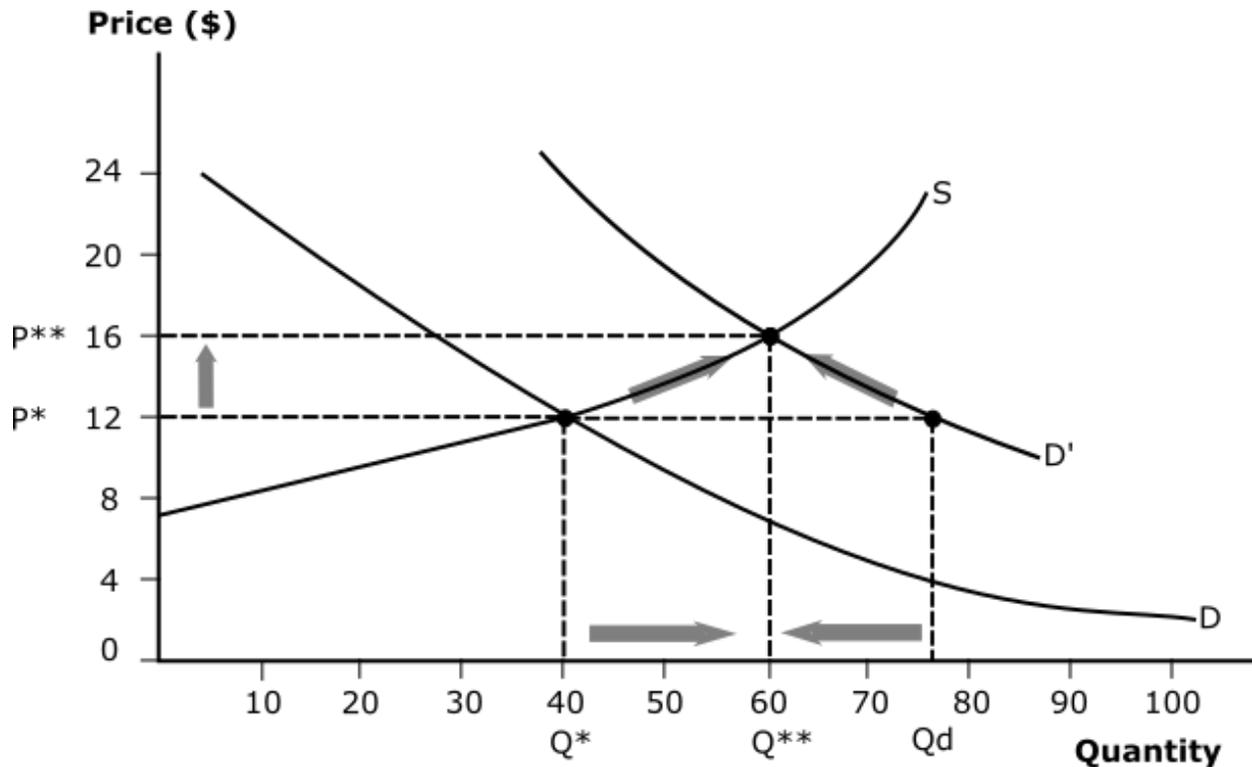
### 5.1. Influences that change demand

There are six main influences that change demand:

1. Population: as population increases, demand increases.
2. Expected Price (or future price): if the price is expected to rise, demand increases (today).
3. Tastes: if individuals' preferences change for better towards a product, the demand increases. Advertising attempts to change individuals' preferences towards goods and services. Fads are often consumers herding towards a particular good or service.
4. Price of related goods
  - a. Substitutes: if the price of a substitute increases, demand increases.
  - b. Complements: if the price of a complement increases, demand decreases.
5. Income: if one's income increases:
  - a. Demand increases if it is a normal good.
  - b. Demand decreases if it is an inferior good.
6. Wealth: acts the same way as income.

## 5.2. Dynamics of the market to a change in demand

When there is a change in demand, the market produces a stable price and quantity. This will be the case even without government intervention. When the demand increases, on its own, a shortage of the goods results, which causes suppliers to increase their price until they can sell the quantity all that individuals demand and nothing more. This is graphically displayed below.

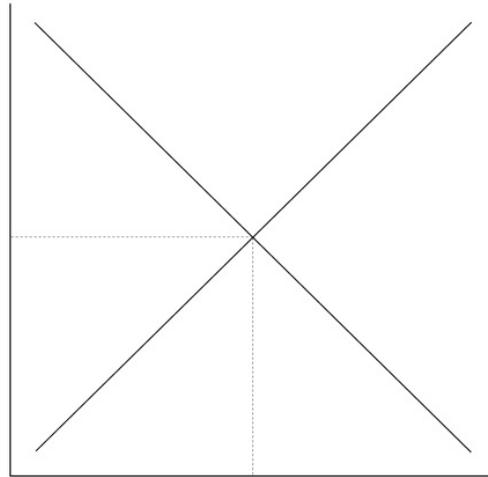


- When demand increases, the original equilibrium price is too low since the quantity demanded is greater than the quantity supplied (a shortage) in the amount of 36 ( $76 - 40 = 36$ ) and consumers bid up the price.
- The price increase acts as a powerful signal, making companies want to produce more and consumers want to purchase less.
- The increase in price moves the market toward equilibrium - consumers move up and to the left along the new demand curve,  $D'$ , and the quantity demanded declines. Meanwhile, producers move up and to the right along the supply curve,  $S$ , and the quantity supplied increases until quantity demanded is equal to quantity supplied.
- When the price reaches \$16, the quantity demanded of 60 is equal to the quantity supplied. At this price, both consumers and producers are satisfied and there is no further pressure for change. At this price of \$16, the market is in a new equilibrium.

❖ Show on the above graph how the market adjusts.

Exercise 8: Suppose that the market for ice cream is in equilibrium and then hot weather causes individuals to prefer more ice cream.

- ❖ What will happen to the equilibrium price and equilibrium quantity? Draw a graph to illustrate your answer.



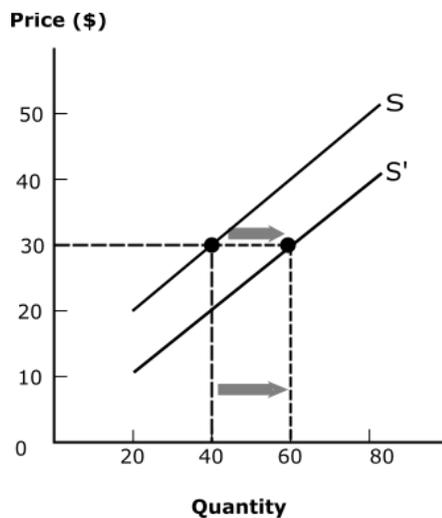
Exercise 9: Given the demand and supply equations and values in exercises 1 and 2, solve for the new equilibrium price and equilibrium quantity if consumer's wealth increases by \$40.

## 6. Changes in supply

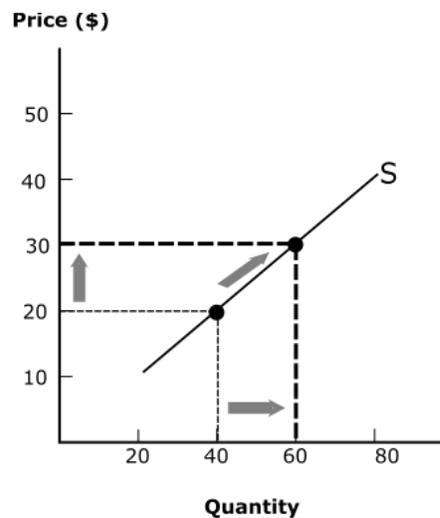
Because the supply curve holds other things constant, it need not be stable over time. If something happens to alter the quantity supply at any given price, the supply curve shifts.

When the supply changes, this shifts the entire supply curve. The supply can either increase or decrease.

- When supply increases, the entire supply curve shifts outward (right).
- When supply decreases, the entire supply curve shifts inward (left).



When demand changes, quantity demanded increases (price doesn't change).



Price changes cause quantity demanded to change.

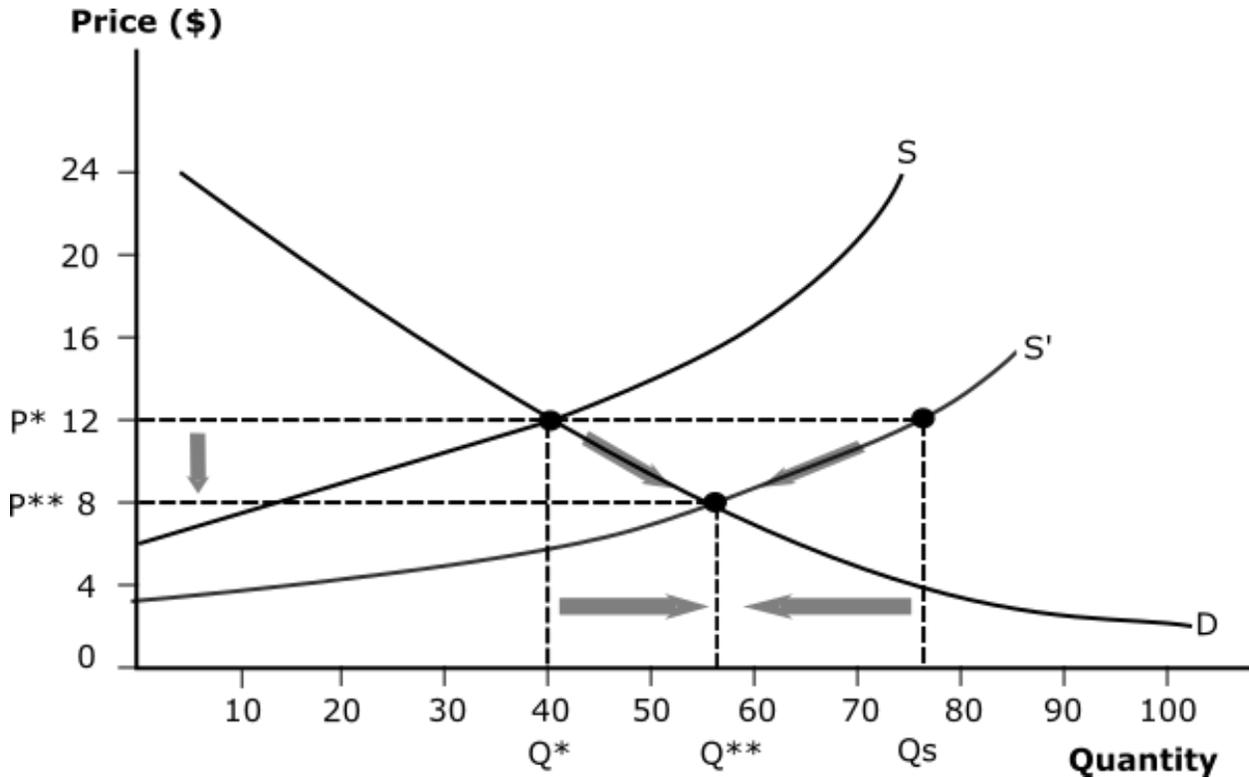
### 6.1. Influences that change supply

There are six influences that change supply:

1. Input price: as the price of inputs rise, supply decreases.
2. Technology: if technology advances, supply increases.
3. Expected Price (or future price): if the price is expected to rise, supply decreases (today).
4. Price of related outputs
  - a. Substitutes (produce different good using same inputs) – if substitute prices increase, supply decreases (think if the price of Toyotas go up, less Scions are produced).
  - b. Complements (similar to a byproduct) – if a complementary in production price increases, supply increases (think if the price of leather belts goes up, more cows are killed and the supply of red meat increases).
5. Number of sellers: if the number of sellers increases, supply increases.
6. Shocks: Unanticipated events that affect production, typically decreasing supply.

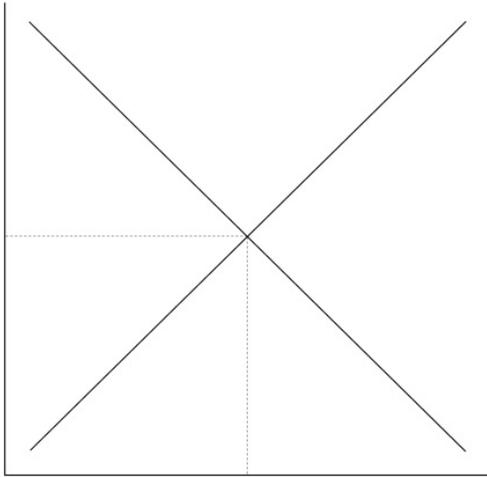
## 6.2. Dynamics of the market to a change in supply

When there is a change in supply, the market produces a stable price and quantity. This will be the case even without government intervention. When the supply increases, on its own, a surplus of the goods results, which causes suppliers to decrease their price until they can sell the quantity that individuals' demand and nothing more. This is graphically displayed below.



- When supply increases, the original equilibrium price is too high since the quantity demanded is less than the quantity supplied (a surplus) in the amount of 36 ( $76 - 40 = 36$ ) and suppliers reduce their price.
- The price decrease acts as a powerful signal, making companies want to produce less and consumers want to purchase more.
- The decrease in price moves the market toward equilibrium - consumers move down and to the right along the demand curve,  $D$ , and the quantity demanded increases. Meanwhile, producers move down and to the left along the new supply curve,  $S'$ , and the quantity supplied decreases until quantity demand is equal to quantity supplied.
- When the price reaches \$8, the quantity demanded of 56 is equal to the quantity supplied. At this price, both consumers and producers are satisfied and there is no further pressure for change. At this price of \$8, the market is in a new equilibrium.

Exercise 10: Suppose that the market for ice cream is in equilibrium and then the cost of sugar, an input in producing ice cream, increases. What will happen to the equilibrium price and equilibrium quantity? Draw a graph to illustrate your answer.



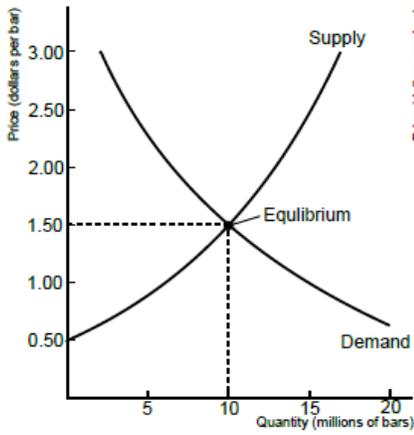
Exercise 11: 10 additional sellers enter the market. Using the supply equation and all other values from exercise 2, update the supply equation below and complete the supply schedule.

Price	$Q_s = 130P$	$Q_s' =$
0	0	
1	130	
2	260	
3	390	
4	520	
5	650	
6	780	
7	910	
8	1040	

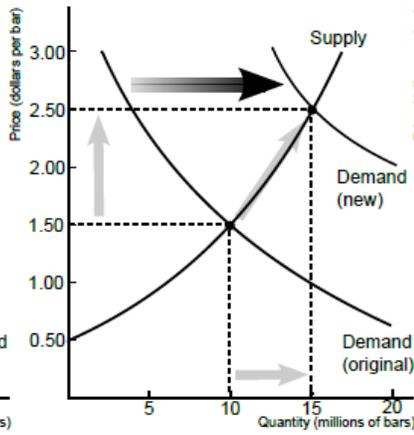


- ❖ Which of the following represents a shift in supply?
- Movement in price from \$2 to \$3 as quantity supplied increases from 260 to 390.
  - Movement in quantity from 130 to 260 when P increases from \$1 to \$2.
  - At  $P = \$1$ , quantity increases from 130 to 180.
  - None of the above.

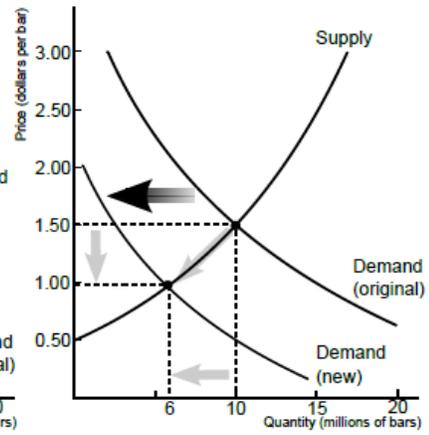
## 7. The effects of all possible changes in demand and supply



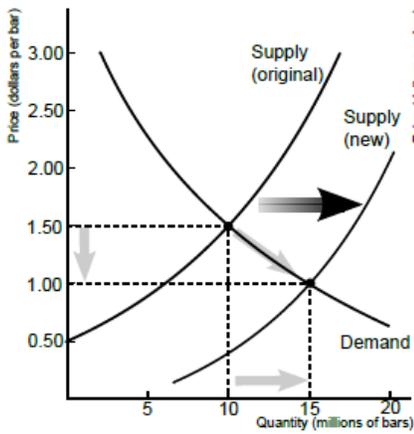
(a) No change in demand or supply



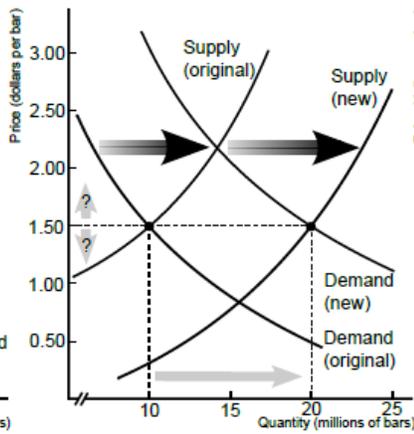
(b) Increase in demand



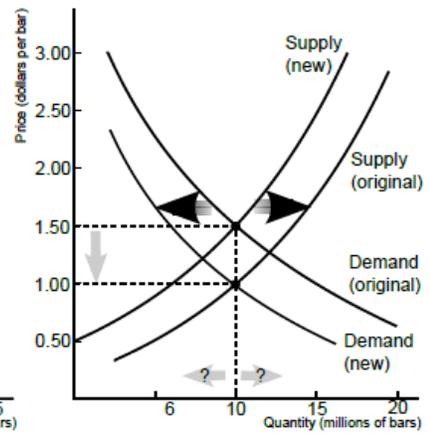
(c) Decrease in demand



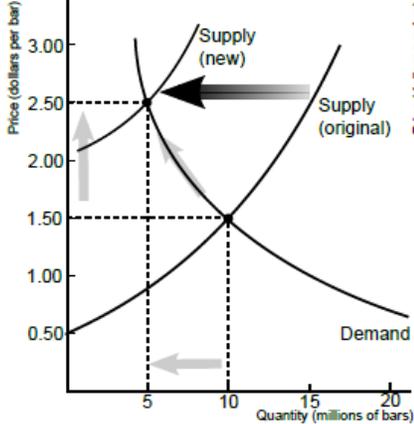
(d) Increase in supply



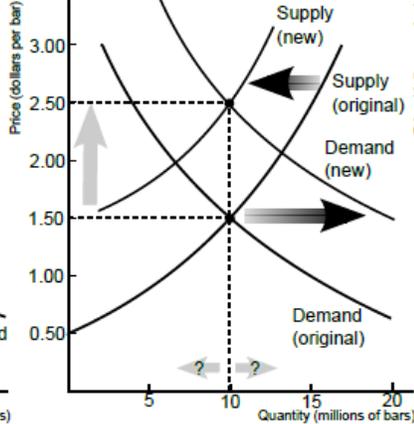
(e) Increase in both demand and supply



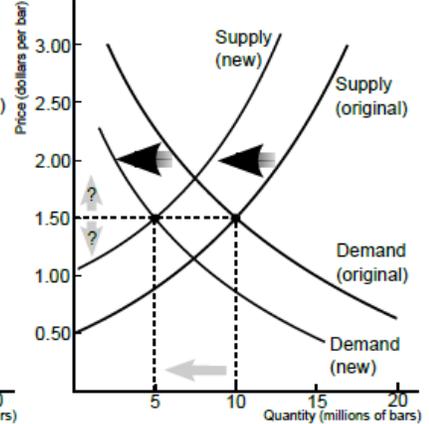
(f) Decrease in demand; increase in supply



(g) Decrease in supply



(h) Increase in demand; decrease in supply



(i) Decrease in both demand and supply

## 8. Why is price gouging not so bad

Price gouging is not as bad as people think. Suppose there is a hurricane off of Louisiana that is about to make landfall. Most individuals' first instinct is to stock up on basic necessities to either wait out the storm or to leave. If prices are regulated (i.e., a price floor is set), then there will be shortages. This is due to the incentives of both consumers and producers. If prices cannot adjust, individuals buy too much and do not leave anything for others. Suppliers also have no incentive to keep their shops open. The only way to combat a shortage is to allow the price to regulate itself.

## 9. Getting it right

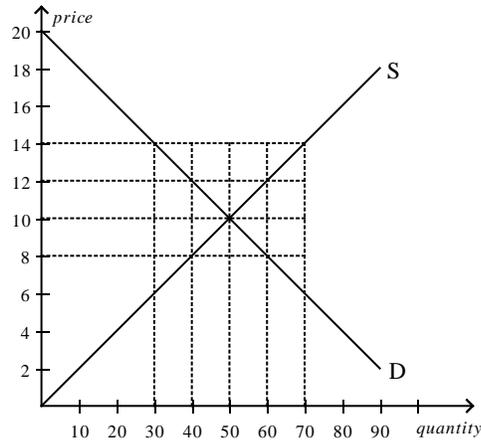
There are four steps to understanding the effects of changes in supply and demand.

1. Sketch the S & D graph and draw the initial equilibrium price and quantity.
2. Decide which curves shift.
3. Decide which way they shift.
4. Observe the change in  $P^*$  and  $Q^*$  on your graph.

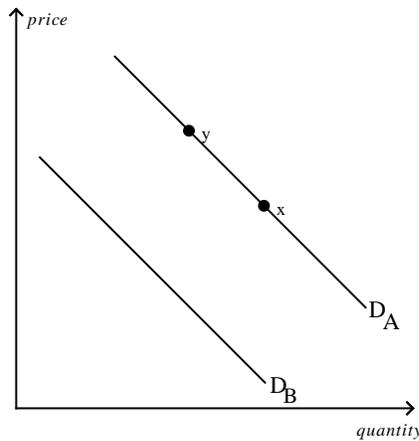
## 10. In-class exercises

1. **Refer to the table.** The demand schedule pertains to sandwiches demanded per week. Whose demand conforms to the law of demand?

Price	Charlie's $Q_D$	Maxine's $Q_D$	Quinn's $Q_D$	Market $Q_D$
\$3	3	4	3	
\$5	1	2	5	
Law of Demand?				

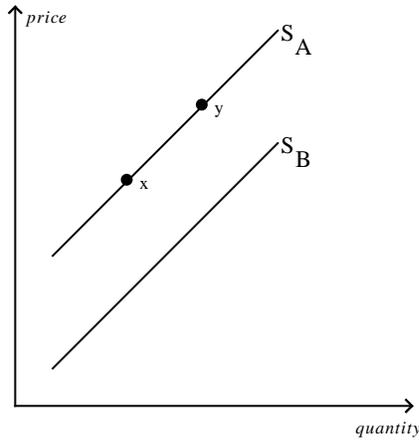


2. **Refer to the above figure.** If there is currently a shortage of 20 units of the good, then
- the law of demand predicts that the price will rise by \$2 to eliminate the shortage.
  - the law of supply predicts that the price will rise by \$2 to eliminate the shortage.
  - the laws of supply and demand predicts that the price will rise by \$2 to eliminate the shortage.
  - the law of supply and demand predicts that the price will fall by \$2 to eliminate the shortage.



3. **Refer to the above figure.** The diagram above pertains to the demand for turkey in the United States. All else equal, the destruction of thousands of turkeys would cause

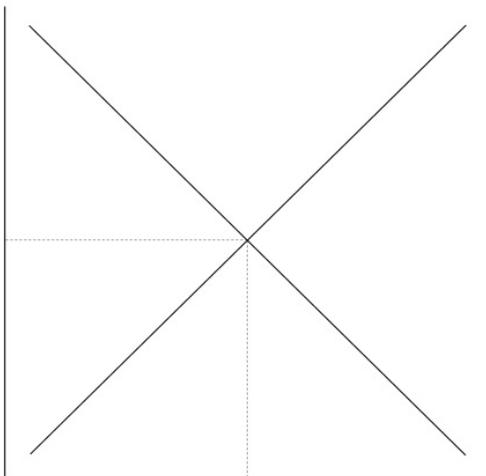
\_\_\_\_\_.



4. **Refer to the above figure.** The diagram above pertains to the supply of paper in university markets. All else equal, buyers expecting paper to be more expensive in the future would cause \_\_\_\_\_.

5. What happens to the equilibrium price and quantity of movies in DVD format if the following occur all at the same time?

- A. DVD players become more expensive.
- B. Blu-ray players become cheaper.
- C. the cost of the resources needed to manufacture DVDs falls
- D. more firms decide to manufacture DVDs



## Lecture 5: Measuring a Nation's Income

### 1. Definition of GDP

One of the most important indicators in macroeconomics is how much an economy produces. The most common measure of an economy's output is Gross Domestic Product (GDP).

**Gross Domestic Product (GDP) is the market value of domestic production of goods and services in a given time period.**

Gross: all goods and services produced are included regardless of use. For example, maintaining depreciating capital is included in GDP. Subtracting this amount off yields Net Domestic Product (NDP).

Domestic: production must take place within the country's borders (irrespective of workers' nationalities).

Product: all goods and services produced are included.

Market: Only transactions that can be tracked are included. This is a data collection issue. Much economic activity is conducted off the books, or without a receipt, which does not get recorded by the government.

Value: prices of goods and services are used to compute value.

- Price allows a way to add up value, even though price may not be a perfect measure.

Goods and services: Measures new production of goods and services.

- Leisure time is included if goods and services were produced to enjoy it.
- Used goods are excluded.
- Includes restoration of used goods, but only the value of the restoration.

Time period: Only goods produced in the time frame examined are included in GDP for that period.

What is excluded from GDP?

- Home production
  - Rises during recessions and falls during expansions (GDP overstates business cycle).
  - Quirky outcomes
    - A chef cooking at home does not increase GDP while cooking at work does.
    - A man mowing the lawn for a woman is included in GDP until he marries her.
- Illegal activities
  - Illegal drug sales are excluded.
  - Paying the neighbor kid for babysitting, mowing the lawn, or shoveling the sidewalk is excluded even though there was clearly a transaction.
- Government transfers
- Negative externalities
  - Negative externalities may even be counted as positive contributors to output. For example, locks and other security devices purchased are positive contributors to GDP.

## 2. Calculating GDP

There are three approaches to calculate GDP.

1. The production approach
2. The expenditure approach
3. The income approach.



Exercise 1: What part of the circular flow diagram is each approach capturing? Should the value of each approach be the same?

In practice, most news agencies report GDP using expenditure data.

All measures are only an approximation of economic activity during a certain time frame. While all approaches technically add up to the same value of economic activity, if substantial amounts of economic activity go unreported, then the official measures may be inaccurate, overstate, or understate the true amount of economic activity.

International Differences in the Underground Economy	
Country	Underground Economy as a Percentage of GDP
Bolivia	68
Zimbabwe	63
Peru	61
Thailand	54
Mexico	33
Argentina	29
Sweden	18
Australia	13
United Kingdom	12
Japan	11
Switzerland	9
United States	8

Source: Fredrich Schneider. Figures are for 2002

- ❖ Given that heads of states can state any measure of GDP desired, what might be a way to measure these nations' incomes?



## 2.1 The production approach

The simplest way to calculate GDP is to sum up the quantities of all goods and services produced ( $Q$ ) multiplied by their current prices ( $P$ ). This is referred to as Nominal GDP (NGDP):

$$NGDP_t = P_t^1 \times Q_t^1 + P_t^2 \times Q_t^2 + \dots + P_t^n \times Q_t^n$$

where  $t$  is the time period of production and  $n$  is the number of goods in the economy.

Exercise 2: Use the table below to 1) Find  $n$ : \_\_\_\_\_ and 2) fill in the table.

$t$	Apples		Oranges		Nominal GDP (NGDP)
	Price	Quantity	Price	Quantity	
2012	0.5	2	1	3	
2013	1	2	2	3	
2014	3	1	2	3	

Notice that prices and quantities adjust to the current year when calculating NGDP.

### 2.1.2. Comparing economic activity between years

Often economic activity is compared across years. Comparing production rates between years requires prices to remain constant across time. Thus, NGDP cannot be used for this comparison. Real GDP (RGDP) is a measure of economic activity that holds prices constant.

- RGDP rises only if an economy produces more goods and services.
- There are two ways to calculate RGDP.
  - Fixed weight: All prices are fixed to a certain year's prices called the *base year*.
  - Chain weight: All prices are fixed across time and are equal to the average prices from the beginning to the end of the comparison period.

RGDP using fixed weight production approach is calculated as

$$RGDP_t(BY) = P_{BY}^1 \times Q_t^1 + P_{BY}^2 \times Q_t^2 + \dots + P_{BY}^n \times Q_t^n$$

where  $t$  is the current year,  $BY$  is the base year, and  $n$  is the number of goods in the economy.

Exercise 3: Calculate fixed weight RGDP for each year using 2012 as the base year.

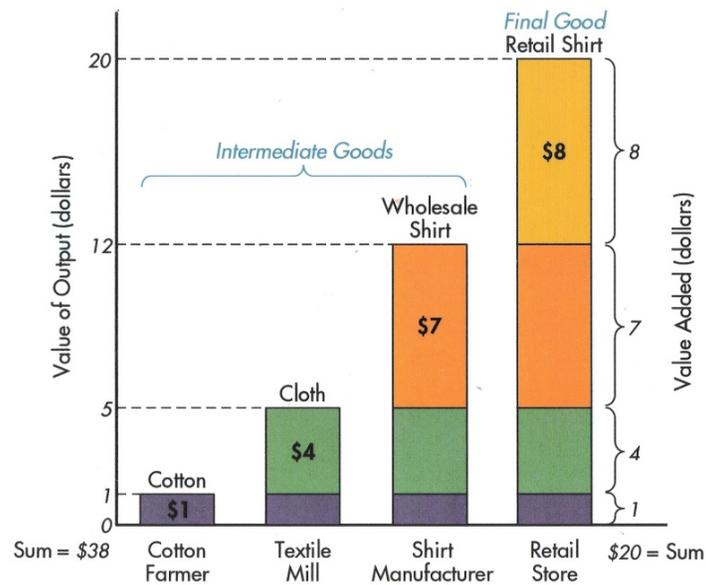
$t$	Apples		Oranges		Real GDP (RGDP)
	Price	Quantity	Price	Quantity	
2012	0.5	2	1	3	
2013	1	2	2	3	
2014	3	1	2	3	

- ❖ Why does *NGDP* rise in Exercise 2?
- ❖ Why does *RGDP* fall in 2014 in Exercise 3?

### 2.1.3. What about intermediate goods?

It may appear that the production approach may double count the value of goods if intermediate goods are used in the production of final goods. For example, an alternator for a car may be produced and sold at an auto store or sold to a car company to be put into a car. What is the value of intermediate goods and are they included in the calculation of GDP with final goods?

Summing up the value added from each production process yields the final good's price. The value added is defined as the value of the firm's finished goods minus its costs. This process is described in the following graph.



Exercise 4: What is the final price of the shirt? What is the sum of the values added from all production processes to construct the shirt?

**The rule of thumb is if the intermediate good is used in the production of a final good, then only the value of the final good is included in the calculation of GDP.**

## 2.2. The expenditure approach

The expenditure approach to calculating RGDP includes both measures of economic activity and the allocation of output. This approach is very similar to the production approach with the addition of categorizing each transaction in terms of its allocation between consumers, business, governments, and foreigners.

RGDP (Labelled as  $Y$ ) in period  $t$  using the expenditure approach is calculated as

$$Y_t = C_t + I_t + G_t + NX_t, \quad NX_t = EX_t - IM_t$$

Personal Consumption ( $C$ ): Personal consumption measures all expenditures of durable goods, nondurable goods, and services.

- Durable goods do not quickly wear out or are ones that yield utility over time. Examples of consumer durable goods include cars, appliances, electronic equipment, home furnishings and fixtures, housewares and accessories, photographic equipment, recreational goods, sporting goods, toys and games. Each existing home is valued and provided with a rental value regardless of ownership.
- Nondurable goods (consumables) are the opposite of durable goods. They may be defined either as goods that are used up when consumed once, or that have a lifespan of less than 3 years. Examples of nondurable goods include fast-moving consumer goods such as cosmetics and cleaning products, food, fuel, office supplies, packaging and containers, paper and paper products, personal products, rubber, plastics, textiles, clothing and footwear.

Gross private investment ( $I$ ): Gross private investment includes purchases of capital equipment, inventories, and structures (including new residential structures). Examples include construction of a new mine, purchase of software, or purchase of machinery and equipment for a factory.

- In contrast to its colloquial meaning, *Investment* in GDP does not mean purchases of financial products. Buying financial products is classified as *savings*.
- In the above formula for GDP, if net investment (which is gross investment minus depreciation) is substituted for gross investment, then NDP is obtained.
- Research and development activity is the sum of its production or input costs.

Government purchases ( $G$ ): Government spending is the sum of government expenditures on final goods and services. It includes salaries of public servants, purchase of weapons for the military, and any investment expenditure by a government.

- It does not include any transfer payments, such as social security or unemployment benefits.

Net exports ( $NX = EX - IM$ ): Net exports is exports ( $EX$ ) minus imports ( $IM$ ). GDP captures the amount a country produces, including goods and services produced for other nations' consumption. Imports are subtracted from GDP to null out their value since they will already be included in C, I, or G when an import is purchased.

GDP (Expenditure Approach), 2016

Item	Amount in 2016 (billions of dollars)	Percentage of GDP
<b>Consumption</b>	<b>\$12,695.10</b>	<b>68.86%</b>
Durable goods	\$1,390.40	
Nondurable goods	\$2,695.60	
Services	\$8,609.00	
<b>Investment</b>	<b>\$2,973.60</b>	<b>16.13%</b>
Business fixed investment	\$2,294.00	
Residential construction	\$698.20	
Change in business inventories	-\$18.60	
<b>Government Purchases</b>	<b>\$3,263.40</b>	<b>17.70%</b>
Federal	\$1,239.20	
State and local	\$2,024.10	
<b>Net Exports</b>	<b>-\$495.50</b>	<b>-2.69%</b>
Exports	\$2,206.80	
Imports	\$2,702.30	
<b>Total GDP</b>	<b>\$18,436.50</b>	<b>100%</b>

Source: U.S. Department of Commerce, Bureau of Economic Analysis

Exercise 5: The following transactions occurred in the United States during the past calendar year. Categorize each item and identify its contribution to GDP.

- Delta purchases an airplane built in Canada for \$90 M.

Circle if included:    C    I    G    EX    IM                      Value to GDP: \_\_\_\_\_

- IBM builds 10,000 new computers valued at \$700 each. At the end of the year, the computers are not sold and placed in inventory.

Circle if included:    C    I    G    EX    IM                      Value to GDP: \_\_\_\_\_

- Government pays \$45 M to a U.S. based company, Northrop Grumman, for a new missile carrier.

Circle if included:    C    I    G    EX    IM                      Value to GDP: \_\_\_\_\_

- You purchase a ticket to a concert in Denver, CO for \$100.

Circle if included:    C    I    G    EX    IM                      Value to GDP: \_\_\_\_\_

- You purchase a new Audi car for \$40 K manufactured in Germany.

Circle if included:    C    I    G    EX    IM                      Value to GDP: \_\_\_\_\_

- Government pays \$100 M to war veterans.

Circle if included:    C    I    G    EX    IM                      Value to GDP: \_\_\_\_\_

### 2.3. The income approach

Another way of measuring GDP is to measure total income. If GDP is calculated this way it is sometimes called *Gross Domestic Income* (GDI), or GDP(I). GDI should provide the same measure as the expenditure method described above. In practice, however, measurement error will make the two figures slightly different when reported by national statistical agencies.

Using the income approach, GDP is calculated as follows:

$$Y_t = Inc_t + Dep_t + T_t + NFP_t$$

**Income (Inc):** Income measures the total amount of labor income (e.g., wages, salaries, benefits) and capital income (e.g., dividends, interest, rent, profits).

**Depreciation (Dep):** Depreciation is the decrease in the economic value of the capital stock either through physical depreciation, obsolescence or changes in the demand for the services of the capital in question. Depreciation is added because the replacement of physical capital that has undergone wear and tear over time is not included in national income.

**Indirect business taxes (T):** Indirect business taxes are taxes that can be shifted to others. Examples include sales tax, customs, licensing fees, and subsidies that consumers bare through higher prices. Taxes are subtracted and subsidies are added into GDI.

**Net factor payments (NFP):** is the returns received on factors of production: rent is return on land, wages on labor, interest on capital, and profit on entrepreneurship. NFP equals the payments to domestically owned factors located abroad minus payments to foreign factors located domestically.

#### GDI or GDP (income approach), 2016

<b>Item</b>	<b>Amount (billions of dollars)</b>	<b>Percentage of GDP</b>
Compensation of employees	10,016.80	54.3%
Net interest	673.3	3.7%
Rental income	702.4	3.8%
Corporate profits	1,612.90	8.7%
Proprietors' income	1,410.70	7.7%
Indirect taxes less subsidies	1,201.80	6.5%
Depreciation	3,042.80	16.5%
<b>GDP (income approach)</b>	<b>18,660.70</b>	<b>101.2%</b>
Statistical discrepancy	-224.2	-1.2%
<b>GDP (expenditure approach)</b>	<b>18,436.50</b>	<b>100.0%</b>

Source: U.S. Department of Commerce, Bureau of Economic Analysis

## 2.4 Comparing the measures of GDP

All measures of GDP equal each other in theory, they simply take different approaches to calculating the value of all goods and services being produced.

Exercise 6: What is GDP using the expenditure, income approach, and production approaches?

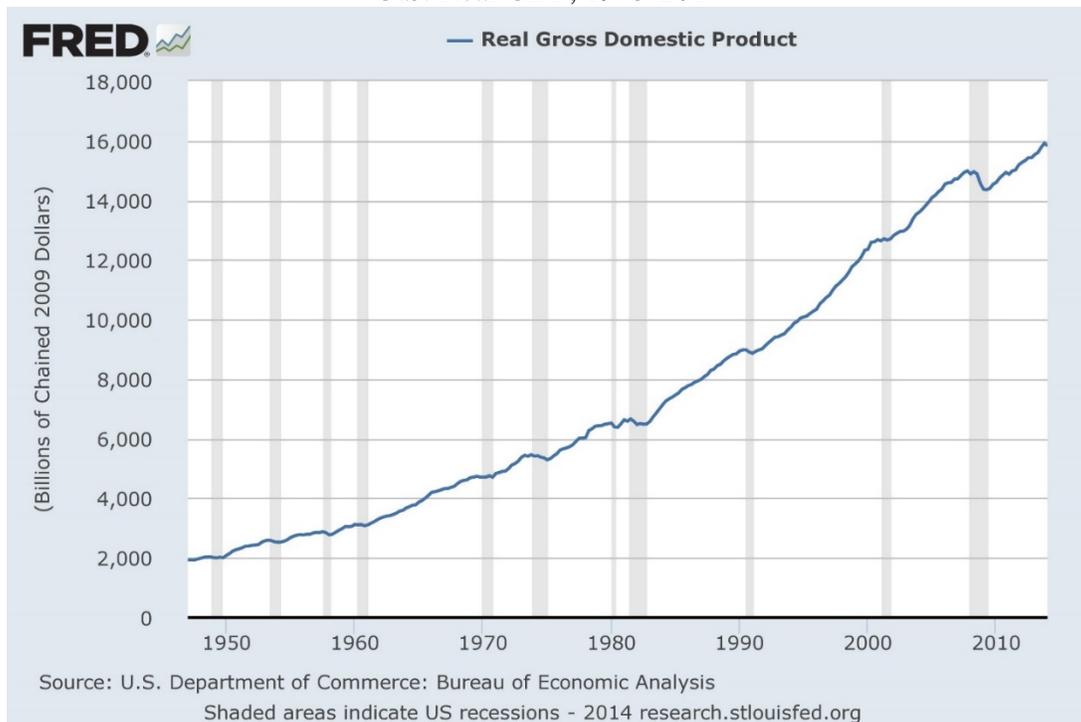
	<b>American Ore, Inc.</b>	<b>American Steel, Inc.</b>	<b>American Motors, Inc.</b>	<b>Total Factor Income</b>
<b>Value of sales</b>	<b>\$ 4,200</b>	<b>\$ 9,000</b>	<b>\$ 21,500</b>	
<b>Intermediate goods</b>	\$ -	\$ 4,200	\$ 9,000	
<b>Wages</b>	\$ 2,000	\$ 3,700	\$ 10,000	<b>\$ 15,700</b>
<b>Interest Payments</b>	\$ 1,000	\$ 600	\$ 1,000	<b>\$ 2,600</b>
<b>Rent</b>	\$ 200	\$ 300	\$ 500	<b>\$ 1,000</b>
<b>Profit</b>	\$ 1,000	\$ 200	\$ 1,000	<b>\$ 2,200</b>
<b>Total Expenditures by firm</b>	<b>\$ 4,200</b>	<b>\$ 9,000</b>	<b>\$ 21,500</b>	
<b>Value added per firm</b>	<b>\$ 4,200</b>	<b>\$ 4,800</b>	<b>\$ 12,500</b>	

GDP (Production Approach) =

GDP (Expenditure Approach) =

GDP (Income Approach) =

## U.S. Real GDP, 1945-2014



- Real GDP grows over time (partly due to population growth)
- Increases by about 3.2% per year.
- Growth is not steady.
- Business cycle causes periods of reduced output while other periods above trend output.

### 2.5. GDP vs. GNP

The U.S. Department of Commerce also computes other various measure of income to get a more complete picture of what is happening in the economy. One of these is Gross National Product (*GNP*) which is the total value of goods and services produced by all nationals of a country (whether within or outside the country). For example, when a U.S. national is working abroad in France, his (or her) production is included in U.S. GNP but not U.S. GDP. Using the income approach, GNP is equal to GDP plus total capital gains from overseas investment minus income earned by foreign nationals domestically.

### 3. GDP per capita as a measure of well being

Because population sizes differ, it is important to take this into consideration when comparing countries. This is done by calculating RGDP per capita ( $RGDPP_t$ ):

$$RGDPP_t = \frac{RGDP_t}{Population_t}$$

where  $Population_t$  is the population for an economy at time  $t$ .

Exercise 7: The information below was reported by the World Bank in 2013. Using this information, what is the correct ordering of RGDP per person (in USDs) from highest to lowest?

Country	Real GDP	Population	RGDP per person	Rank
Japan	\$4,901,530 M	127.1 M		
Switzerland	\$650,782 M	8.1 M		
United States	\$16,800,000 M	320.1 M		

- What is still wrong with this type of analysis?

Suppose that converting U.S. dollars and buying goods and services in Switzerland results in 40% less goods can be purchased, while in Japan 20% less goods can be purchased. Calculate RGDP per capita in purchasing power parity (PPP).

Country	PPP	RGDP per person (PPP)	Rank
Japan	.2		
Switzerland	.4		
United States	1		

RGDPP is often used as such an indicator of standard of living between countries because citizens tend to benefit from their country's increased economic production. However, RGDPP is not an official measure of the standard of living in an economy.

- The major advantage of RGDP per capita as an indicator of standard of living is that it is measured frequently, widely, and consistently across all countries.
  - All other things being equal, the standard of living tends to increase when RGDP per capita increases. As such, RGDP per capita can be a proxy for the standard of living, rather than a direct measure.
- The major disadvantage is that it is not an exact measure of standard of living.
  - GDP is intended to be a measure of particular types of economic activity within a particular country. Nothing about the definition of GDP suggests it is necessarily a measure of standard of living.

### GDP and basic indicators of well-being

Indicator	Least developed countries	Developing countries	Developed countries
GDP per person (U.S. dollars)	1,307	4,054	29,000
Life expectancy at birth (years)	50.6	64.6	78.3
Under-5 mortality rate (per 1,000 live births)	157	89	7
Births attended by skilled health personnel (%)	33	55	99
Prevalence of HIV/Aids (% in 15-49 age group)	3.4	1.2	0.3
Undernourished people (%)	37	17	Negligible
Combined gross enrollment rate for primary, secondary, and tertiary schools (%)	43	60	93
Adult literacy rate (%)	52.5	76.7	99
Total population in group of countries (millions)	700.9	4,936.90	911.6

Source: United Nations, Human Development Report, 2004 and World Bank, WDR 1998/99. All data are for 2002, except births attended by skilled health personnel (1995-2002), prevalence of HIV/AIDS (2003), and undernourished people (1999-2001). GDP data are adjusted for purchasing power parity.

## RGDP per capita and measures of wellbeing

Country	Real GDP per person (2011 dollars)	Life Expectancy (years)	Adult Literacy (% of population)	Internet Usage (% of population)
United States	50,859	79	99	81
Germany	41,966	81	99	84
Japan	35,006	84	99	79
Russia	23,184	68	99	53
Mexico	16,144	78	93.5	38
Brazil	14,301	74	90	50
China	10,771	75	95	42
Indonesia	8,856	71	93	15
India	5,050	67	66	13
Pakistan	4,360	67	55	10

Source: Human Development Report, United Nations. Data on real GDP is from 2012, life expectancy from 2013, and literacy from 2012. Data on Internet use is for 2012.

### **Notice that RGDP per capita does not perfectly correlate with measures of wellbeing.**

Exercise 8: In which ways is RGDPP a measure and not a measure of wellbeing?

## 4. Conclusion

Simon Kuznets, the creator of GDP, in his very first report to the U.S. Congress in 1934 said:

*“...the welfare of a nation can, therefore, scarcely be inferred from a measure of national income...”*

Senator Robert Kennedy gave the following critique of GDP in 1968:

*“[Gross Domestic Product] does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. It measures neither our courage, nor our wisdom, nor our devotion to our country. It measures everything, in short, except that which makes life worthwhile, and it can tell us everything about America except why we are proud that we are Americans.”*

## 5. In-class Exercises

1. Suppose an apartment complex converts to a condominium so that the former renters are now owners of their housing units. Suppose further that a current estimate of the value of the condominium owners' housing services is the same as the rent they previously paid.

What happens to GDP as a result of this conversion?

2. Which of the following transactions adds to U.S. GDP for 2006?
  - a. In 2006, Ashley sells a car that she bought in 2002 for \$6,000 to William for \$5,000.
  - b. An American management consultant works in Mexico during the summer of 2006 and earns the equivalent of \$30,000 during that time.
  - c. When John and Jennifer were both single, they lived in separate condos and each paid \$750 per month. They got married in 2006, rented out their condos for the same amount, and bought a new house for \$250,000. Their mortgage is \$1,500 per month.

3. One day, Barry the Barber, Inc. collects \$400 for haircuts. Over this day, his equipment depreciates in value by \$50. Of the remaining \$350, Barry sends \$30 to the government in sales taxes, takes home \$220 in wages, and retains \$100 in his business to add new equipment in the future. From the \$220 that Barry takes home, he pays \$70 in income taxes.

Based on this information, compute Barry's contribution to the following measures of income.

a. Gross Domestic Product (GDP) =

b. Net Domestic Product (NDP) =

c. National Income (NI) =

d. Personal Income (PI) =

e. Disposable Personal Income (DPI) =

4. Calculate the nominal GDP and real GDP using fixed weights with year 2012 as the base year using the following data:

Year	Pucks		Root Beer		Back rubs	
	Price	Quantity	Price	Quantity	Price	Quantity
2011	5	100	20	300	20	100
2012	7	125	20	250	25	110
2013	9	150	20	250	30	120

Year	Nominal GDP	Real GDP
2011		
2012		
2013		

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## Lecture 6: Growth (CORRESPONDS WITH CHAPTER 7)

### 1. Introduction to economic growth

In this lecture we will discuss the topic of economic growth within and between countries, the consequences of growth, and the factors that determine growth. The study of the determinants of growth is one of the most important topics of all of macroeconomics due to the direct impact on economic wellbeing. For many researchers and countries it is quite the elusive quest.

The growth rate is defined as the percentage change of an economy's real GDP per person from one year to the next. Growth rates somewhat capture living standards. Long-run economic growth is the process by which rising productivity increases the average standard of living over time. Growth rates reveal *whether* and how *fast* a society is able to live better than previous generations.

#### 1.1. Why growth matters

The growth rate of economies matters due to the compounding effect over time (similar to the concept of compound interest on deposits in a bank account). Even small differences in growth rates can make very big difference in the long-run.

Country	Real GDP per capita, 1946	Growth Rate	Growth	Real GDP per capita, 2000
France	\$ 5,921	2.8%	$1.028^{54} = 4.4$	\$ 26,289
Argentina	\$ 6,942	0.8%	$1.008^{54} = 1.5$	\$ 10,674

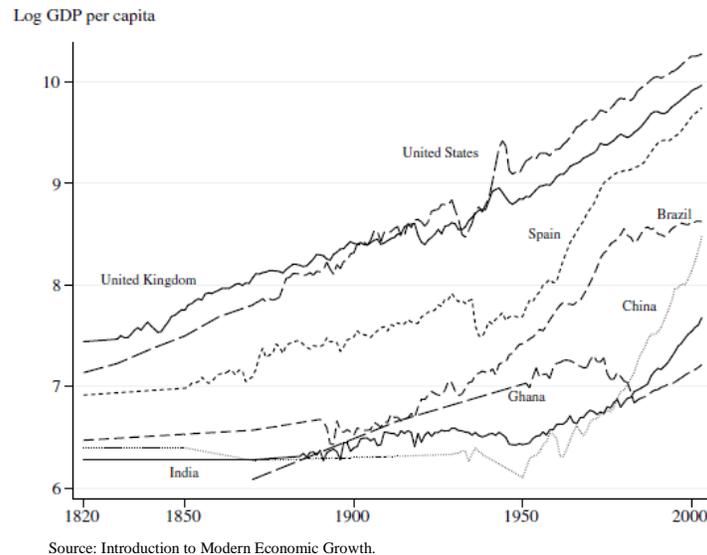
Note: Calculations use  $Income_{FY} = Income_{CY} \times (1 + x)^{(FY-CY)}$

- ❖ There is a large gap between countries. When did the standard of living gap originate?

Prior to the Industrial Revolution, there was very limited economic growth. While certain civilizations, including ancient Greece, Rome, China, and Venice, managed to grow, their growth was either not sustained or progressed only at a slow pace.

The graph on the next page helps unravel when the gap in income between countries originated. Notice that small differences in growth rates sustained over a long time can make a big difference. Much of the income gap is identified during the late 19<sup>th</sup> - early 20<sup>th</sup> century.

## Evolution of Income Per Capita for Various Countries



### 1.1.1 What causes growth?

- The elusive quest for growth in many countries remains.
  - More correlation than causation in factors associated with growth.
  - Many policies that developed nations provide to lesser developed nations are ill-advised and have done harm to the growth of these nations.
- ❖ How many of you will buy a soccer ball knowing that it was made by a child in a least developed country (LDC)?

## 1.2. Calculating growth rates

Assuming population growth is constant, it is possible to determine the growth rate of an economy by using changes in Real GDP over time. Similar to issues of calculating Real GDP, there are two ways to calculate growth rates: 1) using the fixed weight approach and 2) using the chain weight approach.

### 1.2.1. Calculating growth rates using the fixed weight approach

To calculate a fixed weight growth rate between the current year and last year, use the percentage change in Real GDP from one year to the next:

$$g(RGDP_t) = \left( \frac{RGDP_t}{RGDP_{t-1}} - 1 \right) \times 100$$

A recession is defined as negative real GDP growth for two consecutive quarters.

Exercise 1: Calculate  $RGDP$  for all years using base year 2012.

$t$	Apples		Oranges		$RGDP^{BY=2012}$
	Price	Quantity	Price	Quantity	
2012	0.5	2	1	3	
2013	2	4	2	3	
2014	3	6	2	3	

Exercise 2: Calculate  $g(RGDP)$  between 2012 and 2013 from Exercise 1.

There is a technical difficulty with using this measure of growth: the growth rates differ depending on the base year. Thus, we are unable to gauge the true growth rate of an economy. This same technical difficulty arises with measuring the cost of living using the CPI fixed basket.

- Difficult to justify which base year to use.
- Structural changes in the economy make it difficult to use prices from a certain year as weights for goods in other years.

Exercise 3: Calculate  $RGDP$  for all years using base years 2013.

$t$	Apples		Oranges		$RGDP^{BY=2013}$
	Price	Quantity	Price	Quantity	
2012	0.5	2	1	3	
2013	2	4	2	3	
2014	3	6	2	3	

Exercise 4: Calculate  $g(RGDP)$  between 2012 and 2013 from Exercise 3.

Exercise 5: Calculate  $RGDP$  for all years using base years 2014.

$t$	Apples		Oranges		$RGDP^{BY=2014}$
	Price	Quantity	Price	Quantity	
2012	0.5	2	1	3	
2013	2	4	2	3	
2014	3	6	2	3	

Exercise 6: Calculate  $g(RGDP)$  between 2012 and 2013 from Exercise 5.

- ❖ Shouldn't these growth rates be the same?

### 1.2.2. Calculating growth rates using the chain-weight approach

Calculating  $g(RGDP)$  using the chain weight approach corrects the bias from using a particular year's prices. The chain weight approach is a two-step process:

1. Calculate the fixed weight growth rates for a given year using different base years.
2. Calculate the geometric average:

$$g(RGDP_t^{CW}) = (g_t^{BY_1} \times g_t^{BY_2} \times \dots \times g_t^{BY_m})^{1/m}$$

where  $g_t^{BY_j}$  is the fixed weight Real GDP growth rate between years  $t$  and  $t-1$  for base year  $j$  and  $m$  is the number of fixed weight growth rates.

Exercise 7: Use Exercises 2, 4, and 6 to 1) Find  $m$ : \_\_\_\_\_ and 2) Calculate  $g(Real\ GDP^{CW})$  between 2012 and 2013.

- The chain weight Real GDP growth rate provides a stable estimate of growth.
- Can compare growth rates across time and across countries.

### 1.2.3. Calculating chain weight RGDP

Once RGDP growth rates are calculated using the chain weight approach, chain weight RGDP can be calculated for every year. To do so, a base year is selected in which, by definition, Real GDP = Nominal GDP. The base year acts as an anchor in the sense that all other year's RGDP are a multiplicative factor of it. In other words,

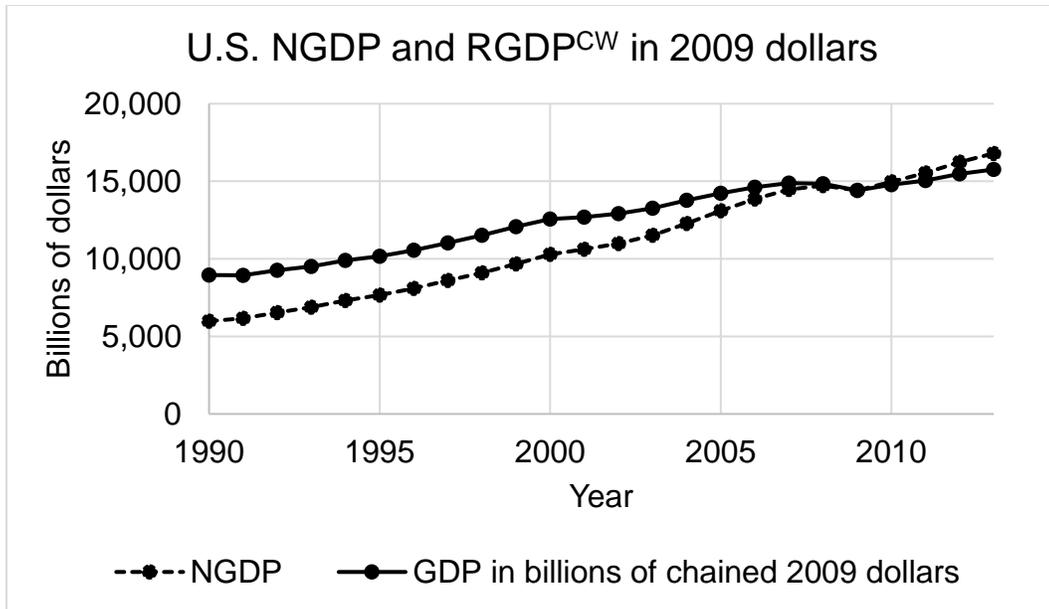
$$RGDP_t = RGDP_{t-1} \times (1 + g(RGDP_t^{CW}))$$

Exercise 8: Using the following chain weight Real GDP growth rates, compute Real GDP for the following years if the base year is 2009 and nominal GDP in 2009 is 125.

Year	$g(RGDP^{CW})$	$RGDP^{CW}$
2007		
	8%	
2008		
	7%	
2009		
	8%	
2010		
	6%	
2011		
	7%	
2012		

Nominal and Real U.S. GDP							
Year	NGDP	RGDP <sup>CW</sup>	$g(RGDP^{CW})$	Year	NGDP	RGDP <sup>CW</sup>	$g(RGDP^{CW})$
1929	\$ 105	\$ 1,056		1972	\$ 1,282	\$ 5,129	5.2%
1930	\$ 92	\$ 966	-8.5%	1973	\$ 1,429	\$ 5,418	5.6%
1931	\$ 77	\$ 904	-6.4%	1974	\$ 1,549	\$ 5,390	-0.5%
1932	\$ 60	\$ 788	-12.9%	1975	\$ 1,689	\$ 5,380	-0.2%
1933	\$ 57	\$ 778	-1.3%	1976	\$ 1,878	\$ 5,669	5.4%
1934	\$ 67	\$ 861	10.8%	1977	\$ 2,086	\$ 5,931	4.6%
1935	\$ 74	\$ 938	8.9%	1978	\$ 2,357	\$ 6,260	5.6%
1936	\$ 85	\$ 1,060	12.9%	1979	\$ 2,632	\$ 6,459	3.2%
.				.			
.				.			
.				.			
1953	\$ 390	\$ 2,569	4.7%	1996	\$ 8,100	\$ 10,550	3.8%
1954	\$ 391	\$ 2,554	-0.6%	1997	\$ 8,609	\$ 11,023	4.5%
1955	\$ 426	\$ 2,736	7.1%	1998	\$ 9,089	\$ 11,513	4.4%
1956	\$ 450	\$ 2,795	2.1%	1999	\$ 9,666	\$ 12,071	4.8%
1957	\$ 475	\$ 2,854	2.1%	2000	\$ 10,290	\$ 12,565	4.1%
1958	\$ 482	\$ 2,833	-0.7%	2001	\$ 10,625	\$ 12,684	0.9%
1959	\$ 523	\$ 3,028	6.9%	2002	\$ 10,980	\$ 12,910	1.8%
1960	\$ 543	\$ 3,106	2.6%	2003	\$ 11,512	\$ 13,270	2.8%
1961	\$ 563	\$ 3,185	2.6%	2004	\$ 12,277	\$ 13,774	3.8%
1962	\$ 605	\$ 3,380	6.1%	2005	\$ 13,095	\$ 14,236	3.4%
1963	\$ 639	\$ 3,527	4.4%	2006	\$ 13,858	\$ 14,615	2.7%
1964	\$ 686	\$ 3,731	5.8%	2007	\$ 14,480	\$ 14,877	1.8%
1965	\$ 744	\$ 3,973	6.5%	2008	\$ 14,720	\$ 14,834	-0.3%
1966	\$ 815	\$ 4,235	6.6%	<b>2009</b>	<b>\$ 14,418</b>	<b>\$ 14,418</b>	-2.8%
1967	\$ 862	\$ 4,351	2.7%	2010	\$ 14,958	\$ 14,779	2.5%
1968	\$ 943	\$ 4,565	4.9%	2011	\$ 15,534	\$ 15,052	1.8%
1969	\$ 1,020	\$ 4,708	3.1%	2012	\$ 16,245	\$ 15,471	2.8%
1970	\$ 1,076	\$ 4,718	0.2%	2013	\$ 16,798	\$ 15,759	1.9%
1971	\$ 1,168	\$ 4,873	3.3%				

Notes: GDP and chain weight GDP are in trillions. Updated: Feb 28, 2014. Not adjusted for population growth. In billions of dollars.



❖ Why is RGDP less than NGDP after 2009?

#### 1.2.4. Real GDP per capita

The above analysis assumed that population growth is constant. One concern is that increasing RGDP growth does not necessarily mean the standard of living has gone up. It could be that population has increased. To address this issues, the growth rate in population is subtracted off:

$$g(RGDPP_t) = g(RGDP_t) - g(\text{Population}_t)$$

and

$$g(RGDP_t) = g(NGDP_t) - g(\text{Prices}_t)$$

where  $g(\text{Prices}_t)$  is a measure of inflation such as the percentage change in the CPI or GDP deflator.

- Per capita is another way of saying per person.
- Tells how fast output per person is rising in a country.
- Growth in RGDPP abstracts from differences in purchasing power between countries because the level of income is not analyzed, rather the growth in incomes.

Exercise 9: Last year a country had *NGDP* of \$27.0 billion, and this year it had *NGDP* of \$31.5 billion. Over the last year, the population increased from 45 million to 50 million people and prices grew by 2.5%. Calculate growth in *RGDPP*.

## 2. Historical and worldwide comparison of growth

As observed in section 1.1., growth rates can have a tremendous effect on the standard of living in an economy.

### 2.1. A U.S. historical comparison

In 1904 in the United States:

- Life expectancy was 47 years
- 14% of homes had bathtubs
- 8% of homes had telephones
- 95% of births were at home
- 10% of physicians had college degrees
- Pneumonia (flu), TB, diarrhea, heart disease, and strokes were the leading causes of death
- 20% of the adult population was illiterate.

Source: Tyler Cowen (marginalrevolution.com)

#### ❖ Who would like to live back in simple life?

Food items, in minutes of work		
	1919	1997
Tomatoes, 3 lbs.	101	18
Eggs, 1 dozen	80	5
Sugar, 5 lbs.	72	10
Bacon, 1 lb.	70	12
Oranges, 1 dozen	68	9
Coffee, 1 lb.	55	17
Milk, half-gallon	39	7
Ground beef, 1 lb.	30	6
Lettuce, 1 lb.	17	3
Beans, 1 lb.	16	3
Bread, 1 lb.	13	4

Source: Federal Reserve Bank of Dallas, Time Well Spent: The Declining Real Cost of Living in America

New house amenities		
Percentage of new houses equipped with...		
	1956	1996
Garage	50	86
Three or more bedrooms	78	87
Two or more bathrooms	28	91
One or more fireplaces	35	62
Two stories or more	6	47
Insulation in the walls	33	93
Storm windows	8	68
Central heat and air	6	81
Range	1	94
Dishwasher	11	93
Refrigerator	5	18
Microwave	0	85
Garbage disposal	34	90
Garage door opener	<1	78
Median square footage	1,150	1,950
Hours of work per sq. ft.	6.5	5.6

Source: Federal Reserve Bank of Dallas, Time Well Spent: The Declining Real Cost of Living in America

## 2.2. Worldwide comparison

The table below provides a snapshot of where various economies around the world were in 1890-1900 and then about a 100 years later.

Growth Experienced Around the World				
Country	Period	Real GDP per Person at Beginning of Period (\$)	Real GDP per person at End of Period (\$)	Growth Rate (per year)
Japan	1890-2008	1,504	35,220	2.71%
Brazil	1900-2008	779	10,070	2.40%
Mexico	1900-2008	1,159	14,270	2.35%
Germany	1870-2008	2,184	35,940	2.05%
Canada	1870-2008	2,375	36,220	1.99%
China	1900-2008	716	6,020	1.99%
United States	1870-2008	4,007	46,970	1.80%
Argentina	1900-2008	2,293	14,020	1.69%
United Kingdom	1870-2008	4,808	36,130	1.47%
India	1900-2008	675	2,960	1.38%
Indonesia	1900-2008	891	3,830	1.36%
Pakistan	1900-2008	737	2,700	1.21%
Bangladesh	1900-2008	623	1,440	0.78%

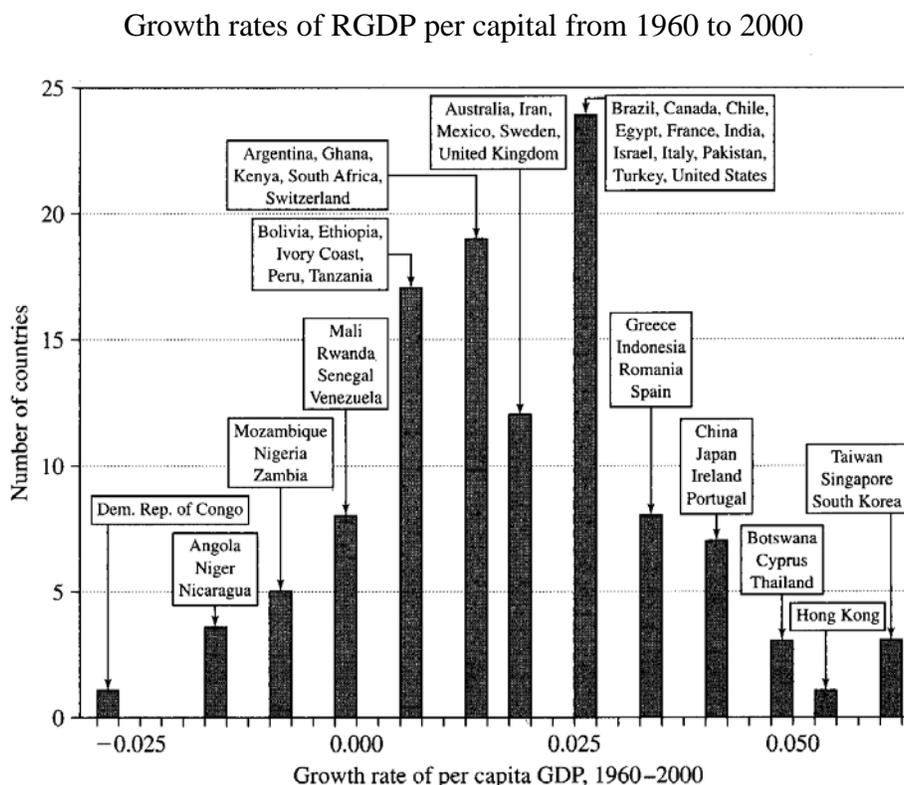
In 2008 dollars.

Source: Robert J. Barro and Xavier Sala-i-Martin, *Economic Growth*, tables 10.2 and 10.3; World Development Report 2010, Table 1.

- Small differences in growth rates can lead to large differences in growth experienced over time.
  - Brazil and China are both examples of how high growth can accelerate an economy.
  - United Kingdom and Argentina are both examples of how low growth can inhibit an economy.

The figure below displays a histogram of average annual real per capita GDP growth rates between 1960 and 2000 for 112 countries; the average is 1.8% per year and the range is -3.2% to 6.4%.

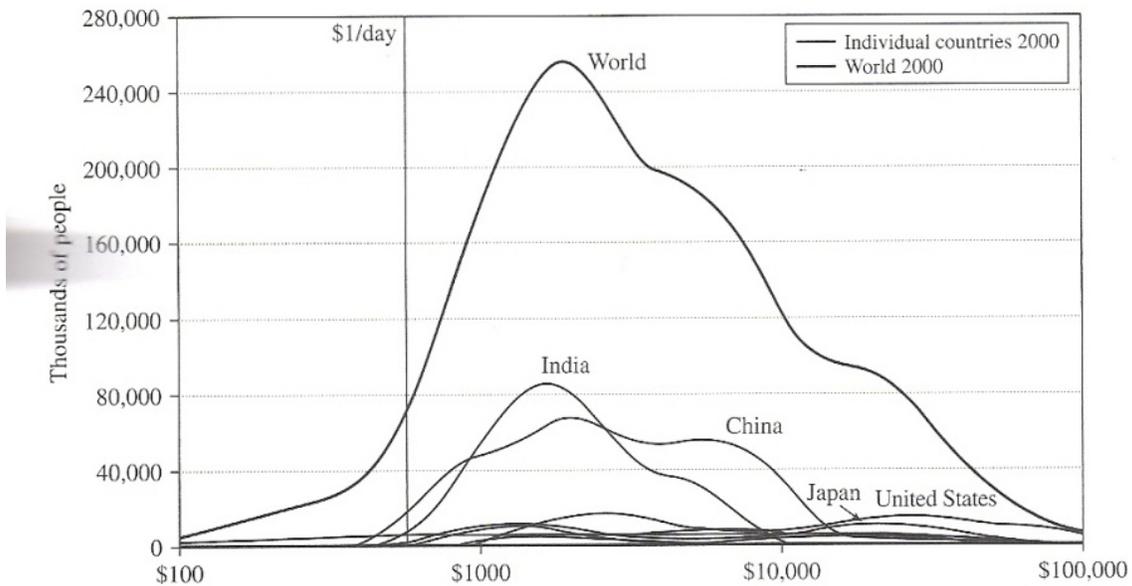
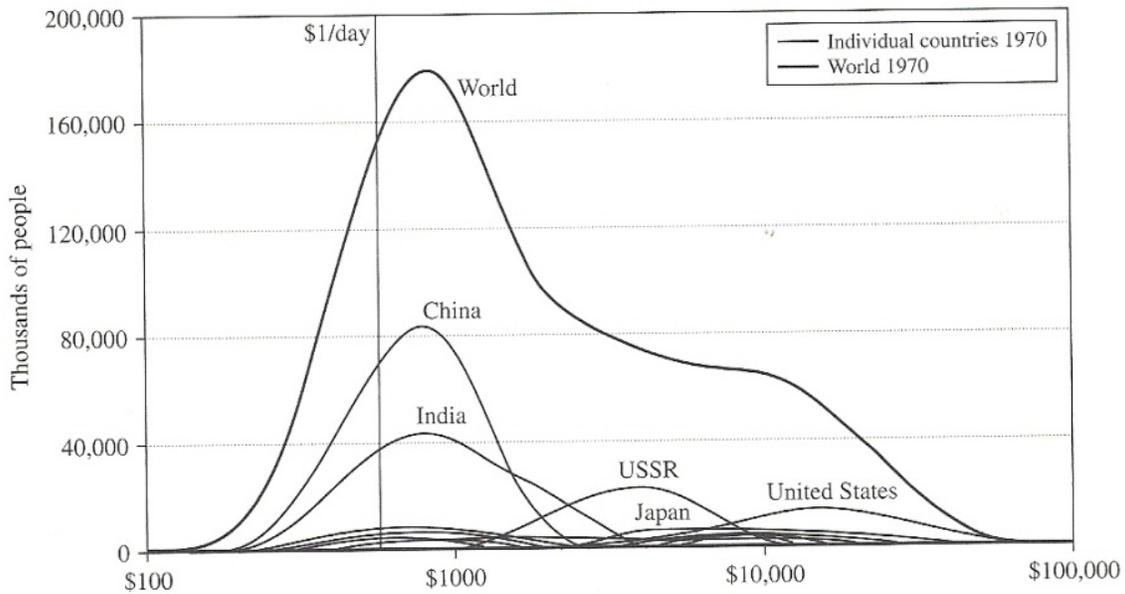
- Many countries have increased their levels of per capita GDP by a multiple of 7 in just 40 years.
- 12 countries sustained negative economic growth; other than Nicaragua and Venezuela, all of these are comprised of sub-Saharan African countries.



Source: Daron Acemoglu, Introduction to Modern Economic Growth (New Jersey: Princeton, 2009)

- The main question that comes out of this comparison is: Why do some countries zoom ahead (e.g., United States, Japan, Canada) while others fall behind (e.g., United Kingdom, Argentina)?
  - This question has been the quest of many economists and policymakers for a very long time.

We now turn to how growth affects incomes over time. The two figures below plot the number of people at each level of income (on a logarithmic scale) for 1970 and 2000, respectively.



Source: Daron Acemoglu, Introduction to Modern Economic Growth (New Jersey: Princeton, 2009)

There are two important facts that are revealed from these graphs:

- Incomes are rising in almost every country while the number of people in poverty has fallen.
- Incomes are more unequal now than they were in the past.

❖ **Are rising incomes bad if it creates larger inequality?**

It should be recognized that the poor are getting richer, just not at the same rate as the rich.

Economic growth is generally good for welfare but often creates winners and losers. Joseph Schumpeter's 'creative destruction' emphasizes this aspect of economic growth; productive relationships, firms, and sometimes individual livelihoods will be destroyed by the process of economic growth, because growth is brought about by the introduction of new technologies and creation of new firms, replacing existing firms and technologies.

Most evidence on the industrial revolution suggests that the living standard of the majority of workers may have fallen or at least remained stagnant. This may shed light on why certain segments of the population favor policies and institutions that do not encourage growth.

Rising income inequality does not imply the poor are getting poorer! Baumol's disease may actually be a benefit to society more than a cost.

❖ **Should we care about cross-country differences? What is the big deal if one country produces more than another?**

### 2.3. Rich Nation / Poor Nation

Below are descriptions of 5 nations from the World Development Indicators in 2012: Argentina, Japan, Nigeria, Russia, and Singapore. Match each nation to its description.

#### Exercise 10

Country 1: \_\_\_\_\_

Population 5,312,000  
 Per capita GDP \$54,007.30  
 Life expectancy 82.14 years  
 Literacy rate 95.9%  
 Infant mortality 2/1000  
 Resources Fish and ports

Country 4: \_\_\_\_\_

Population 173,600,000  
 Per capita GDP \$2,742.22  
 Life expectancy 52.11 years  
 Literacy rate 61.3%  
 Infant mortality 74/1000  
 Resources Petroleum and minerals

Country 2: \_\_\_\_\_

Population 41,090,000  
 Per capita GDP \$14,679.93  
 Life expectancy 76.01 years  
 Literacy rate 97.2%  
 Infant mortality 12/1000  
 Resources Minerals

Country 5: \_\_\_\_\_

Population 127,600,000  
 Per capita GDP \$46,679.27  
 Life expectancy 83.10 years  
 Literacy rate 99.0%  
 Infant mortality 2/1000  
 Resources Fish

Country 3: \_\_\_\_\_

Population 143,200,000  
 Per capita GDP \$14,090.65  
 Life expectancy 70.46 years  
 Literacy rate 99.7%  
 Infant mortality 9/1000  
 Resources Petroleum and Minerals

#### Ranking Countries by Income

	<u>Country Name</u>
Richest	_____
	_____
	_____
	_____

High population growth causes lower incomes (or GDP), not large populations.

Technological progress and government policies are some of the most important factors determining growth.

Poorest \_\_\_\_\_

Natural resources are NOT a key to wealth or high incomes.

### 3. Productivity and long-run growth

Explaining the large variation in living standards around the world is, in one sense, very easy: differences in productivity and labor force participation (LFPR) lead to differences in living standard.

$$RGDPP_t = \underbrace{\frac{RGDP_t}{Workers_t}}_{\text{Productivity}} \cdot \underbrace{\frac{Workers_t}{Population_t}}_{\text{LFPR}}$$

Exercise 11: Compute U.S.'s and China's RGDPP using the following data.

	Productivity	LFPR	RGDPP
U.S.	\$ 84,919	0.47	
China	\$ 9,669	0.58	

#### 3.1. Productivity in the United States

The United States has consistently been one of the most productive countries in the world. The table below helps to illustrate productivity.

Productivity in the U.S.		
	Goods	Services
1959	\$ 38,000	\$ 31,000
2005	\$ 179,000	\$ 55,000

**Some have said that America has lost its competitive edge in the goods manufacturing. Is that true? Another way to state this is if productivity is so high in the goods manufacturing sector, why do we have so few manufacturing jobs?**

Recall that if an economy has a sector-specific increase, then not as much input is needed to produce that sector's goods. Thus, employment in that sector may decrease even with increased productivity.

- Over the last 25 years, the U.S. economy has added 45 million jobs – far more jobs have been added to the service sector than have been lost in manufacturing. How many services jobs did not even exist 25 years ago? This is all due to technological progress.
- Agricultural has had the same type of growth in productivity as goods production.

#### 4. Determinates of productivity and long-run growth

Although productivity uniquely determines the standard of living, many factors determine productivity. Using production theory, economists find that the factors of production mostly determine productivity:

$$Y_t = f(A_t, k_t, h_t, R_t)$$

where  $y$  is productivity,  $f$  is the production function,  $A$  is technology,  $k$  is physical capital per laborer,  $h$  is human capital per laborer, and  $R$  is the amount of natural resources.

##### 4.1. Physical capital per worker - $k$

Physical capital is the stock of equipment and structures that are used to produce goods and services. This is not the same as investment in GDP, as GDP measures a flow. Physical capital increases productivity since more capital allows workers to produce more output quickly and more accurately.

One special feature of capital is that it is a produced factor of production. That is, capital is an input into the production process that in the past was an output from the production process.

##### 4.2. Human capital per worker - $h$

Human capital is defined as the knowledge and skills that workers acquire through education, training, and experience. This includes early childhood programs, grade school, high school, college, and on-the-job training for adults in the labor force.

This particular factor of production has a positive externality component to it – individuals receiving education do not realize how much they are making other individuals better-off. As such, society has a tendency to under invest in education. Further, those in charge of education decisions (parents) tend not to directly reap the benefits from the investment causing them to under invest in their children. Using government subsidies allows an efficient production of human capital.

##### 4.3. Natural resources per workers - $R$

Natural resources are defined as the inputs into the production of goods and services provided by nature, such as land, rivers, and mineral deposits.

**Although natural resources can be important, they are not necessary for an economy to be highly productive in producing goods and services.**

### **4.3.1 Are scarce natural resources a limit to growth?**

Many commentators have argued that natural resources will eventually limit how much the world's economies can grow. The arguments that most resources are nonrenewable natural resources, and coupled with an ever expanding population, this will lead to lower living standards.

The biggest flaw of this argument is that these individuals do not think that the market will adjust. They somehow think that we will keep using the same resources regardless of price. Price is the big motivator which provides incentives for innovators to use new or different resources. Remember, companies always attempt to construct a product using least cost.

#### **Price reflects scarcity**

The comment that we will run out of a natural resources has gone on for centuries. Examples include:

- 1800 - land for food production (Thomas Malthus)
- 1950 – tin and copper
- Recent years - oil

Many minerals are able to be recycled at a cheaper cost than finding new ones. If one views the price of many natural resources, the only conclusion is that there is an abundance of natural resources because the prices are so low. Ferraris and Yachts are scarce, natural resources are not.

### **4.4. Technological knowledge - A**

The last determinant of productivity is technological knowledge – the understanding of the best ways to produce goods and services. Technological knowledge takes many forms. Some technology is common knowledge – after one person uses it, everyone becomes aware of it (e.g., assembly lines, goods that can be privately owned). Other technology is proprietary – it is known only by the company that discovers it (e.g., secret recipes, goods and services where the production processes are hidden).

Property rights are the key to assure that technological knowledge advances. Without property rights, firms and individuals do not reap the benefits from the risk they take. While countries may have many laws that indicate property rights are secure to those individuals who own them, the enforcement of these laws is what truly matters.

Sometimes government subsidies or the production of certain goods and services are required if the risk is too great for private entrepreneurs. The government has access to more funds and may be able to bring together competitors to produce a product that, else wise, would not be able to be produced. The government may also invest in certain technologies for which there are large social benefits.

There are many individuals who do not realize that they are neo-luddites – individuals who oppose technological progress and technological change. Examples include individuals opposed to robots on assembly lines and individuals against search engines. Probably the most famous

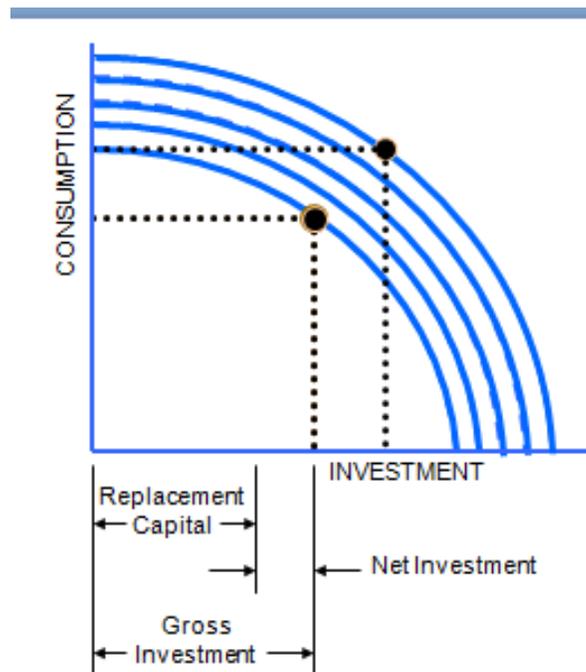
modern American neo-luddite is Ted Kaczynski. Due to technological progress in agricultural, almost no one (< 2 - 3% of the entire nation) is needed to produce food.

## 5. Influences that increase/decrease the factors of production

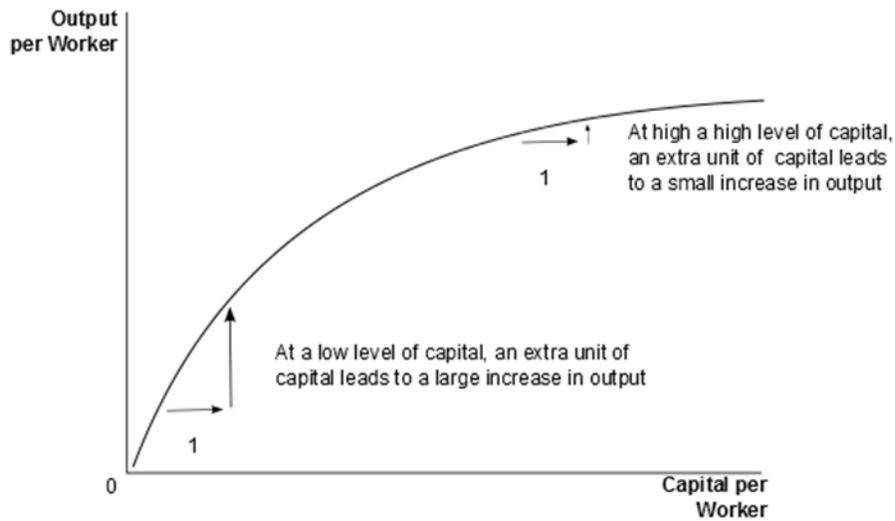
While the factors of production determine productivity, economists still have not fully unraveled what causes some countries to have larger quantities of these factors. While the influences that increase the factors of production (and ultimately increases in income) are not completely known, there are a few correlations in the data that are suggestive that they are important for growth.

### 5.1. Savings and investment

Because capital is a produced factor of production, a society can change the amount of capital it has. Thus, one way to raise future productivity is to invest more current resources and output in the production of capital. However, for some nations, this is extremely painful – a harsh trade-off is whether to eat today or to raise the capital stock for a brighter tomorrow. Since savings rises with income, there may be more correlation than causation.

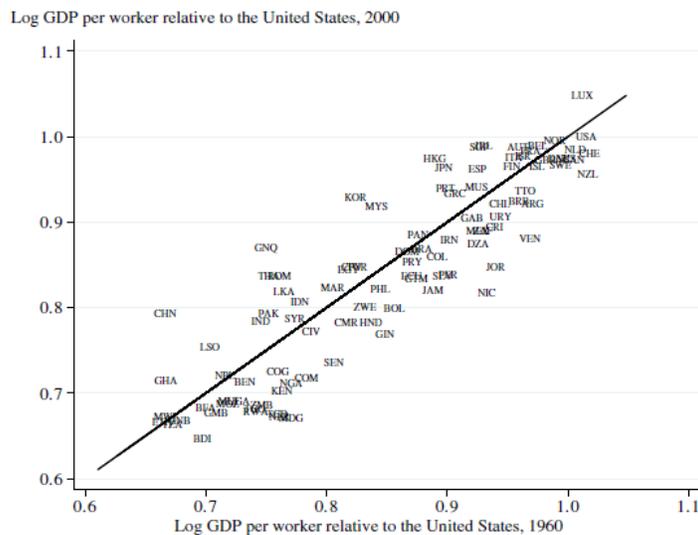


If poor countries can be patient and sacrifice consumption today for savings, the benefits are much larger than for developed nations. This is called *the catch-up effect* and is due to the diminishing returns to capital. When capital is scarce, any additional units of capital increase output per workers compared to when capital is abundant, the marginal gain to output is minimal. This is demonstrated graphically below.



The catch-up effect helps explain why the United States and South Korea devoted similar shares of GDP to investment and South Korea grew more rapidly than the United States during the last forty years.

❖ Does this mean that countries are catching up?



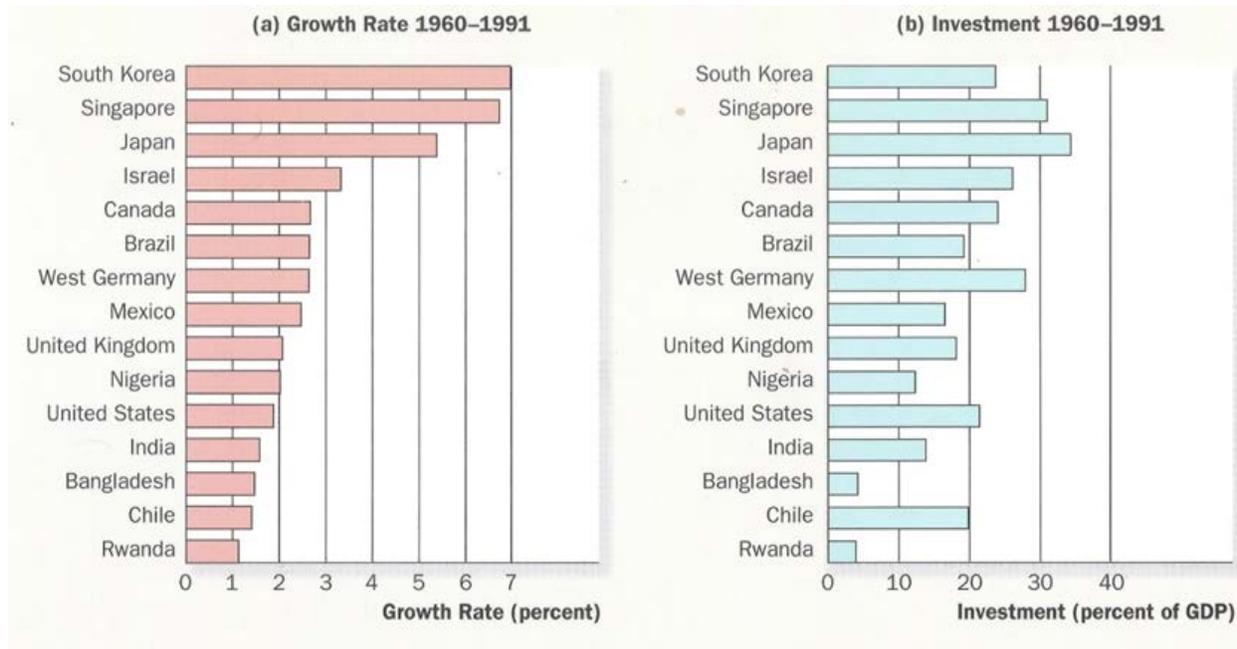
Log GDP per worker relative to the United States

- Countries above (below) the 45 degree have increased (decreased) their GDP per worker relative to the U.S and are converging to (diverging from) the U.S. GDP per worker.
- The figure above reveals that some countries are converging while others are diverging. Thus, there is no evidence of absolute convergence of countries to the United States.

### 5.1.1. Investment from abroad

Another way a country can increase savings is from foreign direct investment (FDI). When foreigners invest in a country, they do so because they expect to earn a return on their investment.

- Much of the income generated by factories abroad leave the country.
- Low productivity countries typically have smaller returns.



### 5.2. Trade policies

Some of the world's poorest countries have tried to achieve more rapid economic growth by pursuing inward-oriented policies. As discussed in previous lectures, when individuals do not engage in trade, they are inefficient and could have higher living standards. Recall that if a nation attempts to produce all goods, then scarce resources are being expended on production processes that are costly to them. If they would engage in trade, then they would be able to shift their resources to more productive sectors.

- Countries with deep seaports find trade easier than countries without this resource. Landlocked countries have a severe disadvantage.

There are many individuals against trade who believe that locally-owned businesses should be supported to keep the local economy going. The information transmitted comes from those who gain the most: the local business and workers in sectors that cannot compete with the global economy. Those that benefit most have a hard time coming together to be a collective voice –

how often do consumers come together to celebrate low prices at Walmart or Target? Since the voices against free trade are louder than those for it, individuals tend to think the consensus is that trade is bad – this is the exact opposite result that would occur if we voted to ban all imports!

### **5.3 Research and Development**

Specialization and trade often lead to increases in technology as firms and countries attempt to maintain their comparative advantage. A mobile workforce also assists as workers carry knowledge from one sector to another.

### **5.3. Government**

The government plays a substantial role in the productivity of its workers. There are many ways in which the government can provide incentives for the private sector to increase production.

- Public infrastructure (roads, rail, ports)
- Law and order
- Political stability
- Public policies

## **6.0. Why isn't the whole world 'developed'?**

If one looks at a world income map, there are striking difference between countries. Given that nations can increase their factors of production, and countries well behind the rest of the nation can grow faster than developed nations, why isn't the whole world 'developed'? It may be there are forces that are constraining the country's economy from growing and converging to economies of similar countries. In this subsection, the fundamental causes of stunted growth are discussed.

### **6.1. Health, income, and poverty traps**

The term human capital usually refers to education, but it can also be used to describe another type of investment in people: expenditures that lead to a healthier population. Other things equal, healthier workers are more productive. The right investments in the health of the population provide one way for a nation to increase productivity and raise living standards.

If individuals that become sick typically cannot work as well. This causes reduced income and the onset of poverty. Due to reduce income, they cannot afford medical treatment and are stuck in a low income-poor health state. This is referred to as a poverty trap.

- Robert Fogel, a Nobel Prize in Economics winner for work on the effects of health on GDP growth, estimates that nutrition accounts for roughly 30% of the growth of per capita income in Britain from 1790 and 1980.

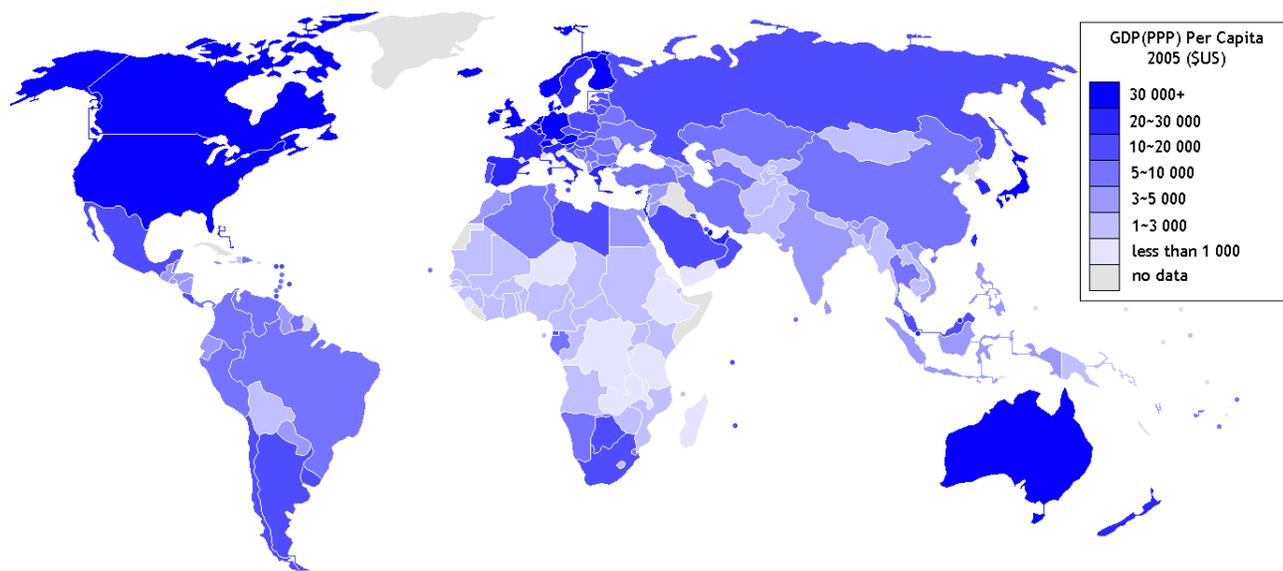
- Poor health and low life expectancy distort individuals' investments in human capital and also savings.
- Programs to increase nutrients by providing grains have had offsetting effects. On the one hand, the population has higher caloric intake. On the other hand, farmers cannot compete with helicopter drops of free food.

## 6.2. Culture

Cultures can play a role as individuals respond to incentives that may be imposed by the norms of the group of people in which they interact. Culture is the key determinant of the values, preferences, and beliefs. While some may think cultures do not change, they do, just extremely slow.

## 6.3. Climate

Climate has a positive correlation with growth. The graph below demonstrates that climate and growth are correlated.



❖ **What is it about certain climates that cause growth to be stunted?**

Exercise 12: What stunts growth or why isn't the whole world developed?

## **5. Conclusion**

In 1962, Simon Kuznets stated “*Distinctions must be kept in mind between quantity and quality of growth, between costs and returns, and between the short and long run. Goals for more growth should specify more growth of what and for what.*”

The words of North and Thomas, 1973, pg. 2 seems fitting, “*The factors we have listed (innovation, economies of scale, education, capital accumulation, etc.) are not causes of growth; they are growth.*”

## 6. In-class exercises

Year	Price of Pretzels	Quantity of Pretzels	Price of Books	Quantity of Books
2011	\$4.00	90	\$1.50	150
2012	\$4.00	100	\$2.50	180
2013	\$6.00	120	\$2.50	200
2014	\$6.00	150	\$3.50	200

1. Refer to the above table containing the production data for a country.
  - a. Calculate the fixed weight RGDP growth rate from 2012 to 2013 using base year 2011.
  - b. Calculate the fixed weight RGDP growth rate from 2012 to 2013 using base year 2012.
  - c. Calculate the fixed weight RGDP growth rate from 2012 to 2013 using base year 2013.
  - d. Calculate the fixed weight RGDP growth rate from 2012 to 2013 using base year 2014.
  - e. Using your answers from a. - d., calculate the chain weight RGDP growth rate from year 2012 to 2013.
  
2. In 2013, Fruitopia had a population of 2,700 and RGDP of \$16,200,000. In 2014 it had a population of 2,500 and RGDP of \$14,640,000. What was the growth rate of RGDP in Fruitopia between 2013 and 2014?

3. A barber shop produces 96 haircuts a day. Each barber in the shop works 8 hours per day and produces the same number of haircuts per hour. If the shop's productivity is 3 haircuts per hour of labor, then how many barbers does the shop employ?

*Hint:* Output = Productivity \* Hours worked \* # of workers

4. RGDP is \$30,000 in Country A, \$20,000 in Country B, and \$11,000 in Country C. Savings per person is \$1,000 in all three countries. Other things equal, we would expect that
- Country A will grow the fastest.
  - Country B will grow the fastest.
  - Country C will grow the fastest.
  - All three countries will grow at the same rate.

## Lecture 7: Measuring the Cost of Living (CORRESPONDS WITH CHAPTER 6)

When I was 15 years old, my first job was working at McDonalds for \$4.25/hour.

Is that really less than the current minimum wage today?

### 1. The Consumer Price Index

In the preceding lecture, we looked at how economists use Gross Domestic Product (GDP) to measure the quantity of goods and services that the economy is producing. This lecture examines how economists measure the overall cost of living.

By estimating the overall cost of living we are able to understand purchasing power (the number of goods and services that can be purchased with a unit of currency). The statistic most commonly used is the *consumer price index*. The consumer price index (CPI) is a measure of the overall cost of goods and services and covers a “basket of goods” that is bought by a typical urban consumer.

Some important points about the CPI are:

- It measures the average cost of living.
- Goods that are included in the basket of goods are updated every 10 years.
- The CPI is an index number, not a percentage. In the base year, the price index is always 100. The percent change of a price index is the inflation rate.

This statistic is computed and reported each month by the Bureau of Labor Statistics (BLS), which is part of the Department of Labor.

The CPI is used to calculate Social Security benefits which adjust for cost of living allowances (COLA) and other long-term contracts between firms and unions that want to assure that payments are indexed for inflation.

#### 1.1. Calculating the CPI

When the BLS calculates the CPI, it uses data on the prices of thousands of goods and services. To see how this statistic is constructed, let’s consider a simple economy in which the consumer buys  $n$  goods. For measuring the change in price, we keep the quantities constant and allow prices to change over time.

There are 4 steps to computing the CPI:

Step 1: Fix the quantities to a base year.

If the typical consumer buys more hot dogs than hamburgers, then the price of hot dogs is more important than the price of hamburgers and, therefore, should be given greater weight (the weight is quantity) in measuring the cost of living.

Step 2: Identify prices of each good and service in the basket for each year.

Step 3: Calculate the total cost of buying specified quantities given in Step 1.

$$\text{Total cost}_t = P_t^1 \times Q_{BY}^1 + P_t^2 \times Q_{BY}^2 + \dots + P_t^n \times Q_{BY}^n$$

where  $t$  stands for the current year,  $BY$  is the base year, and  $n$  is the total number of goods in the basket.

Step 4: Compute the index by dividing all other yearly total costs by the total cost of the base year.

$$CPI_t = \frac{\text{Total Cost}_t}{\text{Total Cost}_{BY}} \times 100$$

The CPI calculates the difference between a *base cost* and the *current cost* for a fixed basket of goods and services.

Exercise 1: Assume that there are two goods in the basket with the quantities of 4 hot dogs and 2 hamburgers and that the prices for each good in each year are as follows.

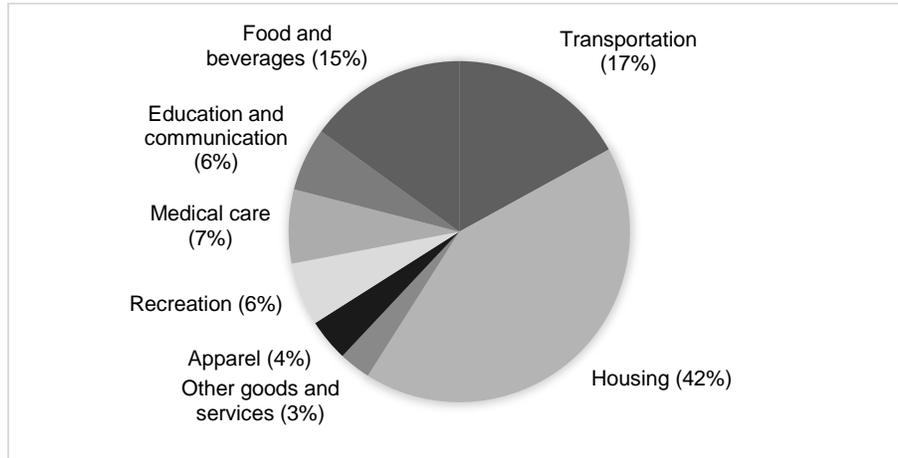
Year	Price of Hot Dogs	Price of Hamburgers
2008	\$1	\$2
2009	\$2	\$3
2010	\$3	\$4

- Calculate the total cost and the CPI for the basket of goods in each period assuming that the base year is 2008.

Year	Total Cost	CPI
2008		
2009		
2010		

### 1.1.1. The CPI basket

When the BLS calculates the CPI, it attempts to make a representation of all the goods and services that the typical consumer buys. Moreover, it tries to weigh these goods and services according to how much consumers buy of each item.



Source: Bureau of Labor Statistics

Housing includes shelter (31%), utilities/fuel (5%), and furnishings (5%).  
Food includes at home (9%) and away (6%).

In 1901, the basket was much different. For instances, food was 43% of one's expenditures, housing was 23%, while apparel was 14%.

### 1.2. Comparing prices from different years or regions

Using the CPI, one can investigate whether former prices and income are higher than today's prices and income. This is a two-step process:

1. Obtain CPI for the year of the former price and this year.
2. Convert former prices or income to any year's dollars according to

$$\text{Dollars}_t = \text{Amount in year } T \text{ dollars} \times \frac{CPI_t}{CPI_T}$$

where  $T$  is the former year.

This equation is easily modified to compare two regions' prices or income:

$$\text{Region A dollars} = \text{Region B dollars} \times \frac{CPI_A}{CPI_B}$$

Exercise 2: How much was my \$4.25/hour in 1993 worth today if the CPI in 1993 was 145 and today it is 238?

### 1.3. The inflation rate

Once the CPI is calculated, a measure of inflation can be calculated which holds the quantities of goods constants.

The inflation rate is calculated as the percentage change in the CPI from year to year:

$$\pi_t = g(\text{Prices}_t) = \left( \frac{CPI_t}{CPI_{t-1}} - 1 \right) \times 100$$

Exercise 3: Calculate the inflation rates for year 2009 and 2010 using the data from Exercise 1.

Year	Inflation Rate
2009	
2010	

## 2. Biases in the CPI

There are several problems inherent in the calculation of the CPI. Most Economists agree that the CPI was overstating the cost of living by about 1% and through corrections, is now overstating inflation by 0.5%.

### 2.1.1. The substitution bias

The first problem is the substitution bias. When prices change from one year to the next, they do not all change proportionately: some prices rise more than others. Consumers respond to these differing price changes by buying less of the goods whose prices have risen by a relatively large amount and buying more of the goods whose prices have risen less or have fallen.

This leads to an overstatement of the cost of living from one year to the next.

### **2.1.2. Introduction of new goods**

There are two problems with the introduction of new goods on calculating the well-being of individuals: lower cost of living and diversity. Both stem from the fact that the basket of goods is fixed. The first is new goods allow individuals to achieve the same level of economic well-being for fewer dollars. This implies the CPI overstates the cost of living. The second is that when a new good is introduced, consumers have more variety from which to choose, and this decreases the cost of maintaining the same level of economic well-being. This again implies that the CPI overstates the cost of living.

### **2.1.3. Quality changes**

If quality changes while prices remain the same, then CPI does not properly reflect the cost of living. The BLS attempts to correct for these changes with adjustments to the price of the good.

Judgment calls are made on which quality changes should reflect price changes. Many have expressed that this is ad hoc and distorts the true cost of living. However, many price adjustments in the CPI are straightforward: when a candy bar get smaller, but is sold for the same price, the CPI reflects that as a price increase. Others are not so easy to make: car radio button on the steering wheel are considered non-essential and thus not a functional change to the radio. Thus, there was no change in the price in the CPI basket for quality improvement.

### **2.1.4. New stores with lower prices**

New stores with lower prices also can distort the CPI. As markets become more complete in a given area, prices tend to fall. The CPI does not take into consideration the expansion of stores (and the accompanying goods and services) into its calculation. This is similar to the introduction of new goods but on a much larger scale.

## 2.2. The GDP deflator and the inflation rate (see Chapter 5 of textbook)

❖ How do we measure the bias in the CPI?

Using an alternative measure of the price level, the bias may be detectable. One measure is the change in the GDP deflator. The GDP deflator measures the difference in nominal and real GDP. It is calculated as follows.

$$\text{GDP deflator}_t = \frac{NGDP_t}{RGDP_t} \times 100$$

Exercise 4: Calculate the GDP deflators for all years.

Year	NGDP	RGDP	GDP Deflator
2012	\$4	\$4	
2013	\$8	\$4	
2014	\$9	\$3.50	

The GDP deflator is not a measure of inflation. Inflation is measured as a rate of change over time, while the GDP deflator only measures the change in the price level for a single year. Using the following equation, inflation can be calculated using the GDP deflators for the various years:

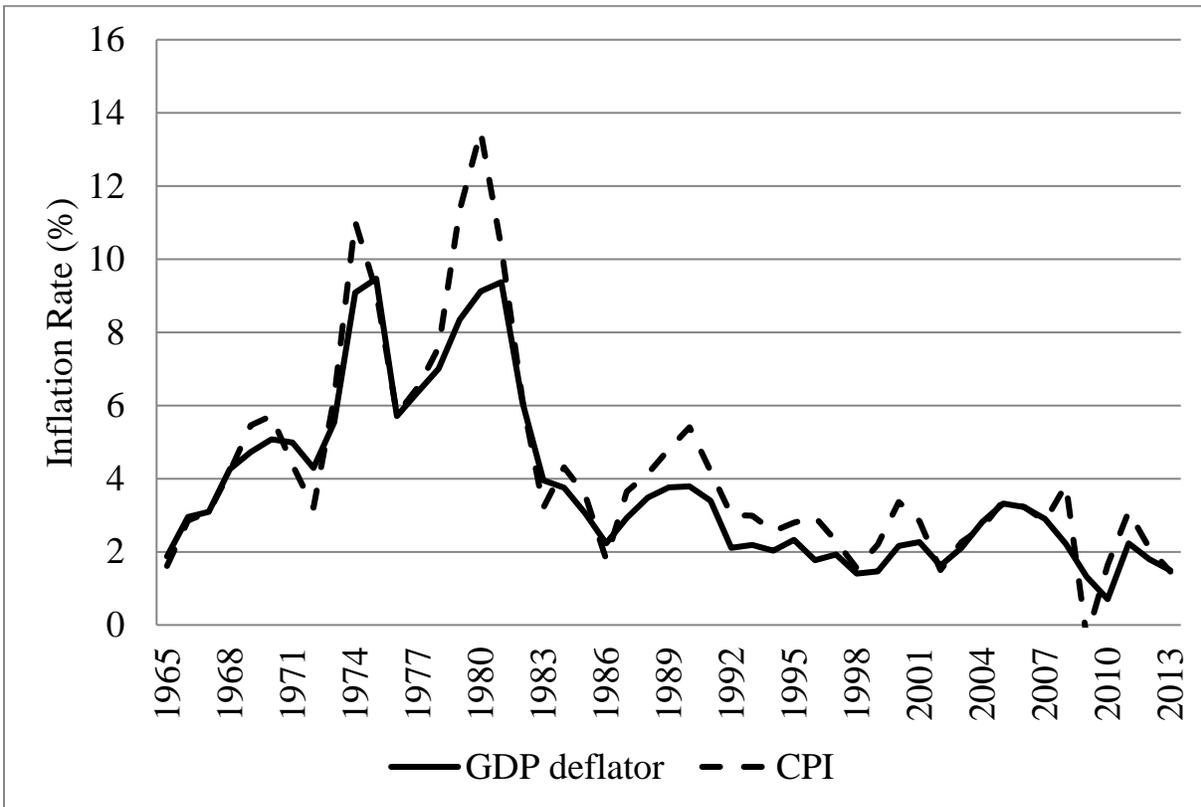
$$\pi_t = g(\text{Prices}_t) = \left( \frac{\text{GDP deflator}_t}{\text{GDP deflator}_{t-1}} - 1 \right) \times 100$$

Exercise 5: Calculate the inflation rate for year 1 and 2 using GDP deflators from the above Exercise 4.

Year	Inflation Rate
2012	---
2013	
2014	

### 2.2.1. CPI vs. the GDP deflator

The CPI measure of inflation can be compared to GDP deflator measure of inflation.



There are some key differences in the two statistics which makes the CPI measure of inflation higher than the GDP deflators.

Which parts of the equation  $Y_t = C_t + I_t + G_t + EX_t - IM_t$  are used to measure the cost of living for the following two price indices?

	CPI	GDP Deflator
Fixed in Base Year		
Uses		
Excludes		

- Recall that consumption (C) includes any goods purchased by individuals, including imports.
- More than half of the oil consumed in the United States is imported. When oil prices jump, there is a bigger impact on the CPI than the GDP deflator.
  - Core CPI excludes more volatile items like food and energy.

### 3.1. Interest rates and inflation

Knowing the inflation rate allows an individual to determine the real interest rate.

- Contracts (e.g. bank loans, student loans, savings deposits, etc.) are negotiated using the nominal interest rate,  $i$ .
- The nominal interest rate does not account for inflation
- The real interest rate provides the true cost of borrowing and lending accounting for inflation.

The *Fisher equation* determines the real interest rate:

$$r = i - \pi$$

where  $i$  is the nominal interest rate,  $r$  is the real interest rate, and  $\pi$  is the inflation rate.

#### 3.1.1. Inflation rates

Often, the inflation rate is not known over the time horizon when lending/borrowing money. There are two rates of inflation that are important for policymakers and the general public. Each has its own significance.

- $\pi$ : actual inflation rate as computed using data. This is referred to as the inflation rate. If a statement indicates that inflation is X percent, then this is referring to actual inflation.
- $E[\pi]$ : expected inflation rate over the time horizon in question. This is referred to as the expected inflation rate. If a statement indicates that inflation is expected to be X percent, then this is referring to expected inflation. The above Fischer equation is modified as follows:

$$E[r] = i - E(\pi)$$

Exercise 6: Suppose Dakota earns \$10,000 per year and his income adjusts with inflation. Dakota is thinking about borrowing \$10,000 extra for living expenses while a student. The interest rate on a student loan is 3% per year.

Fill in the table if inflation is 2%.

Cost of borrowing	
Income in one year	

Calculate the real interest rate: \_\_\_\_\_

Calculate the real cost of borrowing using the real interest rate: \_\_\_\_\_

Fill in the table if inflation is expected to be 3.5%.

Expected cost of borrowing	
Expected income in one year	

Calculate the expected real interest rate: \_\_\_\_\_

Calculate the expected real cost of borrowing using the real interest rate: \_\_\_\_\_

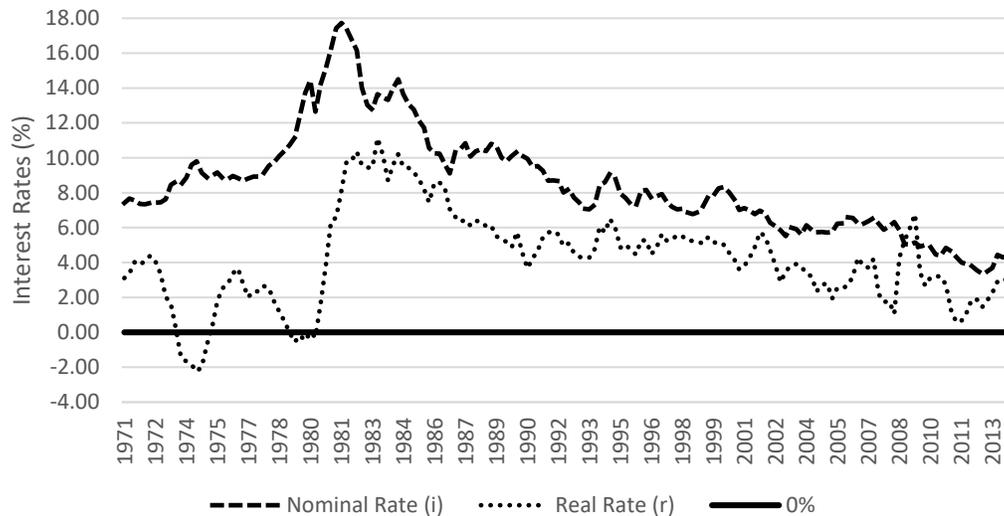
Exercise 7: Suppose \$10,000 is deposited into a savings account that promises a 4.5% annual return. Given that inflation is 3.85%, what is the real interest rate, and how much will be earned after one year?

**Real interest rate:** \_\_\_\_\_

	Deposit	Return on Investment
Nominal		
Real		

How much money would be on the bank statement at the end of the year?

How much would this money buy?



Source: Federal Reserve Bank of St. Louis.

- Even though the 70s had high interest rates, the cost of borrowing was negative because the real interest rate was less than 0%.

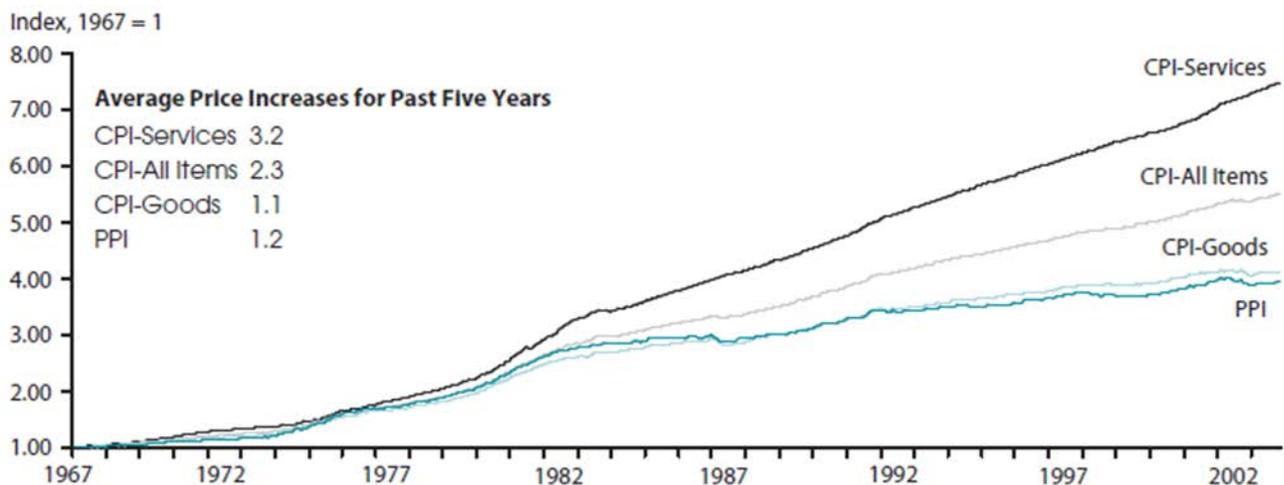
#### 4. CPI and the PPI

There are many other price indices estimated. One well known index is the *Producer Price Index* (PPI). While both the PPI and CPI measure price changes over time for a fixed set of goods and services, they differ in two critical areas: (1) the composition of the set of goods and services and (2) the types of prices collected.

The target set of goods and services included in the PPIs is the entire marketed output of U.S. producers. The set includes both goods and services purchased by other producers as inputs to their operations or as capital investment, as well as goods and services purchased by consumers either directly from the service producer or indirectly from a retailer. Because the PPI target is the output of U.S. producers, imports are excluded.

The price collected for an item included in the PPIs is the revenue received by its producer. Sales and excise taxes are not included in the price because they do not represent revenue to the producer. The price collected for an item included in the CPI is the out-of-pocket expenditure by a consumer for the item. Sales and excise taxes are included in the price because they are necessary expenditures by the consumer for the item.

The differences between the PPI and CPI are consistent with the different uses of the two measures. A primary use of the PPI is to deflate revenue streams in order to measure real growth in output. A primary use of the CPI is to adjust income and expenditure streams for changes in the cost of living.



Should we be concerned about declines in the PPI as a possible harbinger of economy-wide deflation?

The answer, as shown by the data, is tremendous advances in technology and productivity in goods production. For example, the PPI component for electronic computers and computer equipment has fallen an average of 12.3 percent per year for the past five years. Computer prices are expected to decline far into the future, and no one thinks that this is a sign of deflation. Rather, it is a sign of technological advances and cost saving in computer manufacturing.

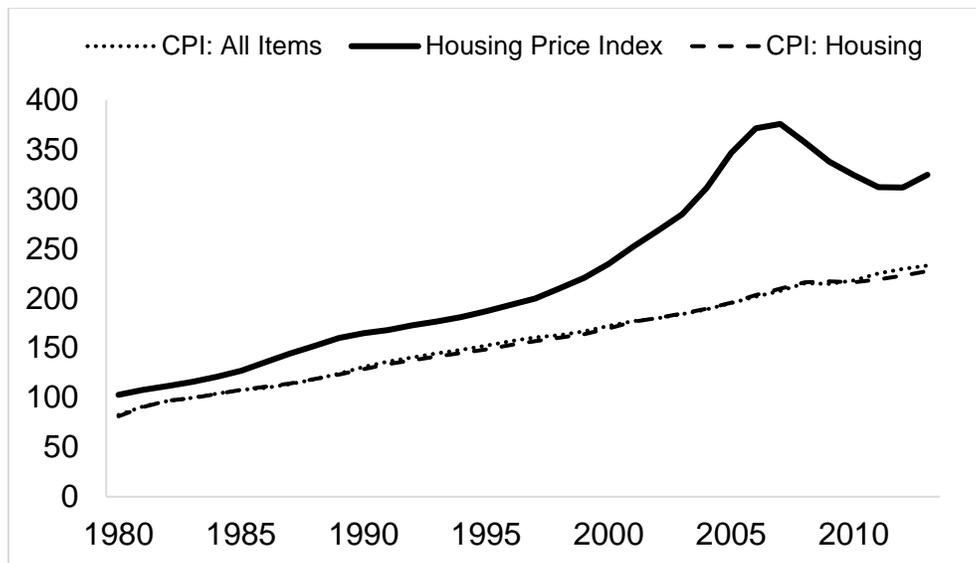
## 5. A new way to calculate the CPI

Some economists have extended the hedonic approach to calculating prices used in CPI to come up with a whole new measure of the cost of living. These economists suggest that one way around the current bias in the CPI due to a change in the basket over time is to fix the basket to today's goods and estimate how much the basket would cost using past years' input prices. This estimate of inflation would take into account technological progress which lowers the cost of living.

## 6. The United States Housing Bubble

The U.S. housing market has been tumultuous in recent years in the wake of a price bubble. We have previously analyzed how a bubble can occur. We now focus our attention on how long it will take to return prices to pre-bubble prices (adjusted for inflation).

The figure below displays the CPI, the CPI housing component, and the house price index. The bubble is easily illustrated by the dramatic increase in the house price index, starting slowing around 1998 and rising rapidly until peaking in 2006.



Source: St. Louis Federal Reserve.

- **Why didn't we see a house price bubble form?**

A part of the answer lies in how we compute inflation. In the early 2000s, housing prices were going through the roof and yet inflation remained low and stable. This is because the housing component of the CPI is not computed using the housing price index. If the CPI took into consideration the housing price index, then inflation would have been substantially higher during housing bubbles.



Year	Price of Peaches	Quantity of Peaches	Price of Pecans	Quantity of Pecans
2005	\$11 per bushel	13	\$6 per bushel	12
2006	\$9 per bushel	10	\$10 per bushel	15

4. **Refer to the above table.** The table pertains to Pieway. If 2006 is the base year, then what was the inflation rate between 2005 and 2006?
5. Jennifer took out a fixed-interest-rate loan for 6% when the CPI was 100. She expected the CPI to increase to 103 but it actually increased to 105. The real interest rate she paid is
- higher than she had expected, and the real value of the loan is higher than she had expected.
  - higher than she had expected, and the real value of the loan is lower than she had expected.
  - lower than she had expected, and the real value of the loan is lower than she had expected.
  - lower than she had expected, and the real value of the loan is higher than she had expected.



## **Lecture 8: Unemployment (CORRESPONDS WITH CHAPTER 10)**

In this lecture we will discuss the causes of unemployment, measures of employment, and unemployment-related issues, such as why the unemployment rate should never be zero. The unemployment rate is an important indicator of strength of the macroeconomy and of the economy's position in the business cycle.

### **1. Types of unemployment**

There are four general types of unemployment.

1. Structural unemployment: unemployment due to changes in the structure of the economy. This causes a persistent mismatch of worker skills and qualification requirements for available jobs. This is often thought to explain long-term unemployment.
  - a. Recall the creative-destruction process. Technological advances cause current businesses to compete with new ones and sometimes they fail.
  - b. Workers have nominal wage preferences that make them unwilling to accept employment at wages lower than their preferred wages.
    - i. Minimum wage.
    - ii. Labor unions.
    - iii. Downward nominal wage rigidity.
2. Frictional unemployment: short-term unemployment due to the lack of perfect information. This unemployment is the time required to match employees to employers.
  - a. Unemployment insurance bridges income from this type of unemployment.
    - i. Monetary incentive to get a job decrease unemployment.
    - ii. As unemployment benefits run out, the rate of employment increases.
    - iii. Better employee – employer matches.
3. Seasonal unemployment: unemployment caused by predictable seasonal changes.
4. Cyclical unemployment: unemployment due to recessions, or economic downturns.

The natural rate of unemployment is the amount of unemployment that the economy normally experiences (types 1-3 above). Cyclical unemployment is short-run unemployment and is the additional amount of unemployment from the natural rate of unemployment during recessions.

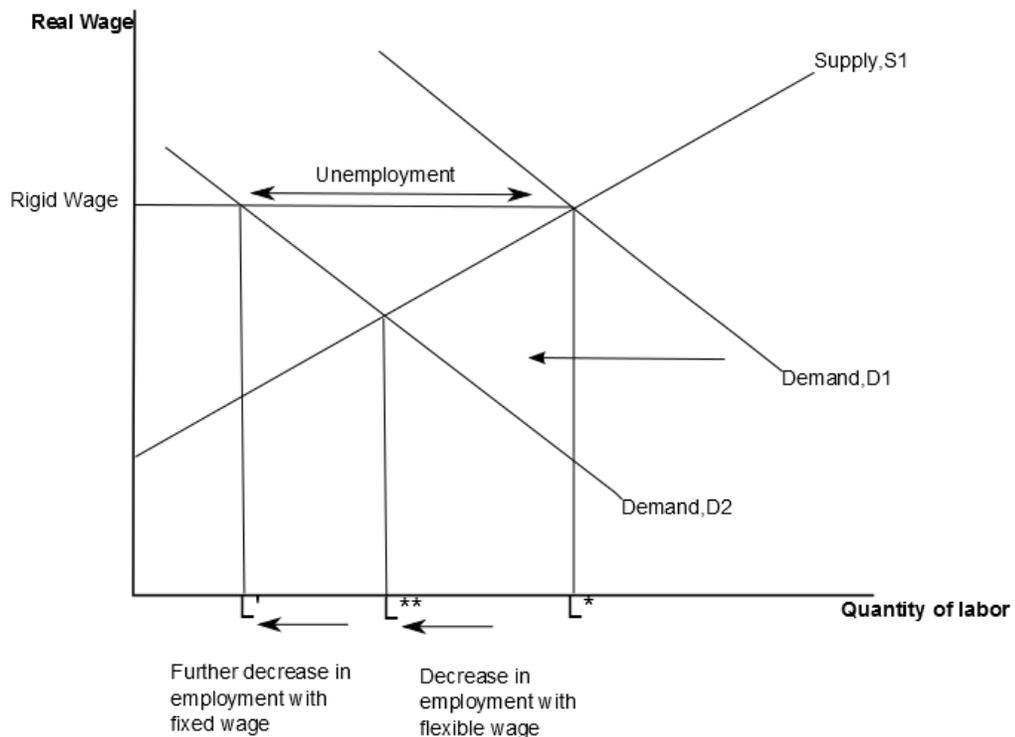
**Because the economy is always growing, unemployment is a natural consequence and some positive unemployment indicates a healthy economy.**

Exercise 1: What happens to the amount and types of unemployment during recessions?

## 1.1. Modeling unemployment using supply and demand

The labor market can be model using supply and demand. The supply of labor is provided by laborers while firms demand labor. The price is the real wage and the quantity is the number of laborers who are employed. The equilibrium defines the total number of individuals employed, unemployed, and not in the labor force. The number of unemployed at the equilibrium is the natural rate of unemployment.

When the economy enters a recession, firm's demand for labor falls. This causes a leftward shift in the demand for labor.



Cyclical unemployment occurs as individuals lose their jobs. This causes the demand for labor to decrease. Total number of cyclically unemployed equals  $L^* - L'$ .

1. If workers and firms accept lower wages (flexible wages), unemployment will decrease as workers are matched to firms.
  - Unemployment decreases from  $L^* - L'$  to  $L^* - L^{**}$ .
  - Some laborers are re-hired at lower wages –  $L^{**} - L'$ .
2. If workers and firms do not accept lower wages (rigid downward wages), unemployment persists until the demand for labor increases.
  - Referred to as real-wage unemployment.
  - Number of unemployed remains at  $L^* - L'$ .
  - Unemployment may shrink if individuals exit the labor market.

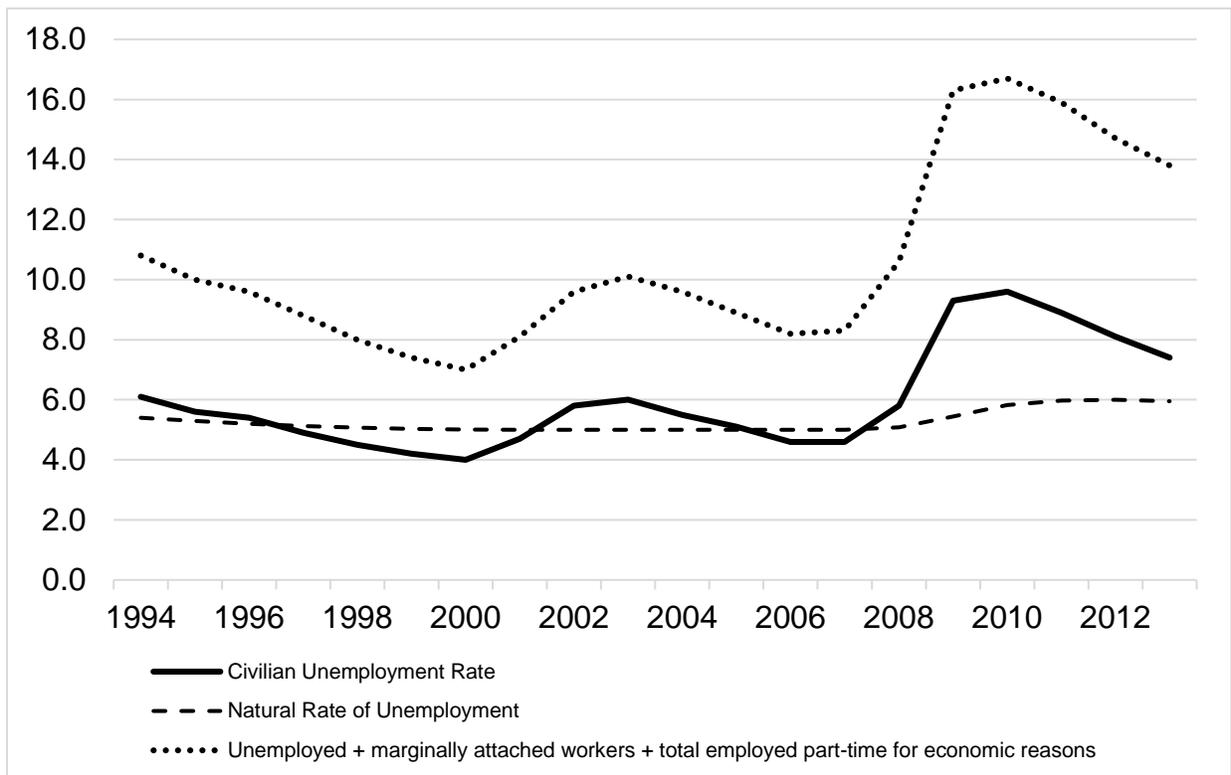
## 1.2. Why is the unemployment rate so important?

One determinant of long-run growth is the amount of labor in an economy. Recall that output in the economy is dictated by the factors of production according to:

$$Y_t = f(A_t, k_t, h_t, R_t)$$

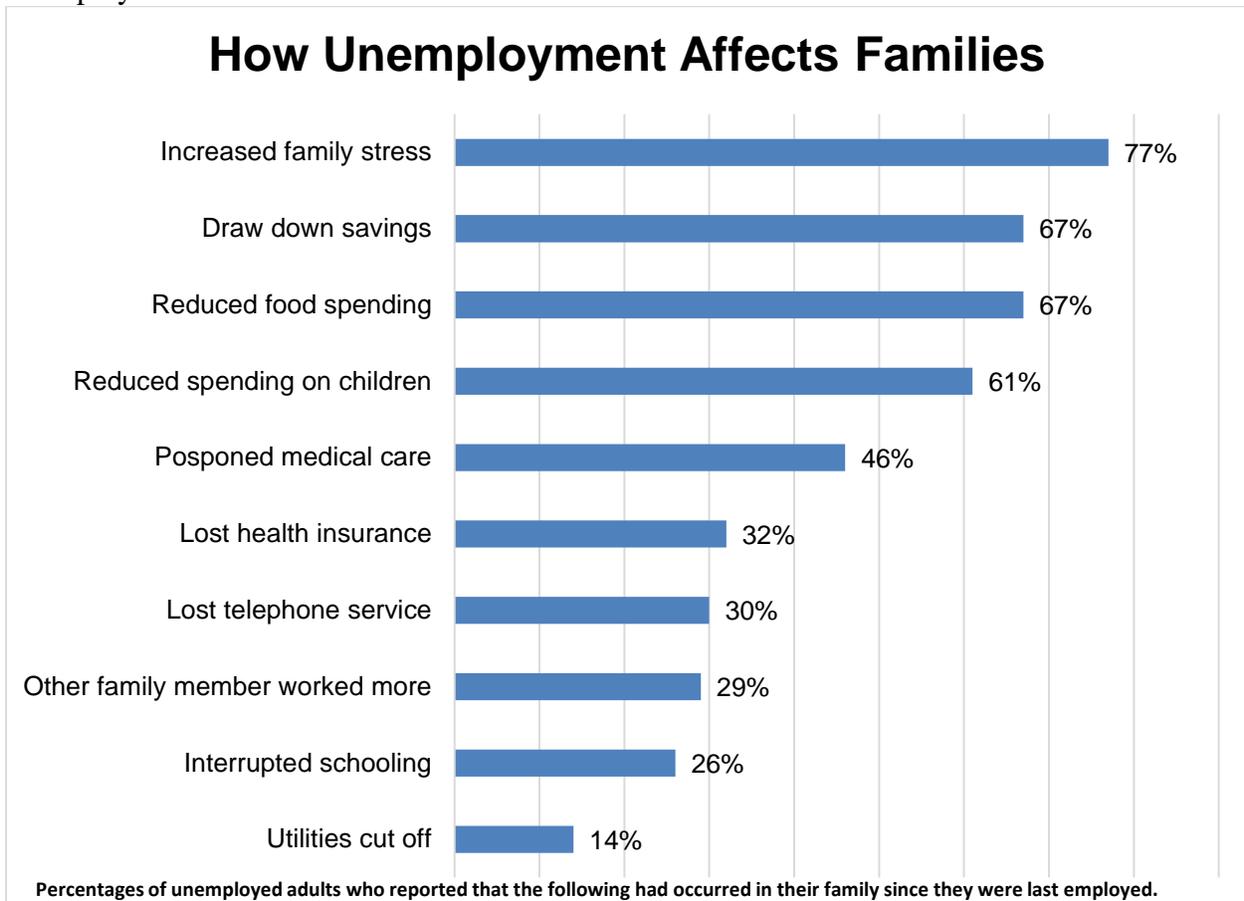
People who would like to work but cannot find a job are not contributing to the economy's production of goods and services. When a country keeps its workers as fully employed as possible, it achieves a higher level of GDP than it would if it left many of its workers standing idle.

The figure below shows the unemployment rate in the United States since 1960. The figure shows that the economy always has some unemployment and that the amount changes from year to year.



- Most unemployment spells are short (fewer than 15 weeks).
- The unemployment rate mostly reflects long-term unemployment. These individuals find it increasingly more difficult to find jobs. The main reasons why many remain long-term unemployed are the discouraged worker effect and the bad signal of being unemployed for so long.

The second main reason why the unemployment rate is so important is due to it being a measure of misery. Substantial welfare loss occurs due to a lack of income when someone becomes unemployed. The table below provides an indication of how families are affected by unemployment.



Source: Peter D. Hart Research Associates, "Unemployed in America: The Job Market, the Realities of Unemployment, and the Impact of Unemployment Benefits."

## 2. Measuring unemployment

Measuring unemployment is the task of the Bureau of Labor Statistics (BLS). Every month the BLS produces data on unemployment and other aspects of the labor market. These data come from a regular survey of 60,000 households, called the *Current Population Survey*. Based on the answers to survey questions, the BLS places each civilian non-institutionalized adult (ages 16 and older) of each surveyed household into one of these categories:

1. **Employed**
  - a. Worked at least 1 hour as paid employees or on their own;
  - b. Worked 15 hours or more as unpaid worker at some business;
  - c. Have a job but are not working due to temporary absence.
2. **Unemployed**
  - a. Not employed but is available for work and has tried to find employment during the previous 4 weeks.
  - b. Workers expecting to be recalled from temporary layoff regardless whether they have engaged in job-seeking activities in the previous four weeks.
3. **Not in the labor force**
  - a. Those not employed or unemployed.
  - b. A subgroup are marginally attached workers
    - i. Wants full-time work.
    - ii. Has actively looked for a job sometime in the past 12 months.

Exercise 2. Categorize each of the following individuals as employed, unemployed, or not in the labor force. If not in the labor force, are they marginally attached?

- a) Not currently working at their place of employment due to bad weather.
- b) A college student that also works 15 hours per week part-time.
- c) A pilot who was furloughed and waiting to be recalled to a job.
- d) A full-time student.
- e) A stay-at-home dad that answers calls for a family business without pay 20 hrs. per week.
- f) A laid off individual for six months who looked for work, but is now waiting until the economy improves.
- g) A 15 year old working full-time at McDonalds during the summer months.
- h) A military officer serving overseas.
- i) A retired school teacher.

Given the categorization of each individual in the surveys, the BLS computes various statistics to summarize the state of the labor market.

1. The labor force is defined as:

$$LF_t = EMP_t + UNEMP_t$$

2. The labor force participation rate is defined as:

$$LFPR_t = LF_t / Pop_t * 100$$

3. The unemployment rate is defined as:

$$unemp\ rate_t = UNEMP_t / LF_t * 100$$

where  $EMP_t$  is the number of employed,  $UNEMP_t$  is the number of unemployed, and  $Pop_t$  is the population during the time period  $t$ .

Exercise 3: Calculate the labor force participation rate and the unemployment rate for the U.S. population broken down by employment status for 2014.

Adult Population	Labor Force	Employed	146.3 million
		Unemployed	9.6 million
	Not in Labor Force		81.7 million

## 2.1. Biases in measuring unemployment

There are a few biases in this measure of unemployment:

1. Individuals move in and out of the labor force quite often (e.g., college graduates, older individuals re-entering). This makes interpreting the unemployment rate quite difficult.
2. Underemployed workers are those who would like to work full time but due to economic circumstances, are not able to obtain full-time employment.

The table below provides a snapshot of the typically current composition of the unemployed by reason.

Category	Percent
Reentrants	29.4
Terminated from last job	40.3
On layoff	10.4
Job leavers	8.6
New entrants	11.3

Source: [www.bls.gov/cps/cpsaat27.htm](http://www.bls.gov/cps/cpsaat27.htm)

## 2.2 Other measures of unemployment

Due to these biases, the BLS also computes other measures of employment. These are not reported as frequently in the news but are available to allow society to see a better picture of what is going on in the labor market. The tables below provide some of these additional measures of employment.

State-level unemployment rates, January 2015, in percent			
United States	5.7		
Alaska	6.3	Montana	4.4
California	7.0	Nevada	7.1
Colorado	4.2	New York	5.8
Florida	5.7	North Dakota	2.8
Hawaii	4.1	South Dakota	3.4
Michigan	6.3	Texas	4.4

Source: [www.bls.gov/news.release/laus.t03.htm](http://www.bls.gov/news.release/laus.t03.htm)

- Unemployment rates vary widely by state.
  - The national unemployment rate is simply a weighted average of the states by population. Thus, high unemployment in California affects the unemployment rate for the nation much more than that North and South Dakota.

- Labor force participation rates increase with education attainment.
- Unemployment rates decrease with education attainment.

<b>Educational Attainment</b>	<b>Unemployment Rate</b>	<b>Labor-Force Participation Rate</b>
College Degree	4.1%	75.5%
Some College or Associate Degree	6.6%	65.6%
High School Diploma, No College	8.8%	59.3%
No High School Diploma	12.0%	45.3%

Source: Bureau of Labor Statistics

			<b>Unemployment Rate</b>	<b>Labor-Force Participation Rate</b>
Ages 20 and over	Female	Black	13.2%	62.9%
		White	6.9%	58.4%
	Male	Black	13.8%	67.5%
		White	6.3%	73.4%
Ages 16-19	Female	Black	34.0%	30.7%
		White	18.6%	39.6%
	Male	Black	44.3%	26.7%
		White	25.1%	41.0%

Source: Bureau of Labor Statistics

- Whites have much lower unemployment rates than minorities
- Teenagers have much higher unemployment rates than adults.
- Females have lower unemployment rates than males.
- Those without a high school degree have the highest unemployment rates, while those with a college degree have low unemployment rates.

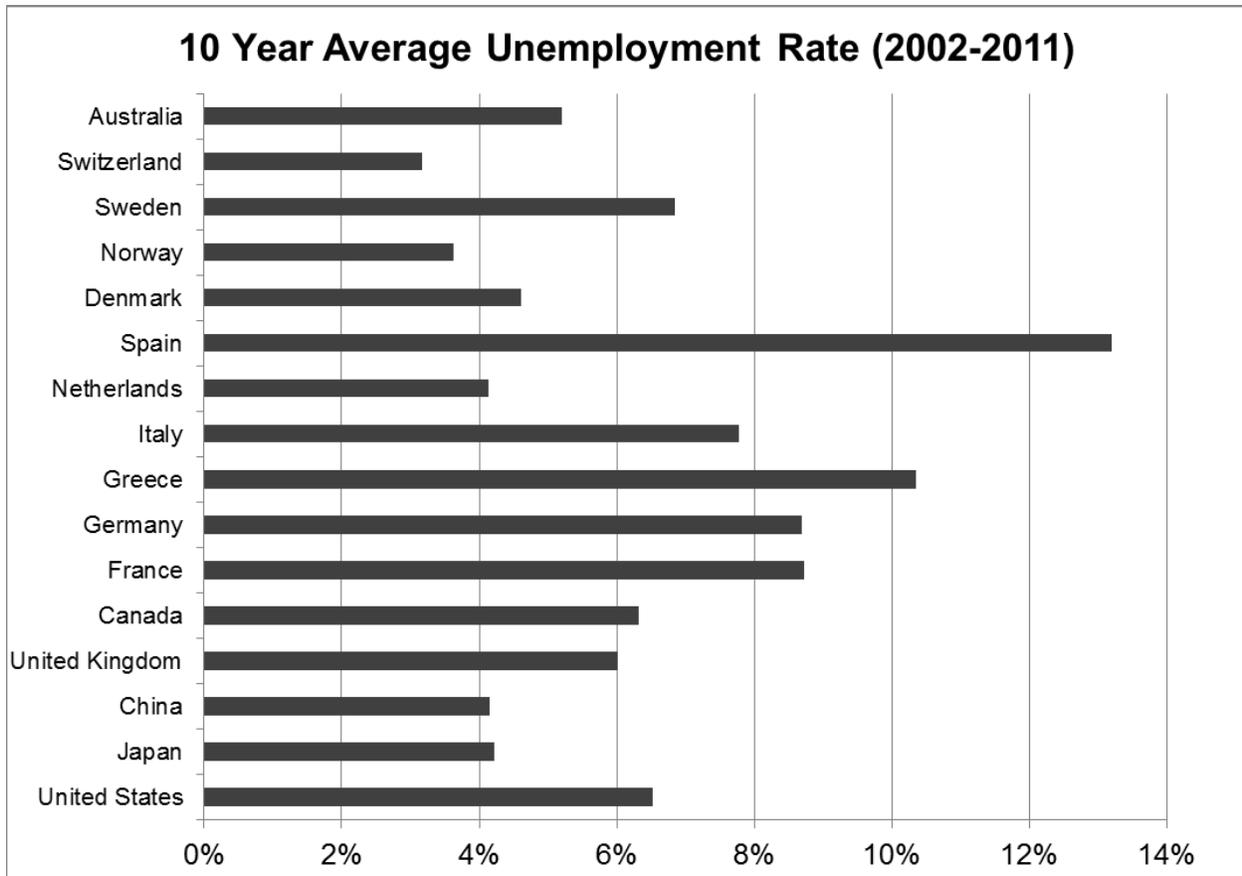
<b>Measure</b>	<b>Description</b>	<b>Rate</b>
U-1	Persons unemployed fifteen weeks or longer, as a percent of the civilian labor force.	3.0%
U-2	Job losses and persons who have completed temporary jobs, as a percent of the civilian labor force (excludes job leavers).	3.1%
U-3	Total unemployed, as a percent of the civilian labor force (official unemployment rate).	6.2%
U-4	Total unemployed, plus discouraged workers, as a percent of the civilian labor force plus discouraged workers.	6.6%
U-5	Total unemployed plus all marginally attached workers, as a percent of the civilian labor force plus all marginally attached workers.	7.5%
U-6	Total unemployed, plus all marginally attached workers, plus total employed part-time for economic reasons, as a percent of the civilian labor force plus all marginally attached workers.	12.0%

Source: Bureau of Labor Statistics

Marginally attached workers are those who currently are neither working nor looking for work but indicate that they want and are available for a job and have looked for work sometime in the recent past.

Persons employed part-time for economic reasons are those who want and are available for full-time work but have had to settle for a part-time schedule.

Note: U-4 measure includes all underutilized labor in U-3 category, U-5 includes all underutilized labor in U-4, and U-6 includes all underutilized labor in U-5.

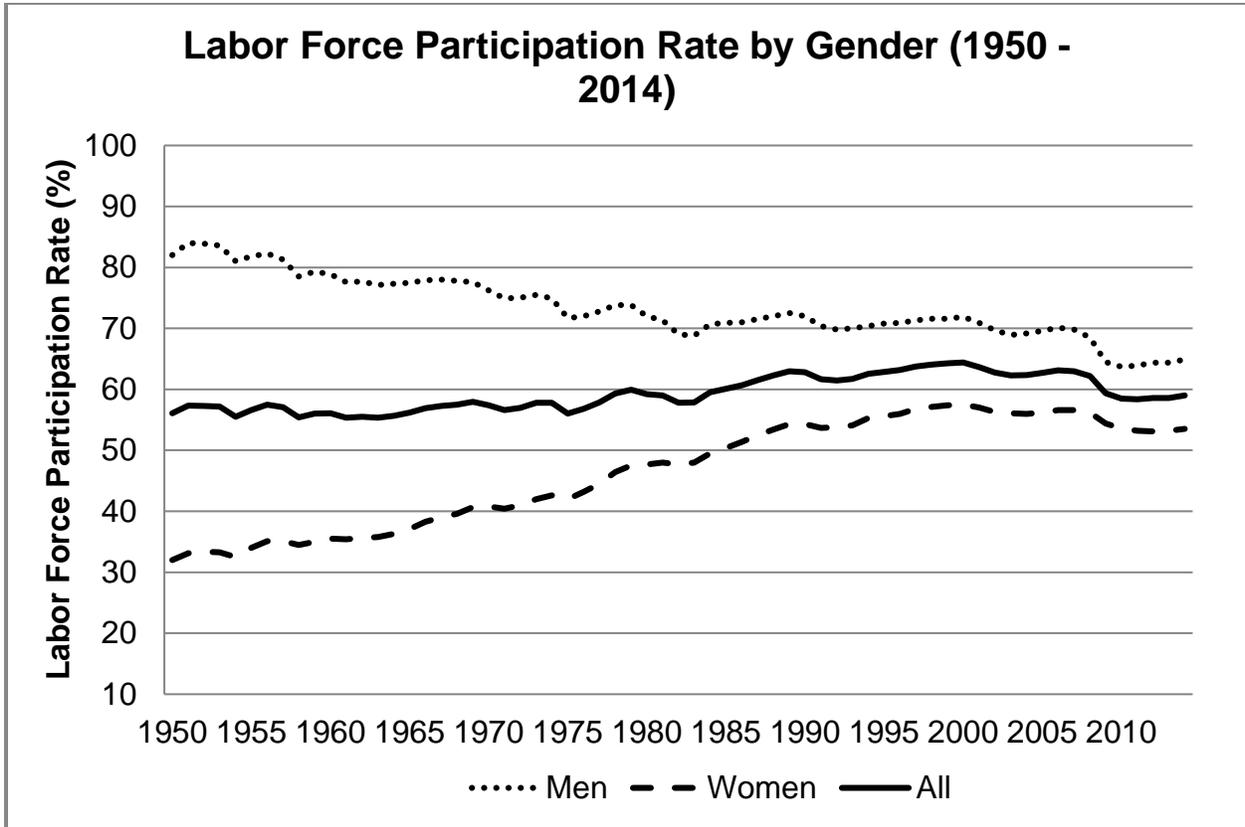


Source: TradingEconomics.com

- 10 year average reflects natural rate of unemployment.
- Northern and central European countries typically have lower rates of unemployment.
- Southern European countries typically have higher rates of unemployment
- The United States has low unemployment rates.
- Southeast Asia has low rates of unemployment.

## 2.2. Labor force participation rates

Women's role in American society has changed dramatically over the past century. Some of these changes can be attributed to technological change, such as washing machines, clothes dryers, refrigerators, freezers, and dishwashers, which have reduced the amount of time required to complete routine household tasks. Another change has been birth control, which has reduced the number of children born to the typical family. The family breadwinner has also changed. In the past, it was the male role to provide and the women role to raise children. From the figure below, it is clear that these roles are no longer assigned by gender.



Source: Bureau of Labor Statistics

#### 4. Unemployment Insurance

Most countries provide unemployment insurance or some form of government transfer payments to unemployed workers. In the United States, the Department of Labor's Unemployment Insurance (UI) programs provide unemployment benefits to eligible workers who become unemployed through no fault of their own, and meet certain other eligibility requirements.

- Base Period: Must have worked the first four out of the last five completed calendar quarters prior to filing claim.
- Payments: Benefits are based on a percentage of an individual's earnings over a recent 52-week period - up to a state maximum amount. Benefits can be paid for a maximum of 26 weeks in most states.
- Federal Unemployment Extensions: Permits some unemployed to receive benefits up to 99 weeks. The last payable week on this extension is December 29, 2012.

#### 5. In-class exercises

1. John is working part-time. Chris is on temporary layoff. Categorize their employment statuses using the Bureau of Labor Statistics' employment classification.

2. Mary owns her own business. Kristina is an unpaid worker in her family's business. Categorize their employment statuses using the Bureau of Labor Statistics' employment classification.

3. Which of the following are requirements for the Bureau of Labor Statistics to place someone in the "unemployed" category?

- a. The person must have been employed.
- b. The person must have been fired from their previous job.
- c. The person must have tried to find employment during the previous 4 weeks.
- d. The person must be available for work.
- e. C and D.

4. The Bureau of Labor Statistics announced that in February 2008, of all adult Americans, 145,993,000 were employed, 7,381,000 were unemployed, and 79,436,000 were not in the labor force. Use this information to calculate the:

- a. Adult population
- b. Labor force
- c. Labor-force participation rate
- d. Unemployment rate
- e. Compare the LFPR and unemployment rate in Exercise 3 of the lecture. Which one moves more? Why?

5. Write out the following equations and then explain what happens to each in the following scenarios.

Unemp rate = \_\_\_\_\_      LFPR = \_\_\_\_\_

	Unemp. Rate	LFPR
An auto company goes bankrupt and lays off its workers, who immediately start looking for new jobs		
After an unsuccessful search, laid-off workers quit looking for work.		
Numerous students graduate from college but cannot find work.		
Numerous students graduate from college and immediately begin new jobs.		
A stock market boom induces newly enriched 60-year-old workers to take early retirement.		
Advances in health care prolong the life of many retirees.		

6. Consider an economy with two labor markets– one for manufacturing workers and one for service workers. Draw supply and demand for labor graphs assuming that neither is unionized and both have the same equilibrium real wage.

- a. If manufacturing workers formed a union, what impact on the wages and employment in manufacturing would you predict?
- b. How would these changes in the manufacturing labor market affect the supply of labor in the market for service workers?
- c. What would happen to the equilibrium wage and employment in both labor markets?

7. If the natural rate of unemployment is 5.2 percent and the actual rate of unemployment is 5.7 percent, then by definition there is \_\_\_\_\_ (type of) unemployment in the amount of \_\_\_\_\_ percent of the labor force.

8. The Bureau of Labor Statistics predicts that the number of jobs for veterinary technicians will grow faster than most occupations while the number of jobs for telephone operators will decline. This change in the labor market could lead to \_\_\_\_\_ (type of) unemployment created by sectoral shifts.

9. Why is frictional unemployment inevitable?



## 1.2 Distinguishing one financial market from another

There are various ways financial markets are distinguished. One way is based on the maturity of instruments. Money markets deal with short-term debt instruments while capital markets deal in longer-term debt and equity instruments.

### Snapshot of various short-term instruments

Type of Instrument	Amount Outstanding (\$ billions, end of year)				
	1980	1990	2000	2008	2010
U.S. Treasury bills	216	527	647	1,060	1,773
Negotiable bank certificates of deposit (large denominations)	317	543	1,053	2,385	1,883
Commercial paper	122	557	1,619	1732	1,057
Federal funds and Security repurchase agreements	64	387.9	768.2	2,118.1	1,234

Sources: Federal Reserve Flow of Funds Accounts; Federal Reserve Bulletin; *Economic Report of the President*.

- U.S. Treasury bills: U.S. gov't debt that matures in less than one year.
- Negotiable CDs: Sold in the secondary market to others.
- Commercial paper: Issue by large banks and well-known corporations.
- Repos: Corporate short-term loans with treasury bills acting as collateral.

### Snapshot of various long-term instruments

Type of Instrument	Amount Outstanding (\$ billions, end of year)				
	1980	1990	2000	2008	2010
Corporate stocks (market value)	1,601	4,146	17,627	19,648	17,189
Residential mortgages	1,106	2,886	5,463	12,033	9,436
Corporate bonds	366	1,008	2,230	3,703	2,983
U.S. government securities (marketable long-term)	407	1,653	2,184	3,621	2,803
U.S. government agency securities	193	435	1,616	8,073	6,158
State and local government bonds	310	870	1,192	2,225	1,807
Bank commercial loans	459	818	1,091	1,605	1,031
Consumer loans	355	813	536	871	710
Commercial and farm mortgages	352	829	1,214	2,526	1,919

Sources: Federal Reserve Flow of Funds Accounts; Federal Reserve *Bulletin*. 2008. 3rd Quarter.

- Corporate bonds can be convertible. That is, they can be converted into stock.
- Mortgages is the largest debt market in the United States.
- Government securities are long-term debt, also known as U.S. Treasury bonds.
- State and local bonds are *municipal bonds* to build roads and schools.

Another way to distinguish the market is through the size of financial intermediaries. The table below captures a snapshot of financial institutions.

<b>Snapshot of financial institutions</b>					
<b>Type of Intermediary</b>	<b>Value of Assets</b>				
	<b>(\$ billions, end of year)</b>				
	<b>1980</b>	<b>1990</b>	<b>2000</b>	<b>2008</b>	<b>2010</b>
<b>Depository institutions (banks)</b>					
Commercial banks	1,481	3,334	6,469	12,272	14,336
Savings and loan associations and mutual savings banks	792	1,365	1,218	1518	1,244
Credit unions	67	215	441	801	912
<b>Contractual savings institutions</b>					
Life insurance companies	464	1,367	3,136	4,798	5,176
Fire and casualty insurance companies	182	533	862	1,337	1,242
Pension funds (private)	504	1,629	4,355	5,193	4,527
State and local government retirement funds	197	737	2,293	2,730	2,661
<b>Investment Intermediaries</b>					
Finance companies	205	610	1,140	1,910	1,439
Mutual funds	70	654	4,435	6,588	7,935
Money market mutual funds	76	498	1,812	3,376	2,755

*Source:* Federal Reserve Flow of Funds Accounts.

### **1.3. The purpose of financial intermediaries**

There are two main reasons for financial intermediaries:

## **2. Loanable Funds Theory**

The loanable funds theory models the credit (or borrowing/lending) market. Developed by Swedish economist Knut Wicksell (1851-1926), the loanable funds theory states that the interest rate is determined by the supply and demand for loans. This theory is based on the central idea that the financial system channels funds from savers to investors (borrowers) through a market for loans (also known as the credit/lending market). In this market, the interest rate is the price that investors pay savers for using their funds.

The loanable funds theory is obviously a simplification of reality

- There is one type of loan and one price.
- Savers lend directly to investors.
- Closed economy (for now) - no imports/export and no savings inflows/outflows.

### **2.1. The model setup**

#### **2.1.1. Demand for loans**

The demand for loans is equal to the level of investment in the economy. If investors decide to undertake more projects, they must borrow more. Aggregate demand for loanable funds can be segmented into two main components:

##### **1. Business Demand**

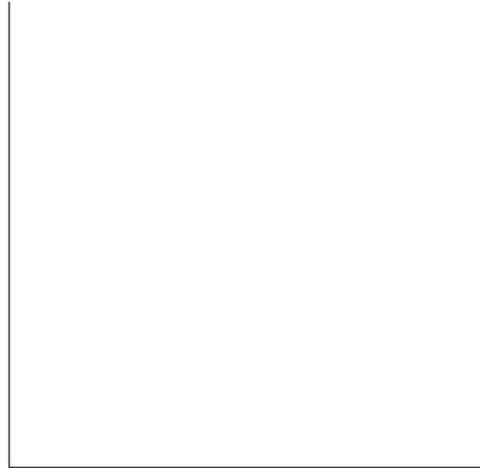
- This can be long-term borrowing for capital projects or short term financing of inventories and other short-term assets. Business demand for funds is usually procyclical.

##### **2. Household Demand**

- Although households are usually the net providers of loanable funds, they are also in the market as borrowers (the life cycle makes it possible to have dual personalities). They demand funds in many ways: mortgages, credit card debt, auto loans, etc.

The sum of their separate demands equals aggregate credit demand. The credit demand curve indicates the level of investment spending at various interest rates.

❖ Is the demand for funds downward sloping?



### 2.1.2. Supply of loans

The supply of loans in a closed economy is the level of savings (private and public) in the economy. Government spending/borrowing is largely interest-inelastic (i.e., not largely a function of prevailing interest rates). This is formulated as follows:

$$\underbrace{S}_{\text{National savings}} = \underbrace{Y - C - T}_{\text{Private savings}} + \underbrace{T - G}_{\text{Public savings}}$$

$T - G > 0$ : Government surplus

$T - G < 0$ : Government deficit

where  $C$  is consumption,  $G$  is government spending, and  $T$  is net taxes.

- Net taxes: taxes revenue minus cash transfer from the government.

Households are the largest suppliers of loanable funds, but by no means the only source. Businesses and governments also can be temporary suppliers. Internationally, Japan, the UK, and Germany have been large suppliers of funds to the United States. This is partially the result of a higher propensity to save in these countries. For example, U.S. personal savings rate is 5.4% of disposable income versus 22.3% in Japan.

❖ Is the supply for funds upward sloping?

Yes. This is easily understood by viewing the future value of \$1,000 in 3 years at alternative interest rates:

Interest rate	Future value
4%	\$1,127.27
5%	\$1,161.47
6%	\$1,196.68
7%	\$1,232.93
8%	\$1,270.24
9%	\$1,308.65
10%	\$1,348.18
11%	\$1,388.88
12%	\$1,430.77

As the interest rate goes up, the quantity supplied will also go up as more savers are enticed into the market.

**Households Net Worth, 2012**  
Trillions of dollars; not seasonally adjusted

<b>Assets</b>	<b>\$ 76.1</b>
Tangible Assets	\$ 24.2
Financial Assets	\$ 51.9
<b>Liabilities</b>	<b>\$ 13.4</b>
Financial	\$ 12.9
Government	\$ 0.6
<b>Net Worth</b>	<b>\$ 62.7</b>

Source: Federal Reserve.

**Historical Households Net Worth**  
Trillions of Dollars; Adjusted to 2010 Dollars

Year	1960	1970	1980	1990	2000	2010
<b>Assets</b>	<b>\$ 15.5</b>	<b>\$ 21.9</b>	<b>\$ 29.1</b>	<b>\$ 40.7</b>	<b>\$ 64.1</b>	<b>\$ 73.0</b>
Tangible Assets	\$ 5.2	\$ 7.9	\$ 11.6	\$ 16.2	\$ 21.4	\$ 23.4
Financial Assets	\$ 10.3	\$ 14.0	\$ 17.5	\$ 24.5	\$ 42.8	\$ 49.5
<b>Liabilities</b>	<b>-\$ 1.5</b>	<b>-\$ 2.8</b>	<b>-\$ 3.7</b>	<b>-\$ 6.2</b>	<b>-\$ 9.4</b>	<b>-\$ 13.7</b>
<b>Net Worth</b>	<b>\$ 14.0</b>	<b>\$ 19.1</b>	<b>\$ 25.4</b>	<b>\$ 34.5</b>	<b>\$ 54.7</b>	<b>\$ 59.3</b>
<b>Per Capita Net Worth (in 1,000s)</b>	<b>\$ 78.1</b>	<b>\$ 93.8</b>	<b>\$ 112.2</b>	<b>\$ 138.8</b>	<b>\$ 194.3</b>	<b>\$ 192.1</b>

### 2.1.3. Equilibrium

Savings and investment can be derived using the formula for GDP using the expenditure approach. For a closed economy, investment (I) is equal to savings (S).

$$Y = C + I + G + \underbrace{NX}_{=0}$$

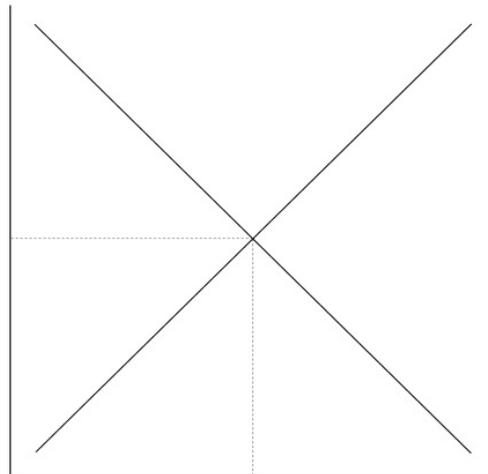
$$Y - T + T = C + I + G + \underbrace{NX}_{=0}$$

$$\underbrace{Y - C - T}_{\text{Private Savings}} + \underbrace{T - G}_{\text{Public Savings}} = I$$

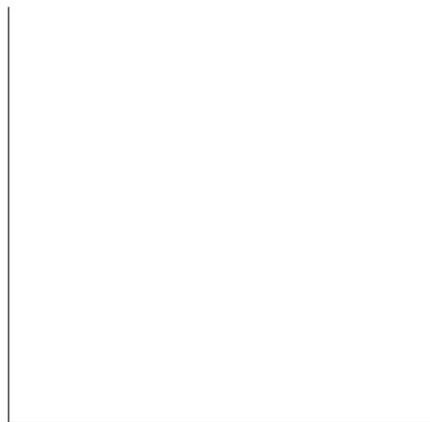
$$\text{Private Savings} + \text{Public Savings} = I$$

$$S = I$$

Graphically, the equilibrium interest rate in the loanable funds market is found at the crossing of the supply and demand curve for loanable funds.



- ❖ What happens if the interest rate is below the equilibrium interest rate?



## 2.2. Changes in demand and supply in the loanable funds model

Economists distinguish between shifts in supply and demand and movements along both curves. At this point with a few economic courses under your belt, this should be second nature.

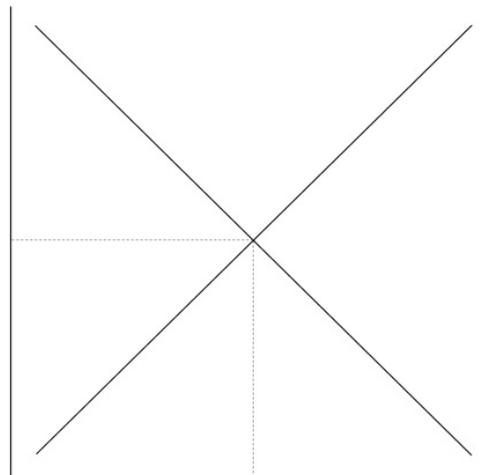
- A movement along the curves is caused by a change in the interest rate.
- A shift is caused by any reason other than a change in the interest rate.

### 2.2.1. Shifts in demand

The demand for loans shifts if a change occurs in the level of investment at a given interest rate. There are a number of reasons that cause demand to shift:

1. Profit expectations
  - a. New technology typically requires capitalization and increases demand.
  - b. Higher investor confidence increases demand.
2. Household's borrowing needs: If households grow more optimistic about the future, demand increases.
3. Government policy towards investing: tax incentives to invest increases demand.
4. Business cycle: During economic expansions, demand increases.

Exercise 1: Many new ideas require a substantial investment to get the product or service to market. Each idea increases the demand for loanable funds.

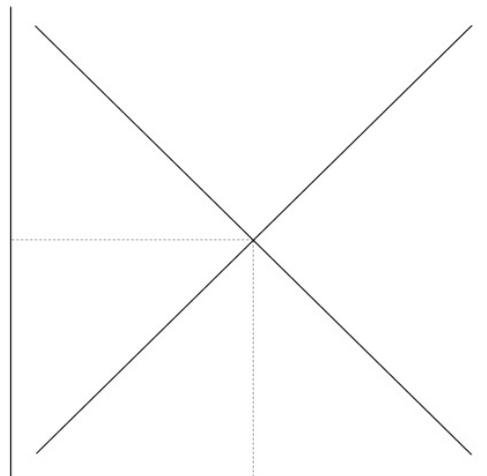


### 2.2.2. Shifts in supply (Savings)

The supply of loans shifts when a change occurs in the behavior of savings, public or private. There are several reasons why supply shifts:

- 1) Behavior of savers: increase in percentage of income saved increases supply.
- 2) Government budget deficit: increase in government deficits decreases supply
- 3) Government policy towards saving and consuming
  - a. Tax incentives to save increases supply.
  - b. Tax to consume increases supply.
- 4) Business cycle: during economic expansions, supply increases.

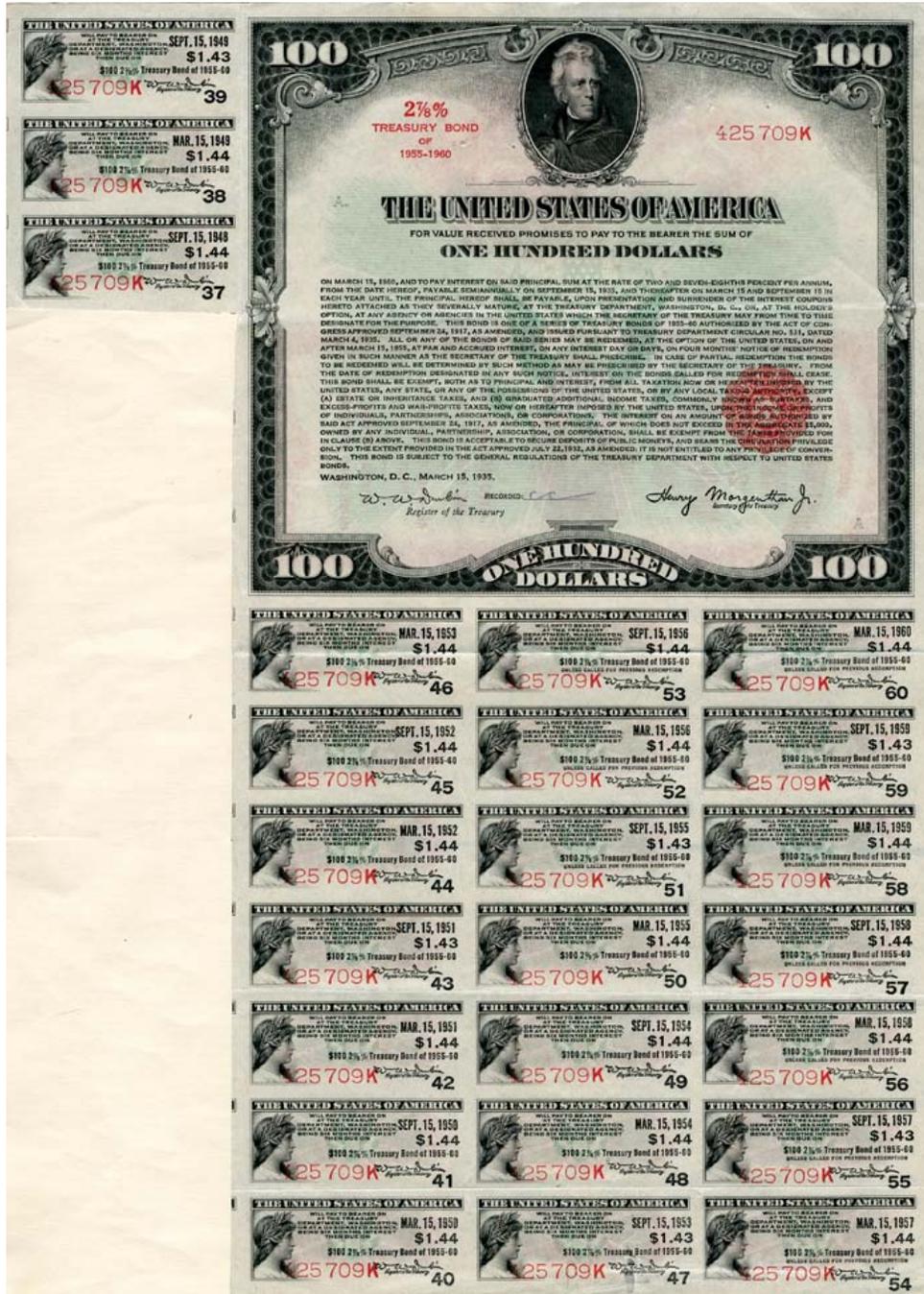
Exercise 2: A fall in private savings causes the supply curve for loanable funds to decrease.



U.S. private savings has fallen considerably over the years. The exact reasons why this has happened have not been established. There are correlations in the data which lend some support to why the private savings have fallen but it remains a puzzle. These are:

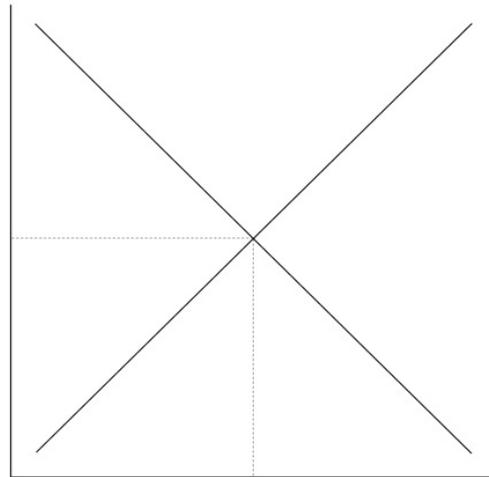
Shifts in public saving is identical to private saving except that it is dictated by government spending and revenue, i.e., the budget surplus or deficit. When the government's spending exceeds tax revenue, they must issue debt (if they don't want to print money). This is done by issue government bonds. A government bond is a debt contract that specifies: 1) the face value –

the amount of the debt, 2) interest rate to be earned on the debt, and 3) the maturity date - date to be paid the face value.



Some government debt is zero-coupon. That is, the government sells the bond below the face value and only pays the bondholder the face value at maturity.

Higher government debt today means either higher future taxes or reduced future spending when the government pays off the debt. This means that future welfare will be lower. Additionally, it also affects households and businesses today through increasing the interest rate at which they borrow as well.



One study by Thomas Lauback estimates that a rise in the forecasted deficit of 1 percent of GDP raises the interest rate by 0.25.

- ❖ Why does the United States seem to enjoy low interest rates when the deficit has ballooned over the last 10 years?

## 2.3. Effects of business-cycle expansions (and recessions) on interest rates

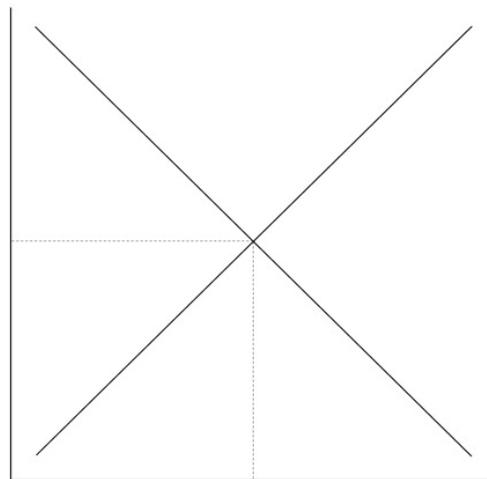
### 2.3.1 Expansions

New investments and savings tend to change depending on where the economy is in the business cycle. Generally speaking, demand picks up as the economy picks up. Businesses are more willing to invest in new products as the demand for goods and services tends to be higher during expansions, and households are more willing to purchase more credit financed purchases, such as cars and houses.

In an expansion:

1. Expected profits rise -> companies invest more -> demand for loanable funds increases.
2. Real GDP increases, so wealth increases -> private savings increases -> supply of loanable funds increases.

Exercise 3: What does the loanable funds theory predict will happen to interest rates during an expansion?



Empirical studies find that the demand shift is larger than the shift in supply.

- ❖ How do higher interest rates act as an automatic stabilizer during expansions?

#### **2.4. Which interest rate does the loanable fund theory predict?**

The loanable funds theory models investment and savings in the long-run and, thus, the long-run interest rate is determined. The short-run interest rate is determined by current financial and monetary conditions in the economy. It should also be noted that the risk level of the investments is constant.

#### **2.5. Criticism of the loanable funds model**

One of the biggest weaknesses of this model is that it is too simple - the market for loanable funds should be affected by other investment opportunities. This model fails to answer why demand increases when investors' confidence increases according to the model; it just does. We need another asset or assets to investigate how the demand for loanable funds increases when there is a change in:

- 1) liquidity of the alternative asset
- 2) risk of the alternative asset
- 3) expected return of the alternative asset
- 4) maturity of an alternative asset
- 5) taxation of an alternative asset
- 6) wealth

#### 4. In-class exercises

1. Classify each of the following as either savings or investment. Explain.

- a. Your family takes out a mortgage and buys a new house.
  
  
  
  
  
  
  
  
  
  
- b. You use your \$200 paycheck to buy stock in AT&T.
  
  
  
  
  
  
  
  
  
  
- c. Your roommate earns \$100 and deposits it in her account at a bank.
  
  
  
  
  
  
  
  
  
  
- d. You borrow \$1,000 from a bank to buy a car to use in your pizza delivery business.

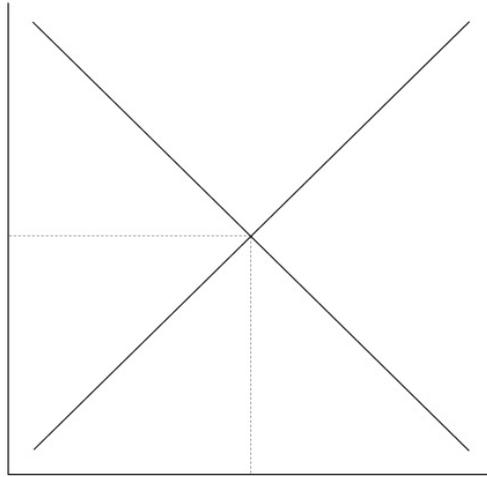
2. Suppose the economy is closed,  $EX = IM = NX = 0$ . Given the table below, determine

Y	\$11,000
T	\$2,500
C	\$7,500
G	\$2,000

- a. Private savings
  
  
  
  
  
  
  
  
  
  
- b. Public savings
  
  
  
  
  
  
  
  
  
  
- c. National savings

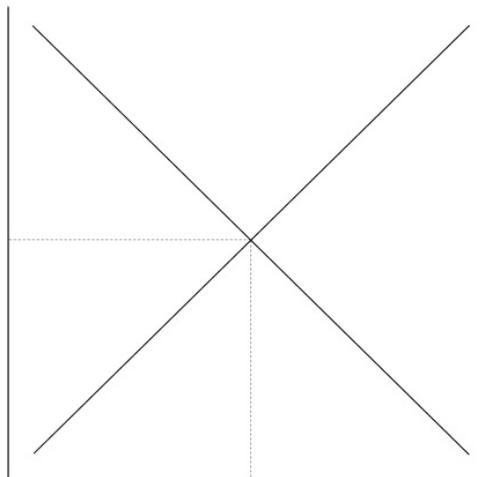
3. Suppose the government borrows \$20 billion more next year than this year.

- a. Use a supply-and-demand diagram to analyze this policy. Does the interest rate rise or fall?



- b. What happens to investment? To private saving? To public saving? To national saving?

- c. Suppose households believe that greater government borrowing today implies higher future income taxes to pay the debt in the future. What does this belief do to private saving and the supply of loanable funds today?



- d. Does it increase or decrease the effect you discussed in part a.?

4. Suppose the market for loanable funds is in equilibrium. Given the table below, determine:

Y	\$8 billion
T	\$1.5 billion
Private savings	\$0.5 billion
Public savings	\$0.2 billion

- a. National saving
  
  
  
  
  
  
  
  
  
  
- b. Investment
  
  
  
  
  
  
  
  
  
  
- c. Government purchases
  
  
  
  
  
  
  
  
  
  
- d. Consumption

5. Suppose the market for loanable funds is in equilibrium. Given the table below, determine:

GDP	\$100 billion
Consumption	\$65 billion
Taxes	\$20 billion
Transfers	\$5 billion
Government Spending	\$20 billion

- a. Public savings
  
  
  
  
  
  
  
  
  
  
- b. Private savings
  
  
  
  
  
  
  
  
  
  
- c. Quantity of loanable funds demanded

**Lecture 10: The Monetary System  
(CORRESPONDS WITH CHAPTER 11)**

**1. Introduction to money**

❖ What is money?

a) Layman's terms:

b) Economic terms:

For economists, money is a narrow class of assets with special properties. Money serves an economy with 3 fundamental functions: medium of exchange, unit of account, and store of value.

**1.1.1. Medium of exchange**

The medium of exchange is an asset, such as currency, that can be traded for goods and services. Money is not unique in this role, but is typically the most convenient.

The use of money, as a medium of exchange, promotes economic efficiency by minimizing the time spent in exchanging goods and services. If society did not use currency to exchange goods and services, then individuals would have to barter. Individuals must have a 'double coincidence of wants' to barter.

❖ What does 'double coincidence of wants' mean?

- The double coincidence problem is more severe in highly developed economies. These economies have a large number of goods and services, many of which are consumed by small parts of the population. Economic specialization makes bartering more difficult.

### 1.1.2. Unit of account

Money is a universal measure the value of goods, services, and assets in an economy. It is a yardstick to understand how much one good costs to another, i.e., the dollar amount is quoted and not the relative price of one good for another. An example is: the price of a shirt is quoted as \$20 and a burger is quoted as \$5; not 1 shirt costs 4 burgers.

Exercise 1: Suppose there are three goods, A,B, and C. Determine the number of prices in a barter economy. What happens to the number of prices if a fourth good, D, is included?

### 1.1.3. Store of value

Money is a repository of purchasing power over time, i.e., enables individuals to transfer purchasing power into the future. It disconnects the time income is received to when it must be spent. Money is not unique in this role; any asset can be used to store value or wealth. Examples include:

Many assets are superior to money in storing value given they can have multiple purposes and may appreciate in value over time.

❖ Why do individuals hold money?

❖ How well does money store value?

### 1.1.3.1. Deferred payment

Since money stores value, it also serves as a standard of deferred payment. Loans and future agreements are stated in monetary terms and the standard of deferred payment is what allows us to buy goods and services today and pay in the future.

### 1.2. What is and what isn't money?

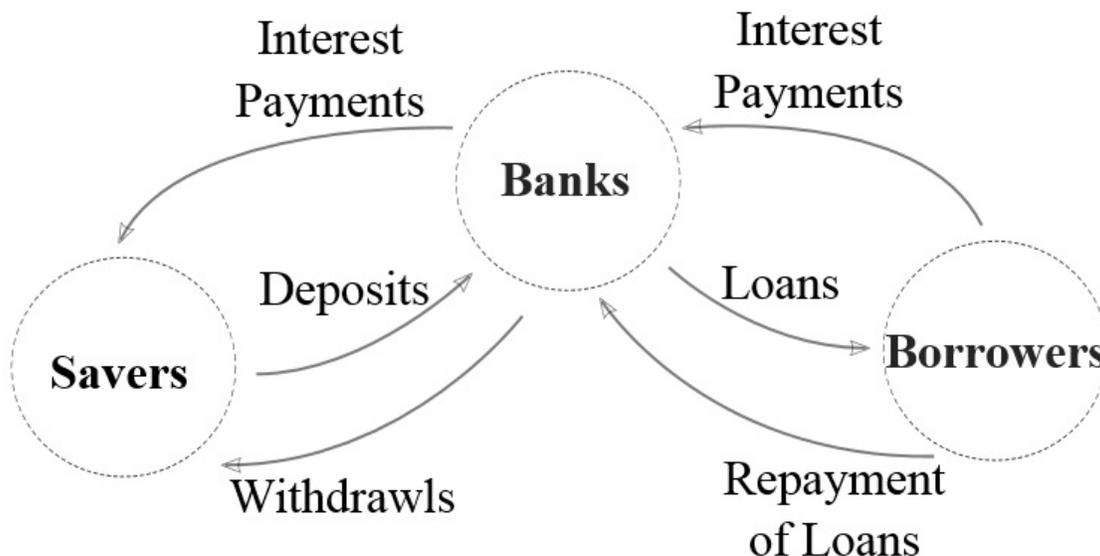
While money is the medium of exchange, there are many ways to purchase a good. For example, many Ebay purchases are conducted using Paypal. Does this mean that Paypal is money? What about checks, BillMeLater, debit and credit cards, and gift certificates?

Money can be loosely defined as anything that can be used for transaction purchases. The two biggest types of money used during transactions are currency and checking accounts. When debit cards, Paypal, and checks, most often these are linked to checking accounts.

Credit cards are not money. They are deferred payments or short-term loans.

## 2. The banking system

Over time, individuals have relied less on currency and more on their checking accounts to conduct transactions. Banks assist in making these payments. They accept deposits from savers and send off payments in your behalf. They also use some of these deposits (savings) to make loans.



### 2.0.1. Bank's balance sheet

Prior to studying monetary policy, it is important to understand how banks will be affected. Below is a bank's balance sheet. Notice that many Federal Reserve liabilities are bank's assets.

Banking System	
Assets	Liabilities

### 2.1. The federal reserve system

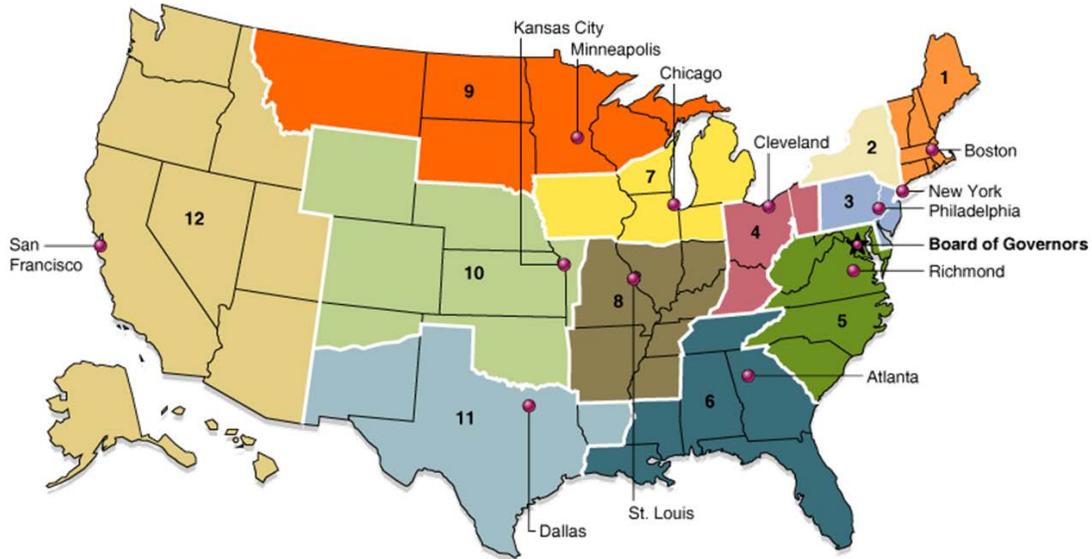
The interactions between banks are facilitated by a clearing house, a central bank. A central bank is an institution designed to oversee the banking system and regulate the quantity of money in the economy. In the United States, the central bank is the Federal Reserve, or the Fed.

There are three roles of the Federal Reserve:

1. Regulate banks and ensure the health of the financial system.
  - a. Check clearing: transmits checks between financial institutions.
  - b. Lender of last resort: lends to banks who cannot borrow anywhere else.
2. Control the money supply.
  - a. Decisions concerning the money supply are called *monetary policy*.
  - b. Effects short-term interest rates and inflation
3. Influence long-term interest rates and the market for loanable funds.

## 2.2. Organization and purpose of the federal reserve

The Fed was organized into 12 regional banks located in major cities and the Board of Governors in Washington, DC in 1913. This decentralized system was created to assure that regional areas could maintain control.



Source: Federal Reserve Bulletin.

The Federal Open Market Committee is a committee made up of seven members of the Board of Governors and five of the twelve regional Federal Reserve Bank presidents. This committee has the power to increase or decrease the money supply in the economy.

## 2.3. The Fed's balance sheet

The Fed influences the economy through the size and composition of its balance sheet.

Federal Reserve Bank			
Assets		Liabilities	
Securities	\$1,667 B	Currency	\$1,307 B
Loans to banks	\$0 B	Reserves	\$2,930 B
Other	\$2,570 B		
<b>Total</b>	<b>\$4,237 B</b>	<b>Total</b>	<b>\$4,237 B</b>

Source: Federal Reserve Board, February 2015 data.

### 2.3.1. The monetary base

The monetary base is equal to the total Federal Reserve liabilities. Equivalently,

$$MB = \text{Fed. Liabilities} = C + R$$

where  $MB$  is the monetary base,  $C$  is currency in circulation and  $R$  is reserves.

Exercise 2: Using the above balance sheet of the Federal Reserve, what is the current monetary base?

### 2.3.2. Reserves

There are two components of reserves, required reserves,  $RR$ , and excess reserves,  $ER$ .

1. Required reserves,  $RR$ , is the amount of deposits that must be held back by banks:

$$RR = rrr \times D$$

where  $D$  is the total amount of deposits and  $rrr$  is the reserve requirement ratio set by the Fed.

2. Excess reserves,  $ER$ , is the amount of deposits chosen to be held back as reserves by the bank in excess to  $RR$ .

Together, they sum to total reserves,  $R$ :

$$R = RR + ER$$

## 2.4. Controlling the monetary base

The central bank exercises control over the monetary base through three policy tools:

- 1) Open market operations: Purchase and sale of government securities.
- 2) Reserve requirement ratio (*rrr*): Percent of deposit that banks cannot loan out.
- 3) Discount rate: The interest rate a bank pays to obtain a loan from the Federal Reserve.

**Since the open market operation is the least volatile and will always affect the monetary base, it is the primary tool of the Fed.**

### 2.4.1. Open-market operations

The Fed can increase/decrease reserves of banks by buying/ selling of government securities, or a  $\Delta R$ .

When the Fed purchases a bond, they increase the money supply since they purchase the bond with dollars. This increases a bank's reserves and lending capabilities.

When the Fed sells a bond, they decrease the money supply since they are given dollars for the bond.

Exercise 3: Suppose the Fed buys a \$100,000 U.S. Treasury bond on the open market from the Bank of Bozeman. What happens to the balance sheets of the Fed and the Bank of Bozeman?

Federal Reserve Bank			
Assets		Liabilities	

Bank of Bozeman			
Assets		Liabilities	

- Increases liquidity in banking sector – a non-liquid asset (security) is traded for a liquid asset (currency).
- The bank can either:
  - Loan the currency out.
  - Store it as excess reserves.
- The monetary base increases by \$100,000.

### 2.4.2. Reserve requirement ratio

The Fed can affect the monetary base by change the required reserve ratio,  $rrr$ .

- When the Fed increases the required reserve ratio, bank reserves increase.
- When the Fed decreases the required reserve ratio, banks reserves decrease.

The required reserve ratio is seldom moved as it raises reserves for all banks simultaneously.

### 2.4.3. Discount rate

The discount rate is the interest rate the Fed charges on loans to banks

- When the Fed increases the discount rate, this may decrease bank reserves if banks are lending from the Fed.
- When the Fed decreases the discount rate, this may increase bank reserves if banks are lending from the Fed.

**All three monetary policy tools can influence the market for reserves. However, open market operations is used most often.**

## 3. Money creation process

The most transparent activities of a bank are accepting deposits and lending money out. However, what is not transparent is that this practice of lending a fraction of each deposit causes money.

The process described above is called *fractional reserve banking*. Fractional is used to indicate that only a fraction of deposits are held in reserve by banks to cover withdrawal liabilities while the remaining is lent to various businesses and households.

### 3.2. Money supply

When the central bank permits fractional reserve banking, money is created in the form of new deposits into the banking system and the amount of money in the economy grows. The money in the economy is:

$$M = C + D$$

where  $M$  is the money supply.

- Bank deposits, not currency, account for the vast majority of the money supply.
- If  $rrr = 1$ , then reserves is equal to required reserves, which also equals deposits.

### 3.1. Money creation process through fractional reserve banking

There is a five-step process that creates money:

1. Banks have excess reserves and decide to lend it out.
2. Banks decide to lend out excess reserves to individuals and businesses.
3. Borrowers use loans to purchase goods and services from businesses.
4. Business owners deposit proceeds in the bank.
  - a. Assume all funds are deposited into the bank.
5. Banks receive deposited funds.
  - a. Hold required reserves.
  - b. Must choose whether to hold remaining as:
    - i. Excess reserves (and not lend it out).
    - ii. Lend it out.
  - c. The money supply increases.

This process repeats itself until no more currency is left.

Exercise 4: Suppose an individual makes a deposit of \$100 into a bank and that  $rrr = 10\%$  and the bank loans out all excess reserves. What is the change in the money supply after the money creation process has finished?

Step 0: Start with the initial change in the banking system's balance sheet.

Banking System	
Assets	Liabilities

Step 1-2: A bank lends its excess reserves since the Fed only requires a fraction of the deposit to be held back for withdrawal liabilities.

Step 3: This money is spent purchasing goods and services.

Step 4: Proceeds from purchases are deposited into banks.

Step 5: Banks receive deposits and split it into required reserve and excess reserves.

After this process:

Banking System	
Assets	Liabilities

What is the change in the money supply?

$$\Delta M = \Delta C + \Delta D = \underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Cycle 2: If the bank decides to not hold excess reserves and loans out the \$81, then this process repeats. Repeat steps 1 – 5 using the above balance sheet.

ER: \$\_\_ -> L: \$\_\_ -> Businesses: \$\_\_ -> D: \$\_\_.  
 1) RR: \$\_\_  
 2) ER : \$\_\_

Banking System	
Assets	Liabilities

Cycle 3

ER : \$\_\_ -> L: \$\_\_ -> Businesses: \$\_\_ -> D: \$\_\_.  
 1) RR: \$\_\_  
 2) ER : \$\_\_

Banking System	
Assets	Liabilities

Cycle 4

ER : \$\_\_ -> L: \$\_\_ -> Businesses: \$\_\_ -> D: \$\_\_.  
 1) RR: \$\_\_  
 2) ER: \$\_\_

Banking System	
Assets	Liabilities

Below is a table showing the total amounts on the balance sheet after each cycle (for the first 7) and after the entire money creation process is complete.

<b>Process</b>	<b>Loans</b>	<b>ER</b>	<b>RR</b>	<b>Deposits</b>
Initial deposit	\$0.00	\$90.00	\$10.00	\$100.00
Cycle 1	\$90.00	\$81.00	\$19.00	\$190.00
Cycle 2	\$171.00	\$72.90	\$27.10	\$271.00
Cycle 3	\$243.90	\$65.61	\$34.39	\$343.90
Cycle 4	\$309.51	\$59.05	\$40.95	\$409.51
Cycle 5	\$368.56	\$53.14	\$46.86	\$468.56
Cycle 6	\$421.70	\$47.83	\$52.17	\$521.70
Cycle 7	\$469.53	\$43.05	\$56.95	\$569.53
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
After many iterations...	\$900.00	\$0.00	\$100.00	\$1,000.00

Using the banking system's balance sheet, the \$100 deposit creates:

<b>Banking System</b>	
<b>Assets</b>	<b>Liabilities</b>

1. The change in the money supply ( $\Delta C + \Delta D$ ) is:  $-\$100 + \$1000 = \$900$ .
  - a. \$100 is taken out of circulation and put into the banking system.
  - b. Currency in the banking system slowly decreases as it is converted into reserves.
  - c. Bank deposits increase and equal \$1,000.
  
2. The change in the monetary base ( $\Delta C + \Delta R$ ) is:  $-\$100 + \$100 = \$0$ .
  - a. \$100 is taken out of circulation and put into the banking system.
  - b. Reserves increase by \$100.

### 2.2.2. The money multiplier

The increase in deposits generated is referred to as the *money multiplier* and is equal to:

$$m = \frac{1}{rrr}$$

Using the money multiplier, the money creation process can be summarized as:

$$D = m \times (R - ER)$$

Exercise 5: Suppose an individual makes a deposit of \$100 into a bank and that  $rrr = 10\%$  and  $ER = 0$  (Same as Exercise 4). After the money creation process has finished:

1. What is the money multiplier?
2. What is the change in deposits?
3. What is the change in the monetary base?
4. What is the change in the money supply?

Exercise 6: Suppose  $rrr = 10\%$ ,  $ER = 0$ , and a bank sells a security to the Fed for \$100. After the money creation process has finished:

1. What is the money multiplier?
2. What is the change in deposits?
3. What is the change in the monetary base?
4. What is the change in the money supply?

Exercise 7: Suppose  $rrr = 11\%$  and  $ER = \$50$ .

1. What is the money multiplier?
2. What is the change in the money supply if an individual deposits a \$100 in currency and the bank loans it out?
3. What is the change in the money supply if a bank sells a \$100 asset to the Federal Reserve and the bank loans it out?

#### **4.1. Multiple deposit destruction**

Similar to multiple deposit creation, multiple deposit destruction is when the Fed pulls money out of the economy by buying securities. The money pulled out of the economy destroys some bank reserves causing total bank deposits, and hence the money supply, to decrease.

- When the Fed decreases the level of bank reserves by selling a bond to a bank and collecting payment by debiting the bank's reserve account, the banking system will have negative excess reserves, a reserve deficiency. Any bank with a reserve deficiency will call in loans for repayment or will have to borrow from the Fed or other banks.
- Their creditors will repay the loans by drawing down their checking accounts.
- The volume of loans and deposits will shrink at the same time.

#### **4.2. A real-world money multiplier**

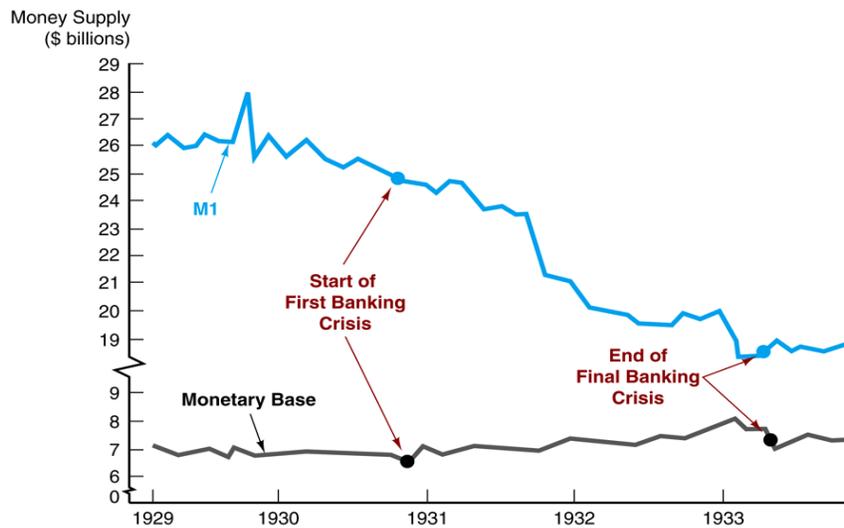
The above analyses assume that loans are fully deposited by business owners back into the banking system.

1. Businesses (and the public) may hold some of the funds as currency.
2. Causes a reduction in money creation. The result is that a real-world money multiplier is about  $m = 2$  for a  $rrr = 0.1$ .

## 5. The great depression and great recession

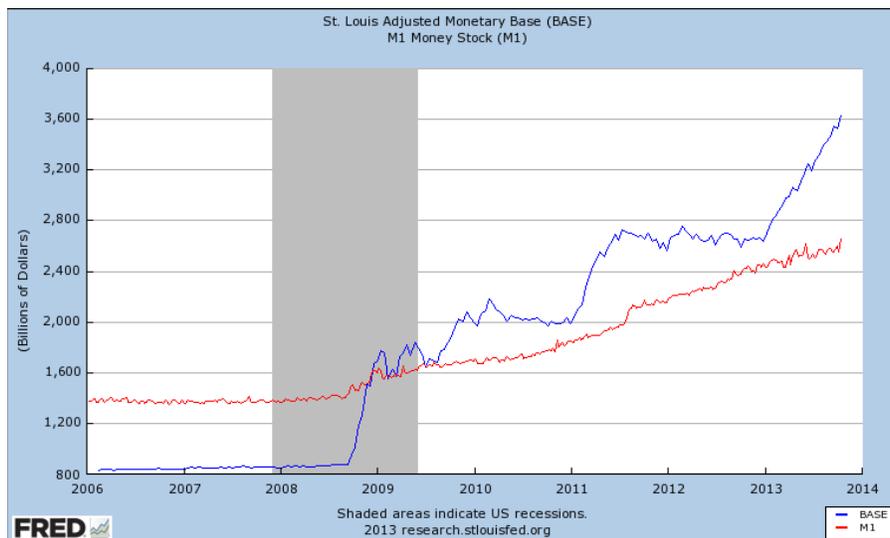
The money multiplier tends to fall during recessions. During the Great Contraction of 1929-33 (Great Depression), the money supply fell by about 25% due to a drop in the money multiplier. A related reason was the huge number of bank failures caused, in large part, by the many runs on the bank by depositors who were trying to convert their deposits into cash. Those bank failures directly and severely reduced the level of bank deposits, a key component of the money supply.

The Federal Reserve could have stimulated the banking industry by providing more reserves, but didn't. At Milton Friedman's 90<sup>th</sup> birthday, Ben Bernanke, President of the Federal Reserve Bank at the time, publicly apologized for the Fed causing the Great Depression.



Source: Milton Friedman and Anna Jacobson Schwartz, *A Monetary History of the United States, 1867–1960* (Princeton, NJ: Princeton University Press, 1963), p. 333.

In contrast, the Great Recession of 2008 wasn't nearly as bad as the Great Depression. The money multiplier fell rapidly and would have led to a substantial decline in the money supply had the Fed not intervened through a doubling of the monetary base.



**6. In-class exercises**

1) Your uncle repays a \$100 loan from a bank by writing a \$100 check from his checking account. Use T-accounts to show the effect of this transaction on your uncle and on the bank. Has your uncle's wealth changed?

<b>Before: Uncle</b>	
<b>Assets</b>	<b>Liabilities</b>

<b>After: Uncle</b>	
<b>Assets</b>	<b>Liabilities</b>

<b>Before: Bank</b>	
<b>Assets</b>	<b>Liabilities</b>

<b>After: Bank</b>	
<b>Assets</b>	<b>Liabilities</b>

2) A bank holds \$250 million in deposits,  $rrr = .1$ , and the bank holds no excess reserves.

a. Fill-in the T-account for the bank.

<b>Assets</b>	<b>Liabilities</b>
Reserves	Deposits
Loans	

b. What happens to reserves and deposits if a customer withdraws \$10M?

c. Fill in the balance sheet with the reduction in deposits. Write in the new reserve amount post-withdrawal. Show its new T-account if the bank decides to restore its reserves by reducing loans.

<b>Assets</b>	<b>Liabilities</b>
Reserves	Deposits
Loans	

d. Why might it be difficult for the bank to take the action described in part (c)? What are other ways for the bank to return to meet its reserve require?

3) Suppose that the Bank of Bozeman has the following balance sheet and due to poor management, loans are only valued at \$679.

<b>Bank of Bozeman</b>			
<b>Assets</b>		<b>Liabilities</b>	
Securities	\$200	Deposits	\$800
Loans	\$700	Bank capital	\$25
Required Reserves	\$50	Discount Loans	\$225
Excess Reserves	\$100		

- a. Given that a bank's assets must equal its liabilities, how can the bank rectify the situation?
  
- b. What is the bank's leverage ratio before and after the change in loan value? *Hint:*  
 $LR = \text{Assets} / \text{Bank Capital}$

4)

<b>Bank's System</b>			
<b>Assets</b>		<b>Liabilities</b>	
Reserves	\$100,000	Deposits	\$500,000
Loans	\$400,000		

- a. Assume the Fed's reserve requirement is 5% and no one holds currency. How much is *ER* and *MS* using the above balance sheet?
  
- b. Assume, in addition, that all banks only hold required reserves. If the bank loans out its remaining excess reserves, by what amount does money supply increase?

5) During the Great Recession, the Fed conducted a series of quantitative easing (*QE*). This entailed the Fed purchasing \$600 billion in U.S. bonds from businesses, pension funds, and other bond holders (non-banks). Does this have an effect on the money supply?

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## Lecture 11: Money Growth and Inflation (CORRESPONDS WITH CHAPTER 12)

### 1. Introduction to inflation

An increase in the overall level of prices is called *inflation*. Earlier in the semester we examined how economists measure the inflation rate as the percentage change in the CPI, the GDP deflator, or some other price index.

The average rate of inflation in the United States has been around 4% per year over the last century. This leads to about a sixteenfold increase in the price level per 100 years. Inflation may seem natural and inevitable but, in fact, it is not. Inflation is a consequence of monetary policy.

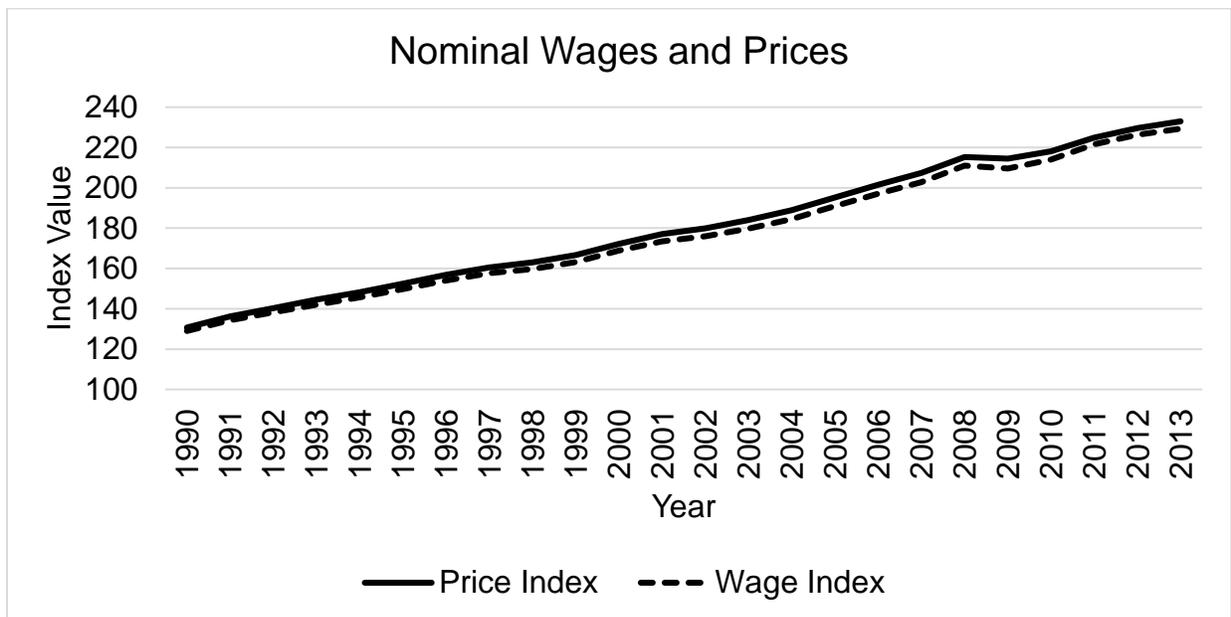
### 2. The classical theory of inflation

An increase in the price level occurs when:

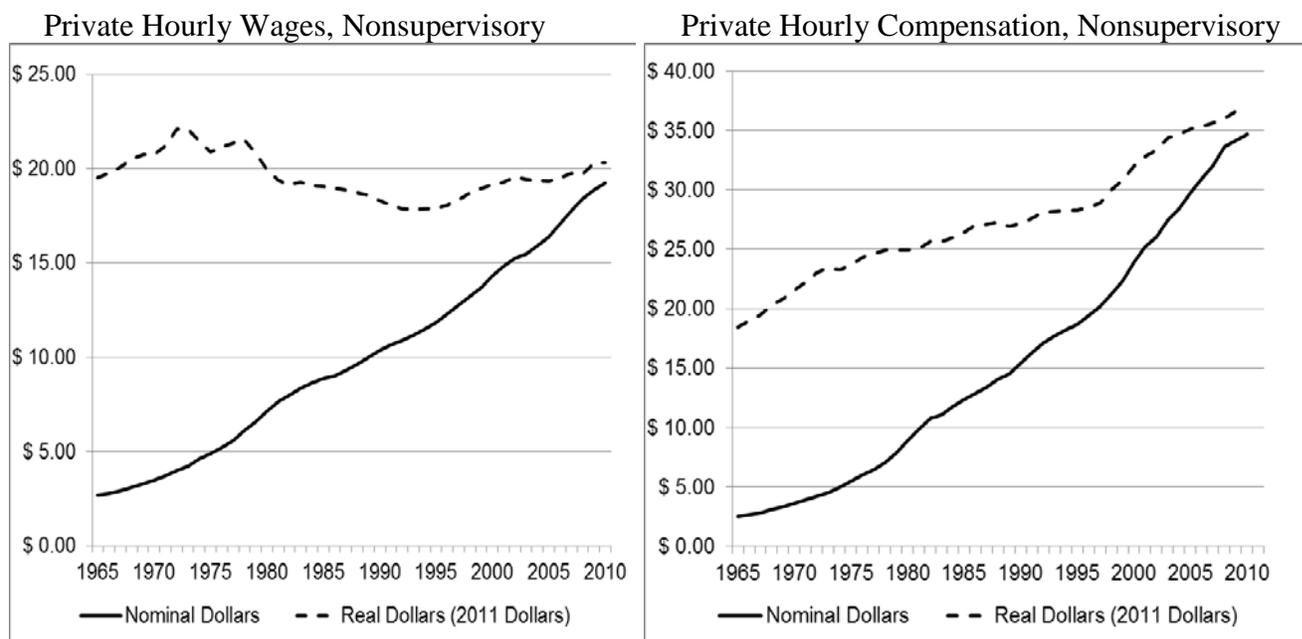
1. The demand for goods and services increases.
2. Money becomes less valuable.

**Inflation is more about the value of money than about the value of goods. That is, inflation concerns the value of the economy's medium of exchange.**

Many individuals believe inflation causes a loss of purchasing power. This is false! Remember that every dollar of expenditure for one person is a dollar of income for someone else. Furthermore, when inflation is persistent, wages/compensation are index for inflation.



Source: Bureau of Labor Statistics



Source: Bureau of Labor Statistics

- Estimations of hourly wages adjusted for cost-of-living shows that wages have fallen in real terms from the 1960s while hourly compensation has risen.

Exercise 1: A worker's hourly wage is \$12. If inflation doesn't cause a loss of purchasing power, then what happens to the hourly wage when the aggregate price level doubles?

## 2.1. The quantity theory of money

An open market purchase operation may cause inflation. To understand the effects of an open market operation, we use the *exchange equation* that provides a mathematical relationship between the amount of nominal money in an economy,  $M_t$ , the velocity of money,  $V_t$ , the price level,  $P_t$ , and real GDP,  $Y_t$  in year  $t$ . That is,

$$M_t \times V_t = P_t \times Y_t$$

The velocity of money is defined as how many times each dollar is used to purchase all of the goods in the economy.

❖ What is  $P_t \times Y_t$ ?

Exercise 2: Suppose that in 2014 there is \$1T in circulation and the current value of output is \$16T. What is velocity?

The exchange equation can also be expressed in terms of growth rates:

$$g(M) + g(V) = \underbrace{g(\text{Price})}_{\pi} + g(\text{RGDP})$$

Under the assumption that changes in the rate of velocity are small ( $\approx 0$ ), then:

$$g(M) = \pi + g(\text{RGDP})$$

The above suggests that money growth leads to:

- Higher prices
- Economic growth

Exercise 3: Suppose the Federal Reserve has set money growth equal to 4%, but U.S. RGDP is only growing at a rate of 3%. What will happen to the price level?

Exercise 4: Suppose the Federal Reserve has set money growth equal to 4%, but U.S. RGDP is only growing at a rate of 0%. What will happen to the price level?

mon

### 2.1.2. Money growth and inflation

Economic variables can be divided into *nominal* and *real* categories. Most economists think that in the long-run inflation only affects nominal variables. That is, monetary policy does not affect real economic variables. This line of reasoning is the classical dichotomy called *monetary neutrality*.

- Monetary neutrality states that changes in the money supply do not affected real economic activity. Using the above exchange equation:

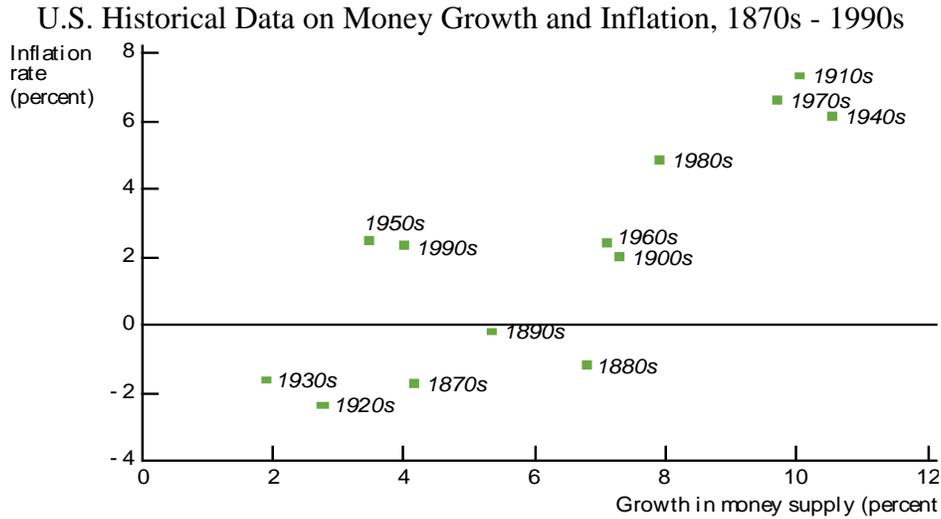
$$\uparrow g(M) \not\Rightarrow \uparrow g(\text{RGDP})$$

$$\uparrow g(M) \Rightarrow \uparrow \pi$$

Exercise 4: Which of the following are ‘real’ and which are ‘nominal’ variable. Which of the following are likely to be affect by changes in the money supply in the long-run if monetary neutrality holds?

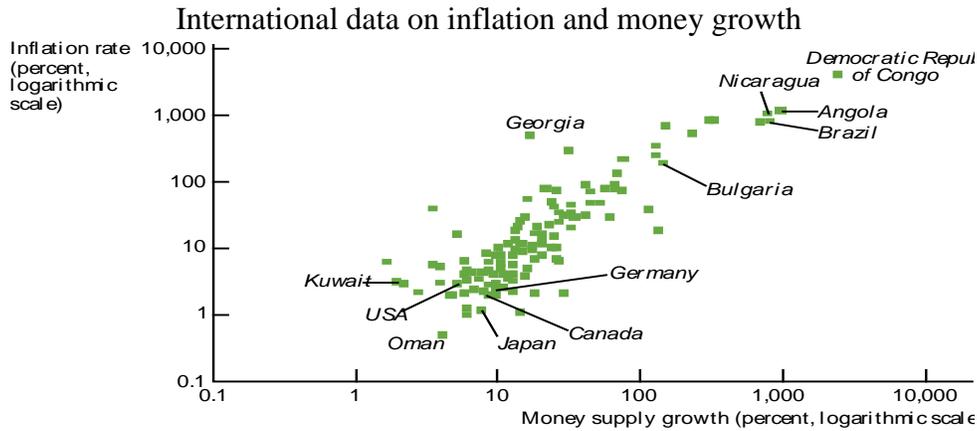
	<u>A real variable</u>		<u>Affected by changes in Money Supply?</u>	
a) Quantity of output	Yes	No	Yes	No
b) Output price	Yes	No	Yes	No
c) 30-year mortgage interest rate	Yes	No	Yes	No
d) Real interest rate	Yes	No	Yes	No
e) Economic growth	Yes	No	Yes	No

### 2.1.3. Empirical evidence of money neutrality in the long-run



- Data indicates positive relationship between money growth and inflation.

International data support the same conclusion that rapid growth in the money supply leads to rapid increases in the price level, typically 1 for 1.



Source: Adapted from Thomas J. Sargent, "The End of Four Big Inflation," in Robert Hall, ed., Inflation (Chicago: University of Chicago Press, 1983), pp. 41-93.

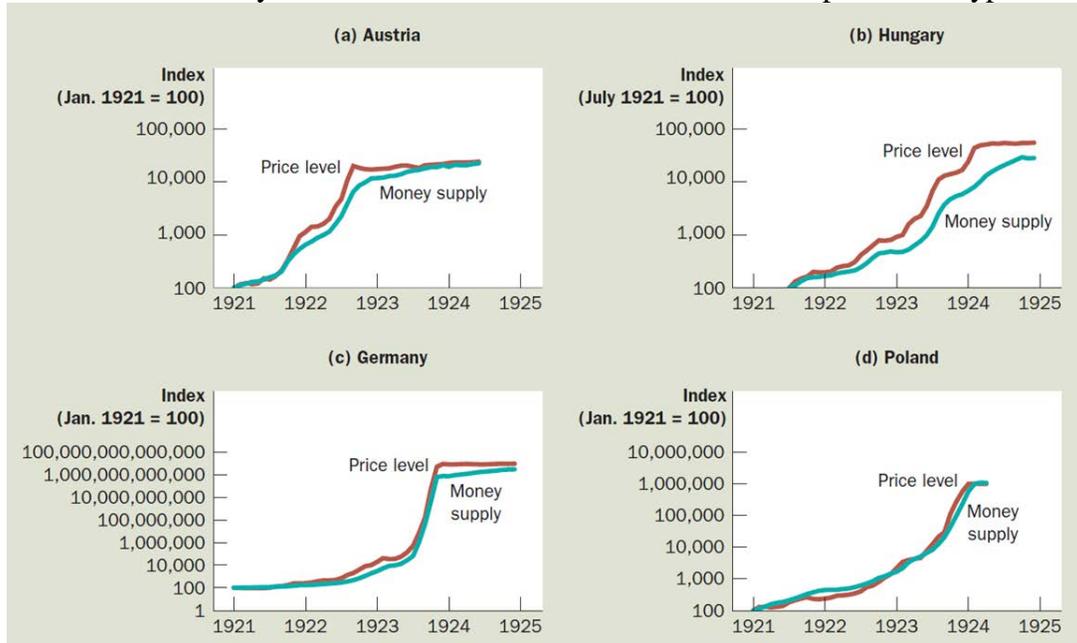
- Rapid growth in the money supply leads to hyperinflation.

## 2.2. Hyperinflation

Economies run efficiently with moderate inflation and firms can index wages to the price level and if inflation is persistent, but predictable. However, an economy breaks down with hyperinflation – inflation that exceeds 50% per month. This translates into a more than 100 fold increase in prices per year.

Hyperinflation is caused by rapid expansions in the money supply. As soon as the growth in the money supply stops, then inflation stops as well. This is why inflation is not inevitable and is avoidable.

The graphs on the following page show four economies that sustained hyperinflation during the 1920s. These are in no way inclusive of all the economies that have experienced hyperinflation.



Source: Adapted from Thomas J. Sargent, "The End of Four Big Inflation," in Robert Hall, ed., *Inflation* (Chicago: University of Chicago Press, 1983), pp. 41-93.

- Logarithmic scale of prices is equivalent to percentage change in price.
- Notice that the price level and money supply move 1-for-1 in hyperinflation economies.

To understand the rapid change in prices in hyperinflation economies, the table below provides the price of a newspaper over 3 year in Germany during 1921-23.:

Newspaper Prices (Marks)	
Germany, 1921-23	
January, 1921	0.30
May, 1922	1.00
October, 1922	8.00
February, 1923	100.00
September, 1923	1,000.00
October 1, 1923	2,000.00
October 15, 1923	20,000.00
October 29, 1923	1,000,000.00
November 9, 1923	15,000,000.00
November 17, 1923	70,000,000.00

Source: Adapted from Thomas J. Sargent, "The End of Four Big Inflation," in Robert Hall, ed. *Inflation* (Chicago: University of Chicago Press, 1983), pp. 41-93.

### **3. Consequences of inflation**

#### **3.1. Shoeleather costs**

The cost of reducing money holdings is called *shoeleather costs* of inflation because one must make more frequent trips to the bank causing wasted time and inconvenience to keep less money on hand than one would if there was no inflation.

#### **3.2. Menu costs and relative-price variability**

Firms change prices infrequently because there are associated costs (both on producers, as they need to update all prices, and on consumers, since search costs go up). The cost of constantly adjusting prices is called *menu costs*. Inflation increases these costs.

#### **3.3. Redistribution of wealth**

If inflation is unanticipated, then redistribution of wealth occurs in favor of those who have borrowed money. This is due to the fact that the real value of debt depends on inflation over the time period of borrowing. If lenders do not suspect inflation to be high, then they will offer lower interest rates to borrowers than otherwise. If these loans are locked in at a given interest rate and inflation occurs, then the real value of the debt decreases and borrowers are able to pay off the loan more easily. The exact opposite occurs with deflation.

*Notice that loss of purchasing power is not a consequence of inflation.*

### 3.4. Tax distortions

Inflation causes individuals to pay higher taxes than they otherwise would. One example is fixed tax brackets. If there is a progressive tax structure in the economy, individuals go into higher tax brackets due to their nominal income rising with inflation.

A second example is the discouraging of savings from higher taxes with inflation. The real after-tax return (in percent) is defined as:

$$r_{AT} = i(1 - \tau) - \pi \quad \text{if inflation is small } (<10\%)$$

$$r_{AT} = \frac{i(1 - \tau) - \pi}{100\% + \pi} \quad \text{if inflation is large } (\geq 10\%)$$

Exercise 5: Solve for the real after-tax interest rate for each of the follow economies.

	Variables	Stable economy	Inflationary economy
Real interest rate	$r$	4%	4%
Inflation rate	$\pi$	0%	8%
Nominal interest rate	$i$		
After-tax nominal interest rate (25%)	$i(1 - \tau)$		
After-tax real interest rate	$r_{AT}$		

#### 4. Why can't some governments stop printing money?

The government's budget constraint is:

$$G_t = T_t + B_t + M_t$$

where government spending ( $G_t$ ) can be financed three ways:

- 1)  $T_t$ : Taxes
- 2)  $B_t$ : Issue new debt
- 3)  $M_t$ : Print currency

When a government cannot tax individuals or sell new debt in the form of government bonds, it must finance spending by printing money.

- In theory, the solution to hyperinflation is simple: stop printing money.
- In the real world, this requires drastic and painful fiscal restraint.

Printing money can be thought of as a tax on individuals. When the government generates revenue by printing money, it levies an implicit inflation tax.

- The inflation tax is not exactly like other taxes because no one receives a tax bill from the government.
- When the government prints money, the price level rises, and the currency in circulation becomes less valuable. Thus, instead of taxing individuals to decrease their income, printing money causes the value of their money to decrease.
- The *revenue* generated from printing money is called *seigniorage*.

Printing money causes double taxation in many developed countries with a tax system:

- 1) The devaluation of money caused by increased price level.
- 2) Higher taxes paid due to being pushed into higher tax brackets.



3. Suppose that Julia bought a parcel of land in 1975 and then sold it in 2005. The current tax rate is 35%.

	1975	2005
Price of land	\$25,000	\$100,000
Price index	250	500

Compute the after-tax real return.

## Lecture 12: Open-Economy Macroeconomics: Basic Concepts (CORRESPONDS WITH CHAPTER 13)

In this lecture we will discuss the basic concepts of open economy and, in particular, the trade balance, the capital balance, and exchange rates.

### 1. Introduction

- ❖ Why does the United States have a trade deficit?

$$Y = C + I + G + \underbrace{NX}_{EX - IM}$$

$$Y - C - G = I + NX$$

$$Y - C - T + T - G = I + NX$$

$$\underbrace{Y - C - T}_{\text{Private Savings}} + \underbrace{T - G}_{\text{Public Savings}} = I + NX$$

$$S - NX = I$$

- If  $I > S$ , then  $NX < 0$ .
- Is this bad for an economy?

#### 1.1. International flow of goods and services

We first analyze the flow of goods and services between countries.

Domestic residents buy foreign goods/services	(↑ <i>IM</i> )
Foreign residents buy domestic goods/services	(↑ <i>EX</i> )

Net exports is the difference between the real value of exports and the real value of imports:

$$NX = EX - IM$$

Net exports is also called *the trade balance*.

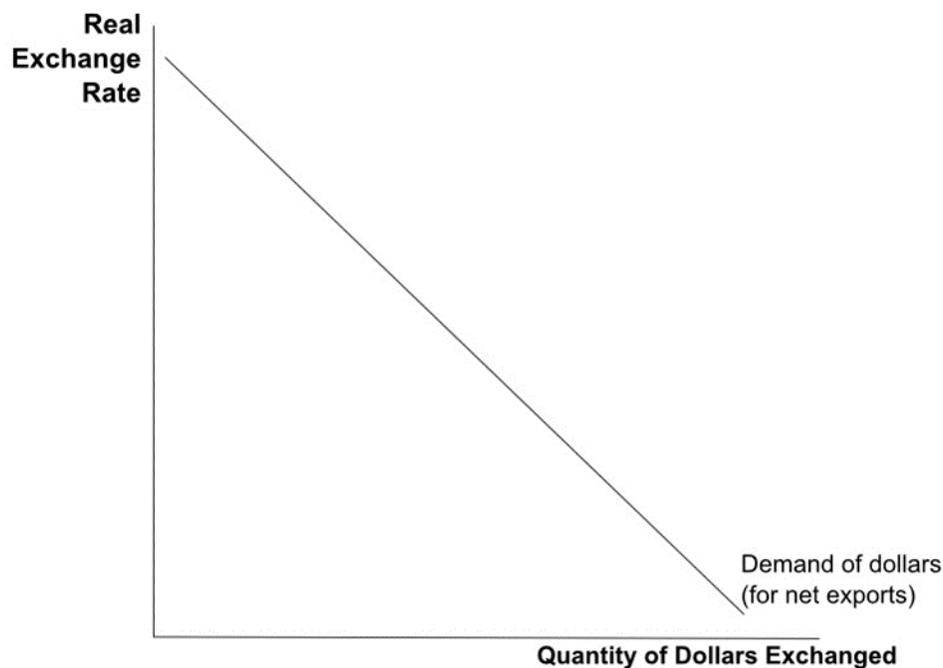
- A trade surplus indicates that  $NX > 0$ . Trade is positively imbalanced.
- A trade deficit indicates that  $NX < 0$ . Trade is negatively imbalanced.
- Balanced trade is when  $NX = 0$ .

Exercise 1: How would the following transactions affect U.S. exports, imports, and net exports?

- a. An American art professor spends the summer touring museums in Europe.
- b. Students in Paris flock to see the latest movie from Hollywood.
- c. Your uncle buys a new Kia.
- d. The student bookstore at Oxford University in England sells a pair of Levi's 501 jeans.
- e. A Canadian citizen shops at a store in northern Vermont to avoid Canadian sales taxes.

## 1.2. Factors that influence net exports

The largest factor that influences net exports is the relative price of domestic and foreign goods and services, called the *real exchange rate*. The figure below represents foreigners' demand for domestic dollars to buy export goods and services.



- As the real exchange rate rises, export goods become more expensive to foreigners and their quantity demanded of domestic dollars decreases.
- As the real exchange rate falls, export goods become cheaper to foreigners and their quantity demanded of domestic dollars increases.

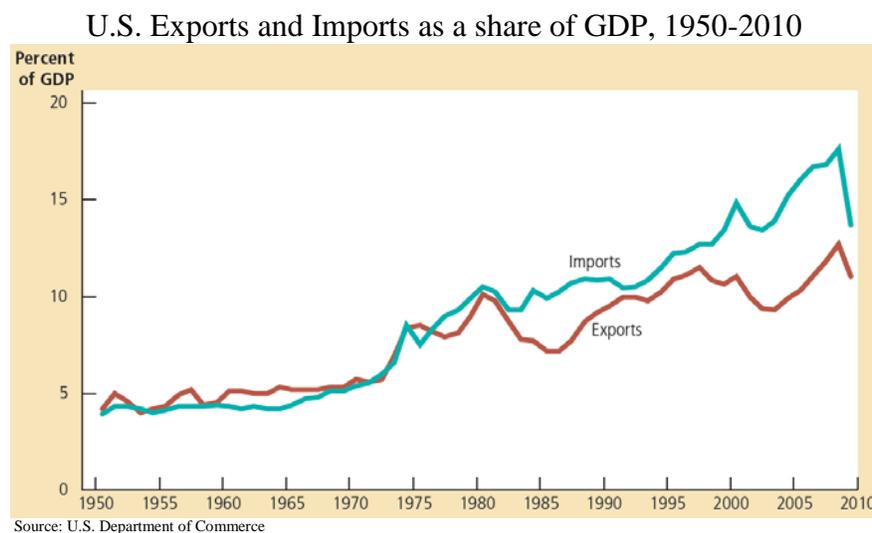
### 1.2.1. Shifts in the demand for dollars

The following factors shift the  $NX$  curve.

1. Consumer preferences for domestic/foreign goods.
2. Domestic and foreign incomes.
3. Trade policies (e.g., tariffs, quotas).

### 1.3. Size of U.S. trade

The size of trade for the United States is significant relative to its size and has grown over the last three decades.



- As of 2008, the largest trading partners of the U.S., as measured by combined imports and exports, were China, Canada, Mexico, Japan, Germany, and the United Kingdom.

#### 1.3.1. Determinants of trade volume

The volume of trade (both  $EX$  and  $IM$ ) is affected by:

1. Cost of transporting goods from country to country.
  - a. Ships are much larger (10K tons of cargo in 1950s to 100K tons of cargo today).
  - b. Air transportation of goods is cheaper.
  - c. Type of goods produced has changed (e.g., lighter, more compact).
2. Cost of trade (e.g., telecommunications).

## 2. International flow of capital

Just like imports and exports, individuals buy (and sell) foreign assets. These assets include stocks, bonds, land, factories, etc.

### Buying of assets

Domestic resident buys foreign asset: Capital Outflow increases ( $\uparrow CO$ )

Foreign resident buys domestic asset: Capital Inflow increases ( $\uparrow CI$ )

### Selling of assets

Domestic resident sells foreign asset: Capital Outflow decreases ( $\downarrow CO$ )

Foreign resident sells domestic asset: Capital Inflow decreases ( $\downarrow CI$ )

The flow of financial resources is measured as net capital outflow (NCO) and measures the change in financial resources flowing in and out of a country.

$$NCO = CO - CI$$

### 2.1. Interpreting net capital outflows

- When net capital outflow is positive, domestic residents are buying more foreign assets than foreigners are buying domestic assets. Capital is flowing out of the country.
- When net capital outflow is negative, domestic residents are buying fewer foreign assets than foreigners are buying domestic assets. The country is experiencing a capital inflow.

### The flow of capital can take two forms

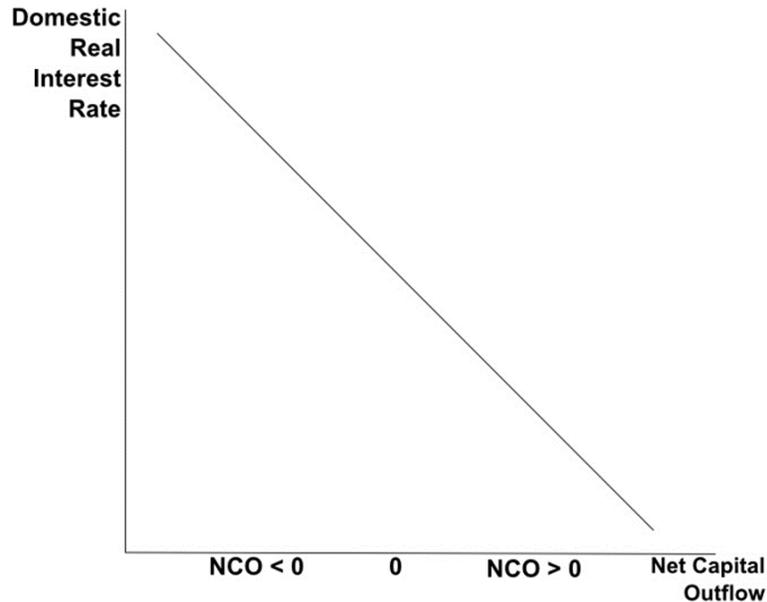
1. Foreign direct investment: capital owned and operated by a foreign entity.
2. Foreign portfolio investment: capital owned by foreign entity, but operated by domestic residents.

Exercise 2: State whether each of the following involves foreign direct investment or foreign portfolio investment. State how each would affect U.S.'s  $CI$ ,  $CO$ , and  $NCO$ .

- a. An American cellular phone company establishes an office in the Czech Republic.
- b. Harrod's of London in the UK sells stock to the U.S. General Electric pension fund.
- c. Honda (Japanese) expands its factory in Maryville, Ohio.
- d. The U.S. Fidelity mutual fund sells its Volkswagen stock (foreign) to a French investor.

## 2.2. Influences on NCO

The biggest factor that influences *NCO* is the domestic real interest rate being paid on domestic assets. Holding the foreign real interest rate constant (and all other influences), as the domestic real interest rate increases, owning domestic assets is more attractive, and *NCO* decreases. This forms a negative relationship.



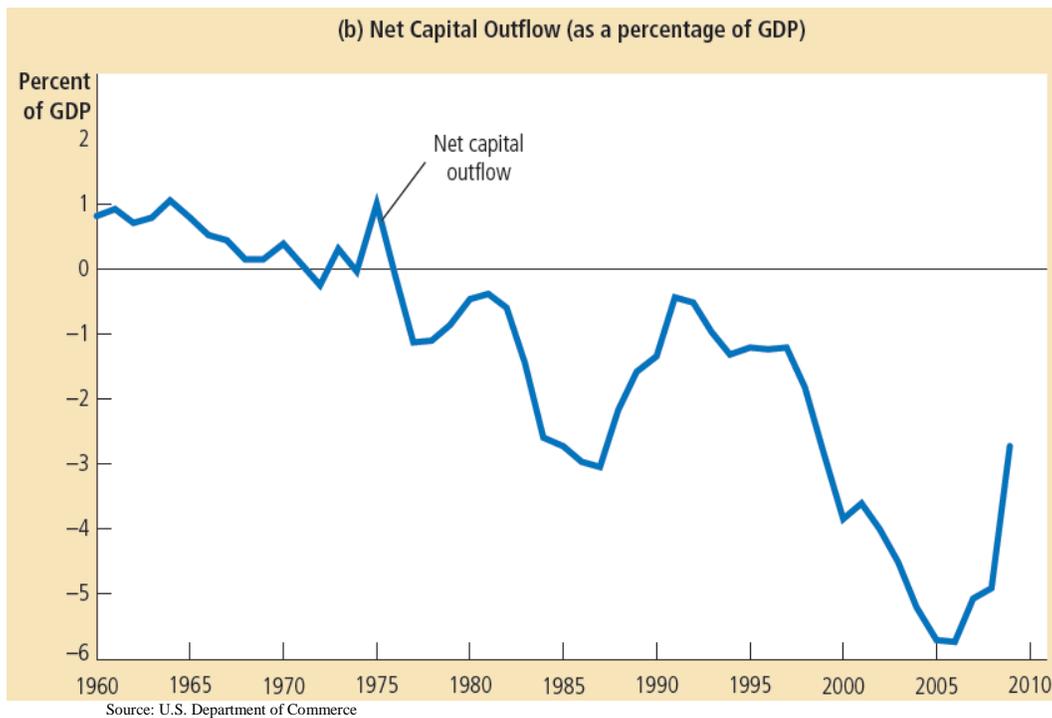
- The downward slope of the NCO curve above demonstrates the negative relationship between the domestic real interest rate and the quantity demanded for foreign assets.

### 2.2.1. Shifts in NCO

The following are factors that shift the *NCO* curve.

1. Foreign real interest rates.
2. The expected rate of currency appreciation between countries.
3. The perceived economic and political risks of holding assets abroad.
  - a. Government policies that affect foreign ownership of domestic assets.
4. Preferences over foreign capital ownership.

### 2.3. Size of U.S. Net Capital Outflow



- In the 1960s, domestic residents were buying more foreign assets than foreign residents were buying domestic assets
- Since 1975, foreigners buy more domestic assets than domestic resident buy of foreign assets.

### 3. Relationship between $NX$ and $NCO$

We have seen that open economies interact with the rest of the world in two ways – in world markets of goods and services and in world capital markets. Net exports and net capital outflow each measure a type of imbalance in a world market.

- Net exports measures the imbalance between a country's exports and imports in world markets for goods and services.
- Net capital outflow measures the imbalance between the amount of foreign assets bought by domestic residents and the amount of domestic assets bought by foreigners in world financial markets.

An important but subtle accounting fact is

$$NCO = NX$$

The imbalance between exports and imports of goods and services must be equal to the imbalance between the purchase and sale of capital assets abroad.

Exercise 3: Suppose that imports from the US to Mexico equal \$12T MXN, exports from Mexico to the US equal \$1T, and the exchange rate is 1 USD per 6 MXN. What is the value of  $NX$  for Mexico in USD? How is  $NX$  financed?

When a country runs a trade deficit ( $NX < 0$ ), it is spending more on foreign goods and services than it is earning from selling goods abroad.

- This spending must be financed by selling domestic assets abroad ( $NCO < 0$ ).

When a country runs a trade surplus ( $NX > 0$ ), foreigners are buying more domestic goods and services than domestic residences are buying foreign goods and services.

- What are domestic residences doing with the excess foreign currency they are getting?
  - They must be buying foreign assets ( $NCO > 0$ ).

Exercise 4: A U.S. consumer wants a \$100 program from China. The Chinese seller is willing to accept USD.

- ❖ What is the asset in this scenario? \_\_\_\_\_
- ❖ What is the good and who is selling it? \_\_\_\_\_

Goods exchanged

U.S perspective

EX	
IM	
NX	

Capital exchanged

U.S perspective

CO	
CI	
NCO	

**$NX = NCO = -\$100$**

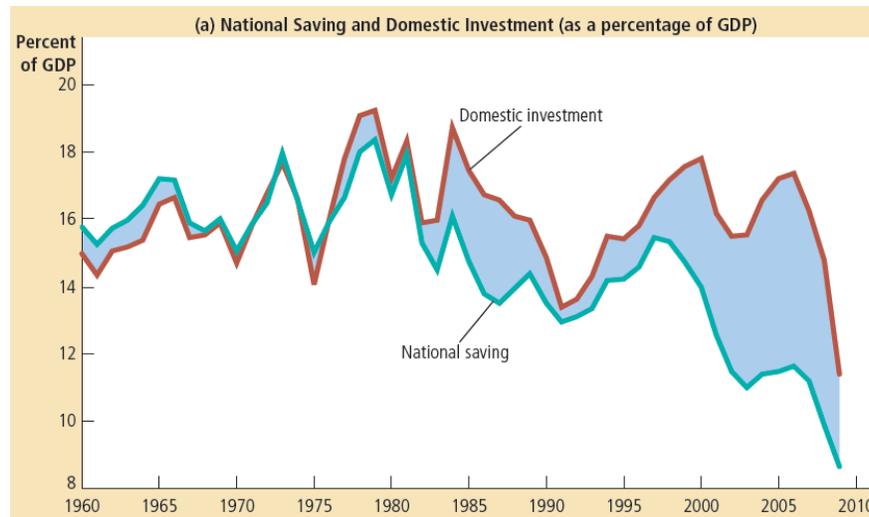
**End result:** U.S. has the Chinese good valued at \$100 USD and China has \$100 U.S. asset.

### 3.1. Understanding the relationship S, I, NX, and NCO

We can use the *GDP* expenditure equation along with  $NX = NCO$  to demonstrate the relationship between savings, investment, and NCO:

$$S = I + NCO$$

A country's savings may be either invested domestically (*I*) or abroad (*NCO*).



Since NCO is negative since 1975, this implies that  $I > S$ .

### 3.2. Summarizing the relationships

The relationships can be summarized as follows:

<b>Trade Deficit</b>	<b>Balanced Trade</b>	<b>Trade Surplus</b>
Exports < Imports	Exports = Imports	Exports > Imports
Net Exports < 0	Net Exports = 0	Net Exports > 0
Savings < Investment	Savings = Investment	Savings > Investment
Net Capital Outflow < 0	Net Capital Outflow = 0	Net Capital Outflow > 0

## 4. Exchange rates

### 4.1 The nominal exchange rates

If you have traveled to another country then most likely you exchanged currency to purchase goods in that country. The nominal exchange rate is the relative price of two countries' currencies. For example:

12 pesos per 1 USD

When a currency appreciates, the value of that currency increases as measured by the amount of foreign currency it can buy. When a currency depreciates, the value of that currency decreases as measured by the amount of foreign currency it can buy. When the U.S. dollar appreciates against a particular currency, that currency must depreciate against the dollar.

There are many sources available to find out the exchange rates between countries. For example, *The Economist* prints the nominal exchange rate in the back of each magazine they print.

	Nominal Exchange Rate		
	Currency Units per USD		
	Apr 8, 2015	1 year ago	10 year average
Britain	0.67	0.60	0.60
Euro	0.93	0.72	0.75
Switzerland	0.97	0.88	1.05
Canada	1.25	1.09	1.08
Singapore	1.36	1.25	1.39
Saudi Arabia	3.75	3.75	3.75
Hong Kong	7.75	7.75	7.77
South Africa	11.80	10.50	8.2
Mexico	14.90	13.10	12.3
Russia	53.60	35.70	30.7
Indonesia	12,962	11,255	9,827

Source: The Economist and <http://www.oanda.com/currency/historical-rates/>

#### 4.1.2. Determinants of the nominal exchange rate

Exchange rates are determined by inflation, technology, trade policies, savings, and investment.

- When the nominal exchange rate changes so that each domestic dollar buys more foreign currency, the dollar is said to appreciate or strengthen.
- When the nominal exchange rate changes so that each domestic dollar buys less foreign currency, the dollar is said to depreciate or weaken.

## 4.2. The real exchange rate

When goods or services are purchased abroad, individuals tend to do mental calculations to determine if they are getting a good deal or not. The real exchange rate is the relative price of two countries' goods. For example:

2 bushels of Mexican corn per 1 bushel of American corn.

### 4.2.1. Calculating the real exchange rate

The real exchange rate ( $RER$ ) for foreign goods with respect to domestic goods depends on the nominal exchange rate ( $NER$ ) and on the prices of goods in the two countries measured in the local currencies:

$$RER_{f,d} = NER \times \frac{price_d}{price_f}$$

where  $price_d$  is the domestic price of the good and  $price_f$  is the foreign price of the good.

- $RER > 1$ : consumers can buy more foreign goods/services than domestic goods/services.
- $RER = 1$ : parity in prices across countries. The law of one price holds.
- $RER < 1$ : consumers can buy more domestic goods/services than foreign goods/services.
- *Monetary neutrality* implies that inflation affects nominal but not the real exchange rates. This is because both the NER and foreign have the same magnitude of change when the inflation occurs.

Exercise 5: Suppose that the price of Mexican corn is 50 pesos/bushel, the price of American corn is \$10/bushel, and the nominal exchange rate: \$1 = 10 pesos. What is the real exchange rate for US corn?

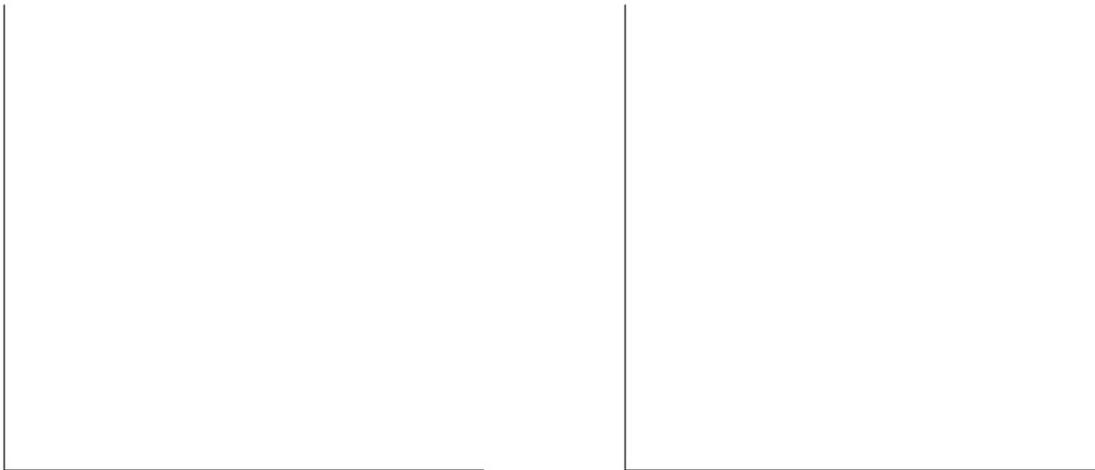
### 4.3. Purchasing power parity

Purchasing power parity is a theory of exchange rates whereby a unit of any given currency should be able to buy the same quantity of goods in another country. Purchasing-power parity means that the nominal exchange rate between the currencies of two countries will depend on the ratio of prices between two countries.

$$NER = \frac{\text{price}_f}{\text{price}_d} \text{ when } \underbrace{RER = 1}_{\text{Law of one price}}$$

- If a good sells for less in one location than another, a person might be able to make a profit by buying the good in the location where it is cheaper and selling it in the location where it is more expensive.
- The process of taking advantage of differences in prices for the same item in different markets is called *arbitrage*.
- Note what will happen as people take advantage of the differences in prices. The price in the location where the good is cheaper will rise (because the demand is now higher) and the price in the location where the good was more expensive will fall (because the supply is greater). This will continue until the two prices are equal.

Exercise 6: Draw supply and demand graphs to demonstrate the equalization of prices across countries.



- ❖ What assumptions must hold for the law of one price to prevail?

## 5. In-class exercises

1. Would each of the following transactions be included in U.S. net exports or net capital outflow? Be sure to say whether it would represent an increase or a decrease in that variable.

- a. An American buys a Sony TV.
- b. An American buys a share of Sony stock.
- c. The Sony pension fund buys a bond from the U.S. Treasury.
- d. A worker at a Sony plant in Japan buys some Georgia peaches from an American farmer.

2. Holding national saving constant, does an increase in net capital outflow increase, decrease, or have no effect on a country's accumulation of domestic capital? *Hint:  $S = I + NCO$*

3. Would each of the following groups benefit or not if the U.S. dollar appreciated? Explain.

- a. Dutch pension funds holding U.S. government bonds.
  
- b. U.S. manufacturing industries.
  
- c. Australian tourists planning a trip to the United States.
  
- d. An American firm trying to purchase property overseas.

4. What is happening to the U.S. real exchange rate in each of the following situations? Explain.

- a. The U.S. nominal exchange rate is unchanged, but prices rise faster in the United States than abroad.
  
- b. The U.S. nominal exchange rate is unchanged, but prices rise faster abroad than in the United States.
  
- c. The U.S. nominal exchange rate declines, and prices are unchanged in the United States and abroad.
  
- d. The U.S. nominal exchange rate declines, and prices rise faster abroad than in the United States.

5. Some researchers have studied purchasing-power parity for several countries using the price of Big Macs, a well-known tasty sandwich from McDonalds. Here are data for a few countries.

- a) For each country, compute the predicted exchange rate of the local currency per U.S. dollar. (Recall that the U.S. price of a Big Mac is \$4.20.)

Country	Price of a Big Mac		Price <sub>d</sub> / Price <sub>f</sub>		Nominal exchange rate	
Indonesia	22,534	rupiah		\$/rupiah	9,160	rupiah/\$
Hungary	645	forints		\$/forints	246	forints/\$
Czech Republic	70.22	korunas		\$/korunas	20.4	korunas/\$
Brazil	10.25	real		\$/real	1.81	real/\$
Canada	4.73	CAD		\$/CAD	1.02	CAD/\$

- b) What is the real exchange rate between the above countries and the United States?

Country	RER = NER * Price <sub>d</sub> / Price <sub>f</sub>	Units
Indonesia		
Hungary		
Czech Republic		
Brazil		
Canada		

- c) According to purchasing-power parity, does the law of one price hold in all countries?

## **Lecture 13: A Macroeconomic Theory of the Open Economy (CORRESPONDS WITH CHAPTER 14)**

In the last lecture we found that differences in national savings and domestic investment can cause a trade and capital imbalances. In this lecture we will discuss a theory that explains how government policies affect an open economy.

### **1. Introduction**

In this lecture we will highlight the forces that determine the economy's trade balance and exchange rates. In one sense, the model is simple: it applies the tools of supply and demand to an open economy. Yet, the model is also more complicated than others we have seen because it involves looking simultaneously at two related markets: the market for loanable funds and the market for foreign-currency exchange.

These two markets are central to the macroeconomics of open economies.

- In the market for loanable funds, the real interest rate adjusts to balance the supply of loanable funds (from national saving) and the demand for loanable funds (from domestic investment and net capital outflow).
- In the market for foreign-currency exchange the real exchange rate adjusts to balance the supply of dollars (from net capital outflow) and the demand for dollars (for net exports).
- Net capital outflow is part of the demand for loanable funds and it provides the supply of dollars for foreign-currency exchange.
  - It is the link that connects these two markets.

#### **1.1. The market for loanable funds**

We extend the loanable funds market in a closed economy to permit international investment.

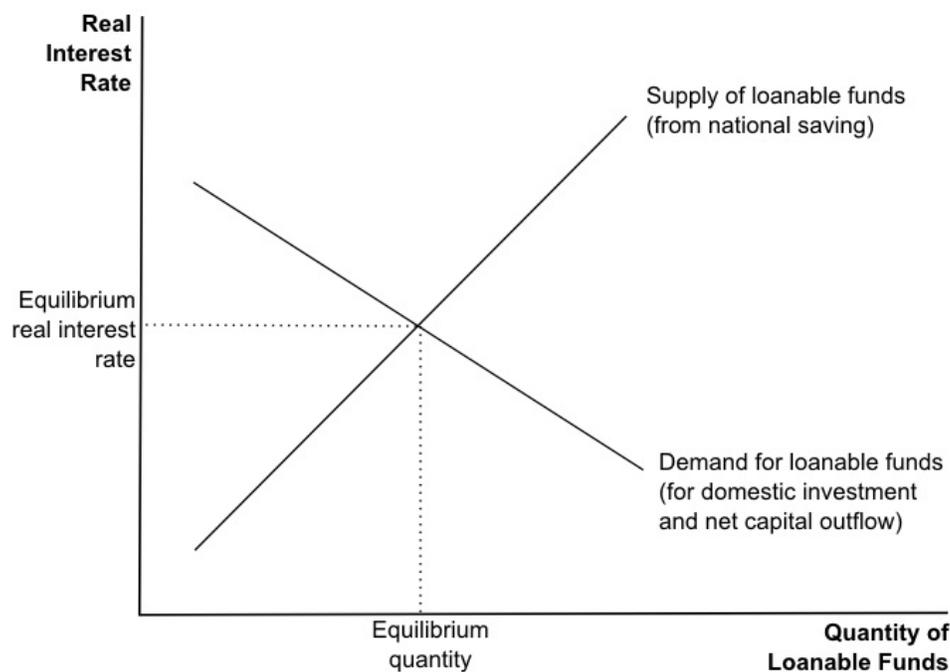
- The supply of loanable funds comes from domestic national savings.
- The demand for loanable funds comes from domestic investment and NCO.
- Because net capital outflow can be positive or negative, it is either added to or subtracted from the demand for loanable funds that arise from domestic investment.
  - When NCO increases, domestic investors increase demand for foreigner assets and seek domestic financing of these investments. This implies demand for loanable funds increases.
  - When NCO decreases, foreigners are buying domestic assets and removing them from domestic market. This implies demand for loanable funds decreases.

### 1.1.1 The domestic real interest rate

The quantity of loanable funds demanded and the quantity of loanable funds supplied depend on the domestic real interest rate.

- A higher domestic real interest rate encourages people to save and, thus, raises the quantity of loanable funds supplied (upward sloping supply curve).
- A higher domestic real interest rate makes borrowing to finance capital projects more costly, discouraging investment and reducing the quantity of loanable funds demanded.
- A higher domestic real interest rate in a country will also lower net capital outflow.
  - A higher domestic interest rate implies that purchases of foreign assets by domestic residents falls and purchases of domestic assets by foreigners rises.

The supply and demand for loanable funds can be shown graphically.



### 1.1.2. Equilibrium

The interest rate adjusts to bring the supply and demand for loanable funds into balance.

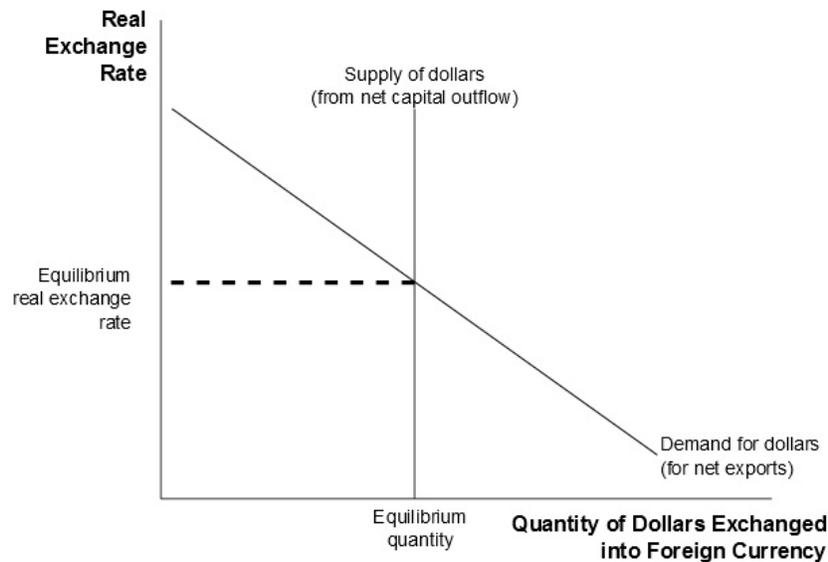
- If the interest rate was below  $r^*$ , the quantity of loanable funds demanded would be greater than the quantity of loanable funds supplied. This would lead to upward pressure on the interest rate.
- If the interest rate was above  $r^*$ , the quantity of loanable funds demanded would be less than the quantity of loanable funds supplied. This would lead to downward pressure on the interest rate.
- At the equilibrium interest rate, the amount that people want to save is exactly equal to the desired quantities of domestic investment and net capital outflow.

## 1.2. The Market for foreign-currency exchange

The second market in the open economy model is foreign-currency exchange. In equilibrium:

$$\underbrace{NCO}_{\text{Supply of domestic currency}} = \underbrace{NX}_{\text{Demand for domestic currency}}$$

- The supply of foreign currency is equal to NCO.
  - NCO is equal to the difference between CO and CI.
  - NCO is primarily determined by the relative difference between domestic and foreign real interest rates. This implies that the supply curve is perfectly inelastic with respect to the real exchange rate.
- The demand for foreign currency is foreigners desiring to buy export goods.
  - From the perspective a country selling a good: foreigners purchase ‘domestic’ dollars to purchase an export goods when they do not have sufficient domestic dollars.
  - When the real exchange rate appreciates, export goods become more expensive to foreigners relative to their own domestic goods, causing a reduction in NX.

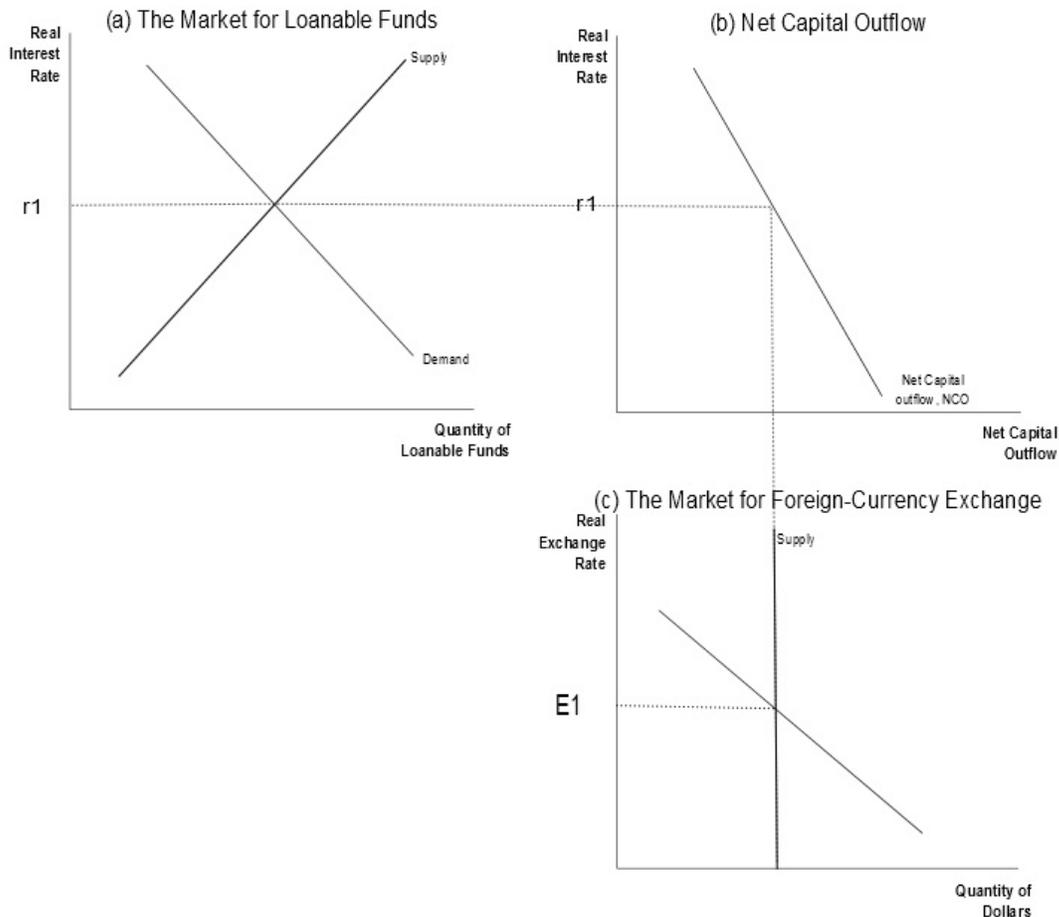


The real exchange rate is determined in the market for foreign-currency exchange.

- If the real exchange rate was lower than  $rer^*$ , the quantity of dollars demanded would be greater than the quantity of dollars supplied, and there would be upward pressure on the real exchange rate.
- If the real exchange rate was higher than  $rer^*$ , the quantity of dollars demanded would be less than the quantity of dollars supplied, and there would be downward pressure on the real exchange rate.
- At the equilibrium real exchange rate, the demand for dollars to buy net exports equals the supply of dollars to be exchanged into foreign currency to buy assets abroad.

## 2. Simultaneous equilibrium in two markets

NCO is the both the loanable funds market and the foreign-currency exchange market. These markets are connect by the demand for foreign assets.



The dynamics of the model are as follows:

1. The real interest rate is determined in the market for loanable funds.
  1. This is observed in graph (a) above.
2. This real interest rate determines the level of net capital outflow.
  1. This is observed in graph (b) above.
3. Because net capital outflow must be paid with foreign currency, the quantity of net capital outflow determines the supply of dollars.
  1. This is the supply curve on graph (c) above.
4. The equilibrium real exchange rate brings into balance the quantity of dollars supplied and the quantity of dollars demanded.
  1. This is observed in graph (c) above.

The real interest rate and the real exchange rate adjust simultaneously to balance supply and demand in the two markets. As they do so, they determine the levels of national saving, domestic investment, net capital outflow, and net exports.

### 3. How policies and events affect an open economy

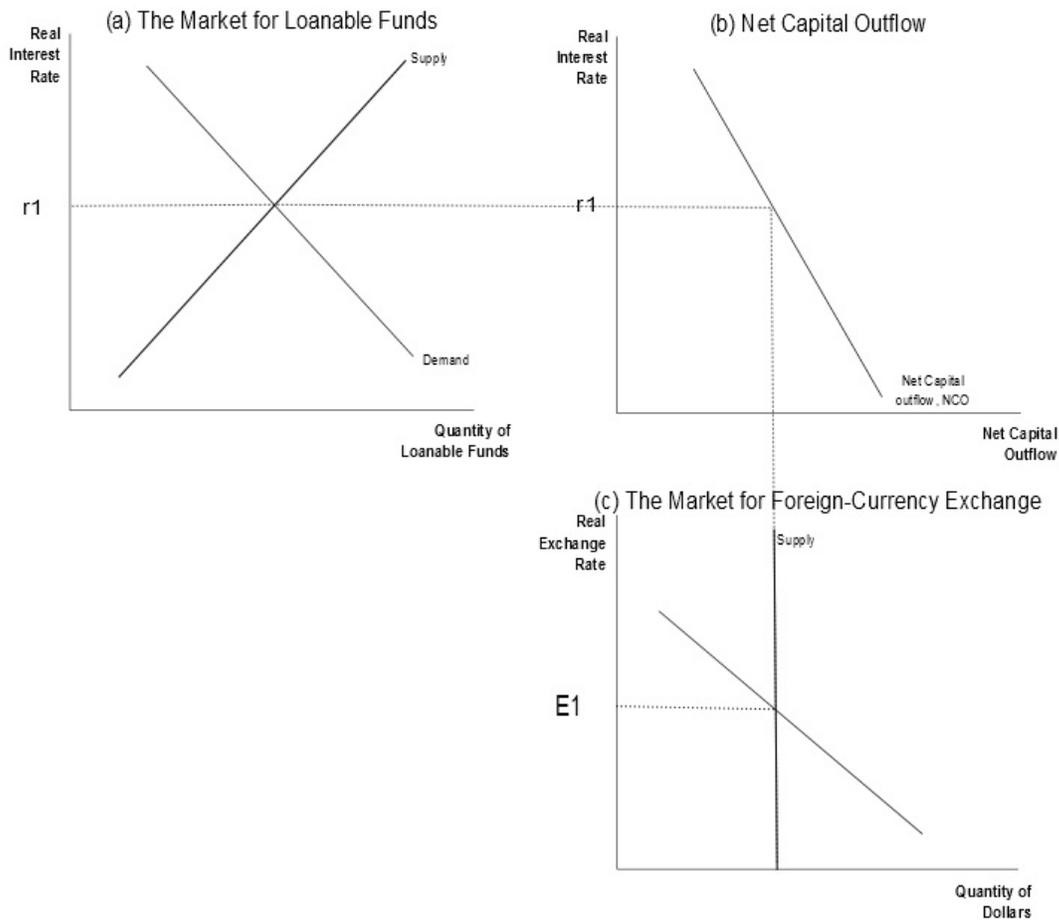
We can now use this model to study how various government policies and events affect the economy's equilibrium. As we proceed, keep in mind that our model is just supply and demand in two markets: the market for loanable funds and the market for foreign-currency exchange.

For the next three applications, use the three-step process to determine the effects of a change in supply or demand developed in Lecture 4.

1. Determine which of the supply and demand curves have been affected.
2. Determine in which direction the curves shift.
3. Use the supply and demand diagrams to examine how these shifts alter equilibrium in the two markets.

#### 3.1. A decline in U.S. savings

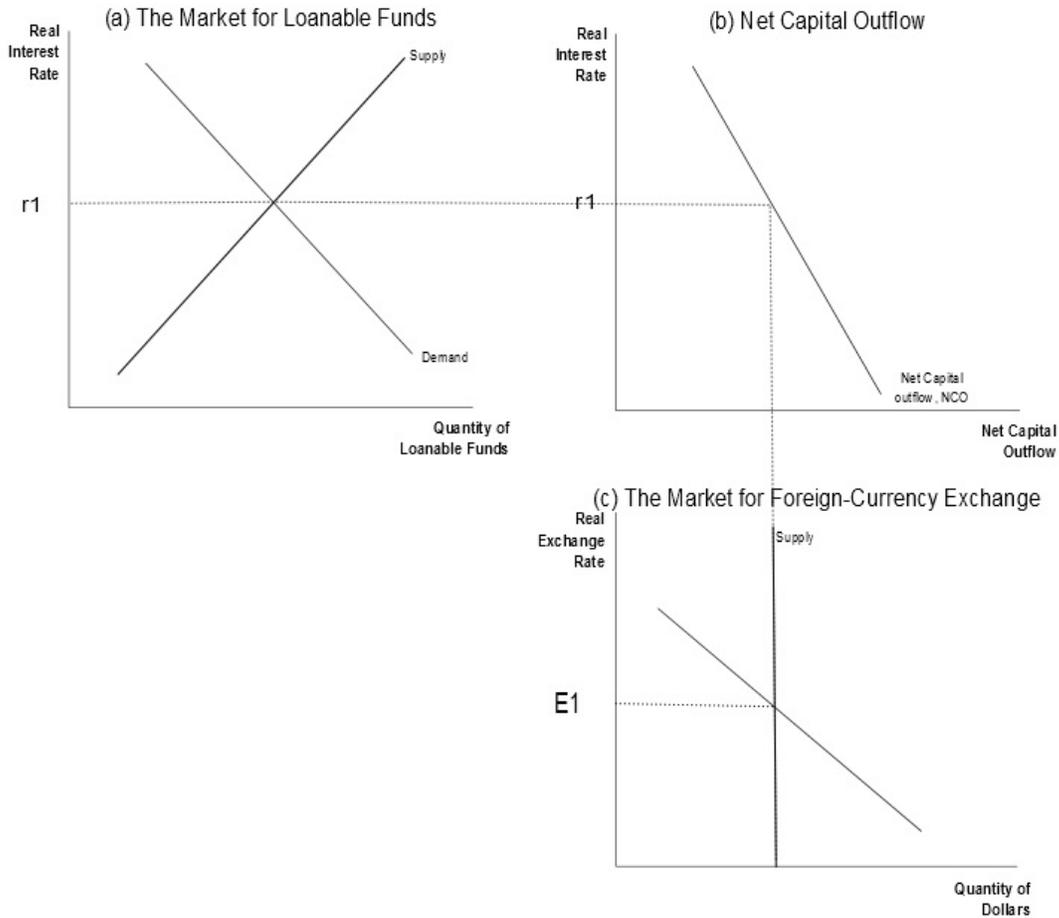
Exercise 1: Suppose that the government runs a budget deficit (or negative public savings). This leads to a decline in the supply of loanable funds. What is the effect on interest rates, capital outflow, the foreign exchange rate, and net exports?



### 3.2. Purchase of domestic assets by foreigners

Over the last 25 years, much of the world has saved a tremendous amount of money. So much that domestic savings is much larger than domestic investment in many nations. This excess savings usually ends up in the U.S. as foreigners purchase U.S. assets.

Exercise 2: Suppose that the Chinese Central bank buys U.S. bonds. What is the effect on interest rates, capital outflow, the foreign exchange rate, and net exports?



Exercise 2 is an example of how the Chinese manipulate their exchange rate to maintain lower export prices. For example, suppose that you buy a toaster made in China for \$10. If China sold the 10 USD in exchange for RMBs, then two things would happen:

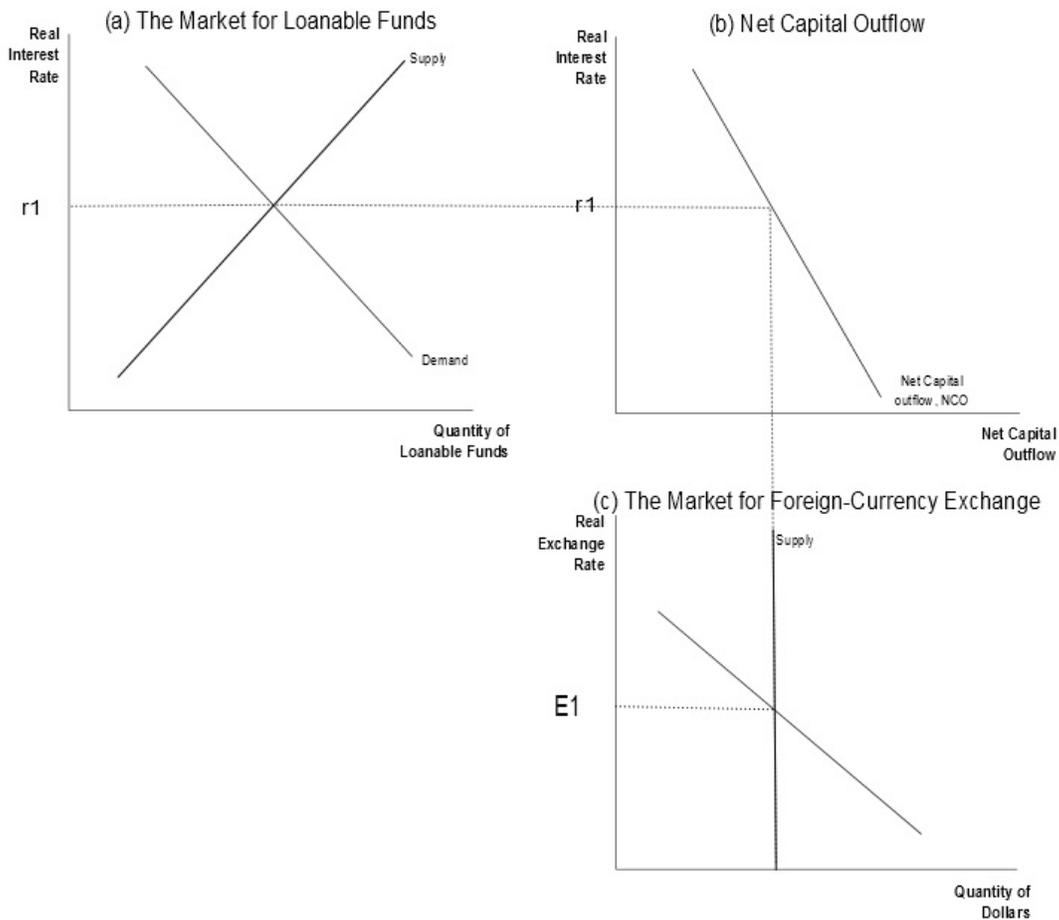
1. The supply of U.S. dollars would increase (prior the U.S. dollar sat abroad doing nothing) causing the value of the dollar to fall in the U.S. money market.
2. The demand for RMB would increase causing the value of the RMB to increase in the RMB money market.

1. and 2. imply that Chinese goods would become more expensive. Instead of selling these USD dollars in the foreign-currency exchange market, China buys \$10 of U.S. government bonds (as in exercise 2) causing the exchange rate to remain fixed.

- The exchange rate manipulation in essence acts as a loan to the United States:  $I > S$ .
- ❖ Why do the Chinese do this?

### 3.2. The effect of tariffs on goods imported from China

Exercise 3: Suppose that the United States imposed a tariff on Chinese imports until China stopped manipulating its currency in the exchange market. What would be the effect on interest rates, capital outflow, the foreign exchange rate, and net exports?



#### **4. International financial crisis**

Many times countries attempt to fix their exchange rate with the United States or with a basket of currencies to assure that theirs does not devalue or appreciate. The central bank sets a target exchange rate that then buys and sells currency to hit this target.

Suppose that a country desires to no longer allow its currency to devalue. Any time the market equilibrium exchange rate is below the target, the country defends its currency by buying its own currency and selling foreign currency. As one can imagine, this uses up foreign reserves for the central bank.

If foreign exchange speculators observe this behavior, often they bet against the currency by buying put options that give them the right, but not the obligation, to sell the underlying currency at a strike price (a higher price) in the future. Thus, if the currency devalues they can buy it cheap and exercise the put option to force the sale at a higher price (the strike price).

Once a speculation attack occurs, a country may spend all of their foreign reserves in an attempt to correct the market. Most often, the country runs out of foreign reserves well before the attack is over.

Some say that currency speculation should not be allowed because it can bankrupt a nation. Others say that if politicians behaved, they would never get into trouble with the market. In some sense, speculators act as the check and balance against political heavyweights.

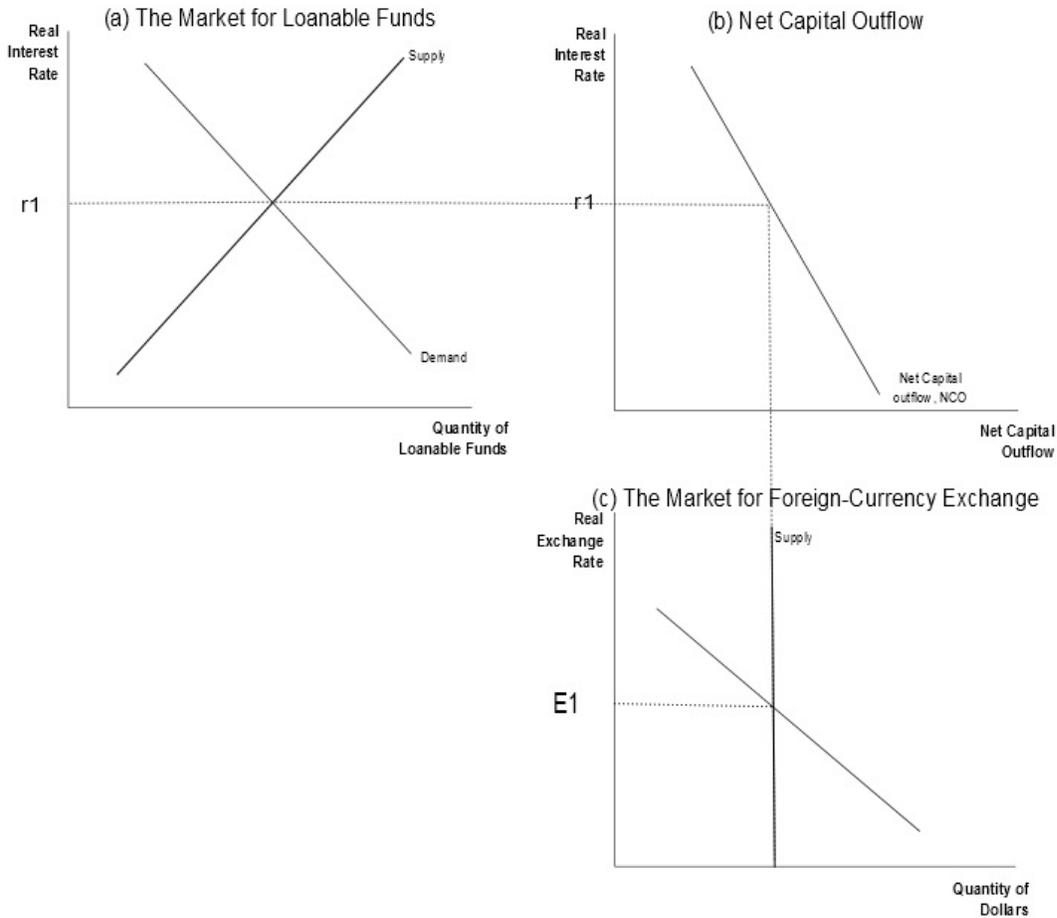
Countries that have had problems with devaluation are:

- England – 1992
- Sweden – 1992
- Mexico – 1994
- South Korea, Thailand, Indonesia, and Malaysia – 1997
- Russia – 1998
- Argentina - 2002

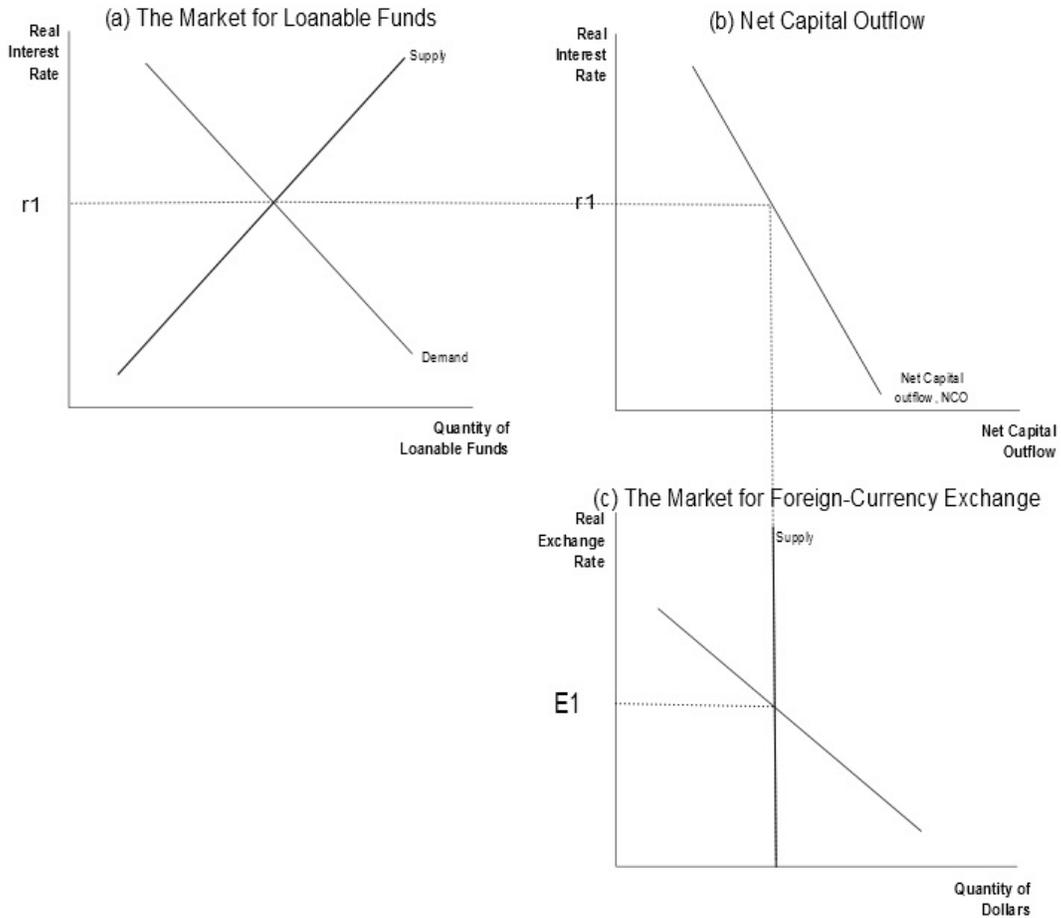
## 5. In-class exercises

1. An article in USA Today (December 16, 2004) began “President Bush said Wednesday that the White House will shore up the sliding dollar by working to cut record budget and trade deficits.”

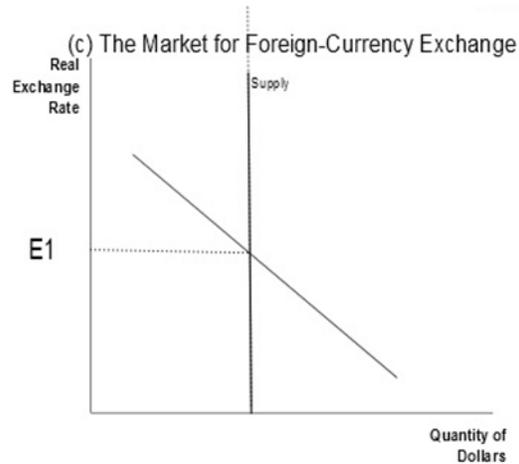
- a. According to the model in this chapter, would a reduction in the budget deficit reduce the trade deficit? Would it raise the value of the dollar? Explain.



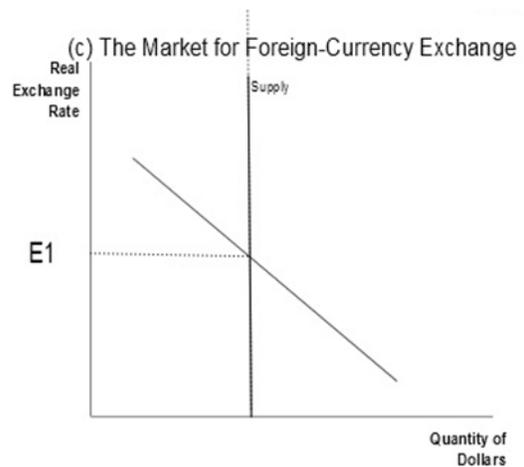
- b. Suppose that a reduction in the budget deficit made international investors more confident in the U.S. economy. How would this increase in confidence affect the value of the dollar? How would it affect the trade deficit?



2. An economist discussing trade policy in *The New Republic* wrote: "One of the benefits of the United States removing its trade restrictions [is] the gain to U.S. industries that produce goods for export. Export industries would find it easier to sell their goods abroad—even if other countries didn't follow our example and reduce their trade barriers." Explain in words why U.S. export industries would benefit from a reduction in restrictions on imports to the United States.

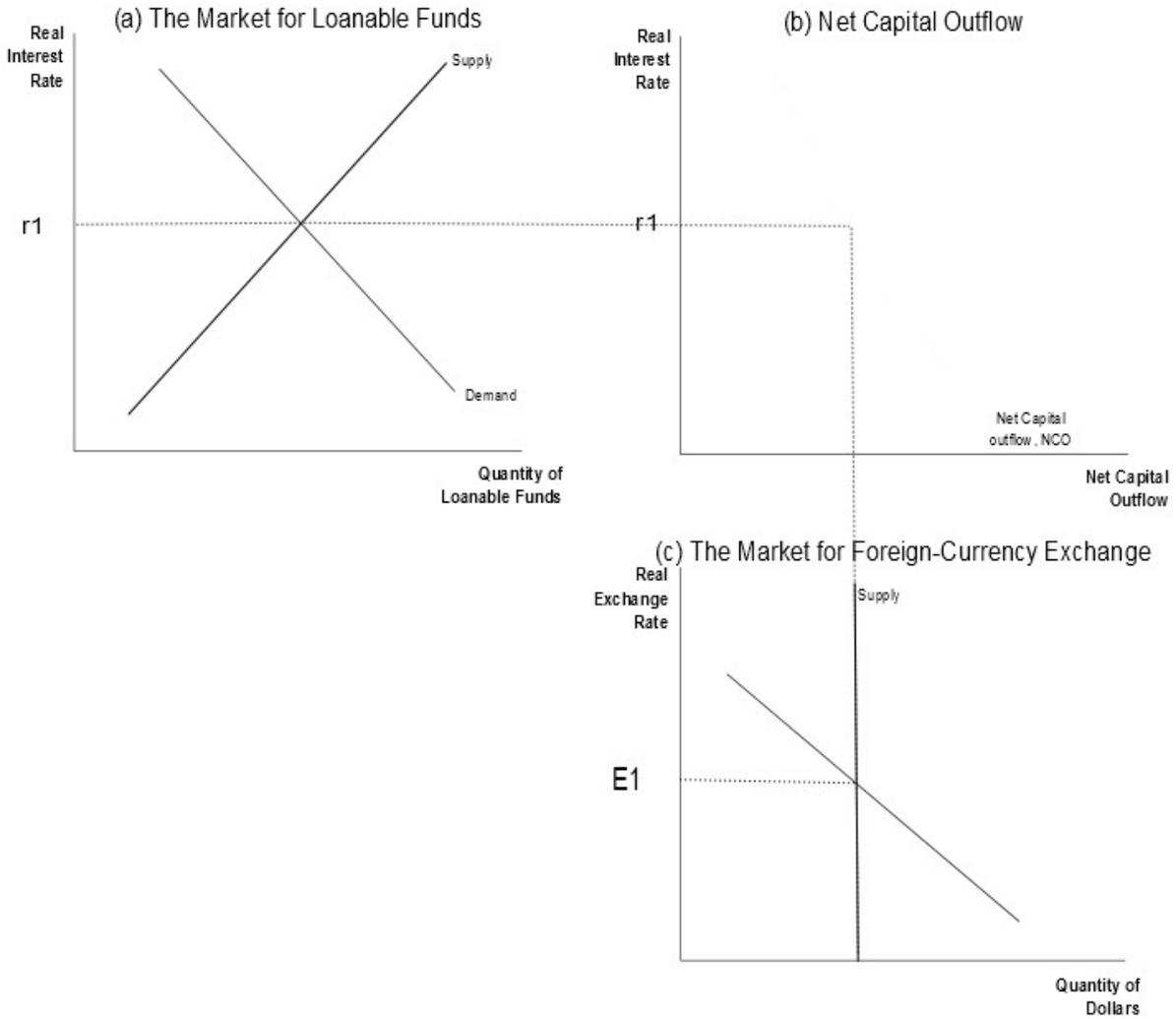


3. Suppose the United States decides to subsidize the export of U.S. agricultural products. Explain in words how this U.S. policy affects the value of imports, exports, and net exports.

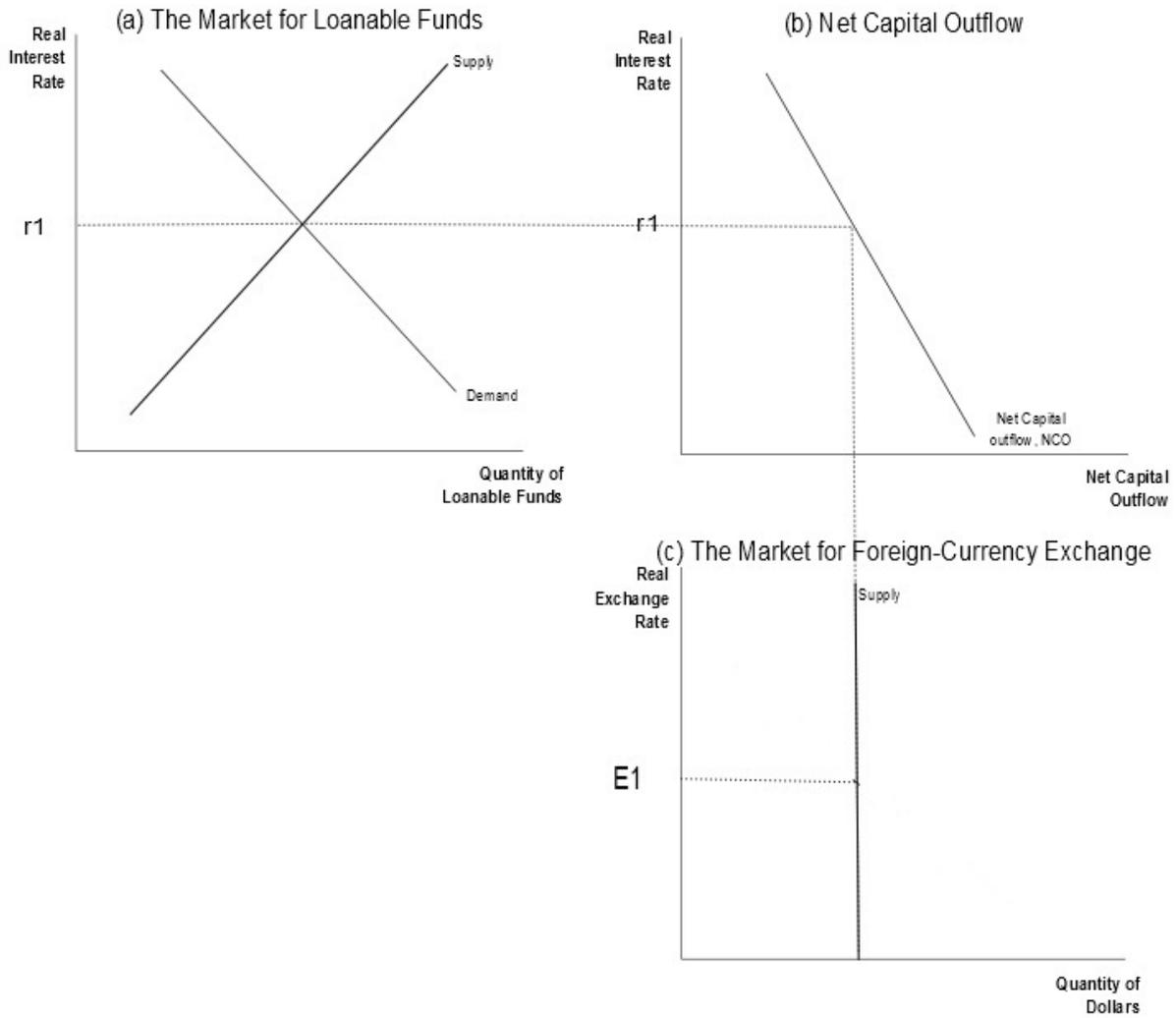


4. Suppose that Americans decide to increase their saving.

- a. If the elasticity of U.S. net capital outflow with respect to the real interest rate is very high, will an increase in private saving have a large or small effect on U.S. domestic investment?

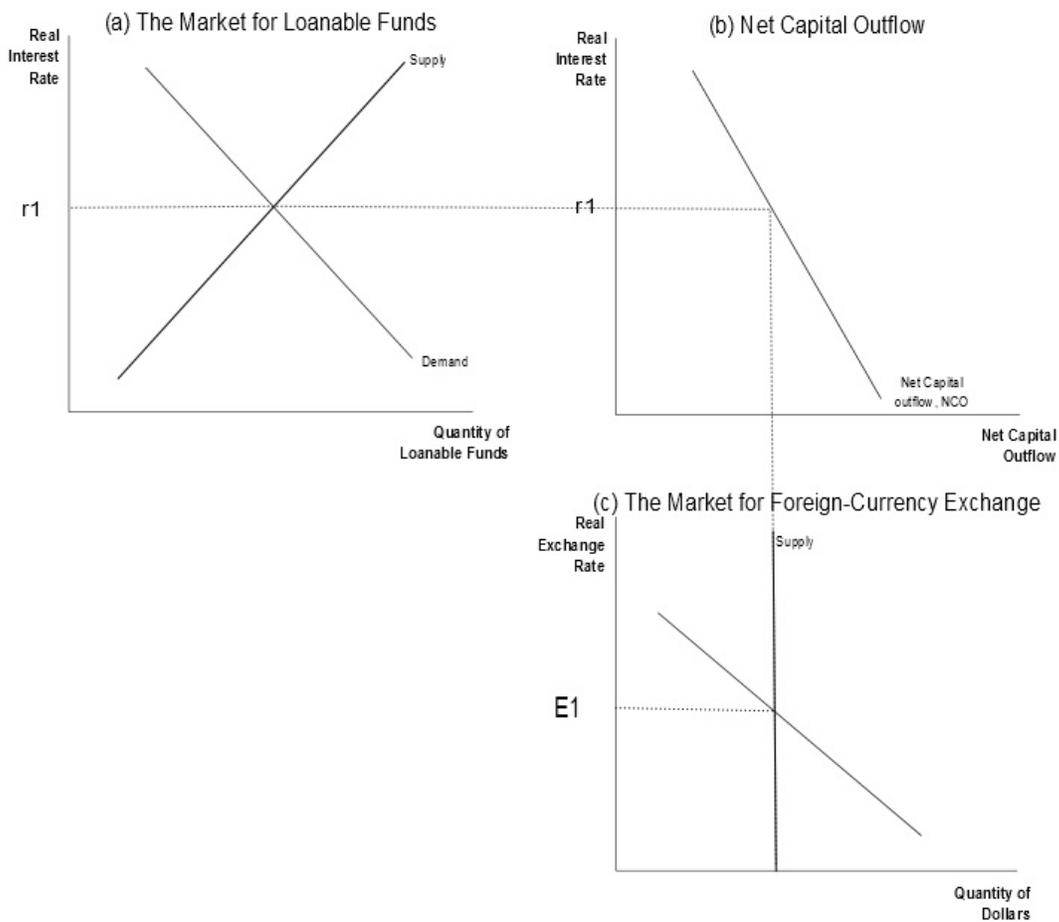


- b. If the elasticity of U.S. exports with respect to the real exchange rate is very low, will an increase in private saving have a large or small effect on the U.S. real exchange rate?



5. The chapter notes that the rise in the U.S. trade deficit during the 1980s was due largely to the rise in the U.S. budget deficit. On the other hand, some have noted that the increased trade deficit resulted from a decline in the quality of the U.S. products relative to foreign products.

- a. Assume that U.S. products did decline in relative quality during the 1980s. How did this affect net exports at any given exchange rate?
- b. Draw a three-panel diagram to show the effect of a shift in net exports on the U.S. real exchange rate and trade balance.



- c. Is the claim in the popular press consistent with the model in this chapter? Does a decline in the quality of U.S. products have any effect on the trade balance?

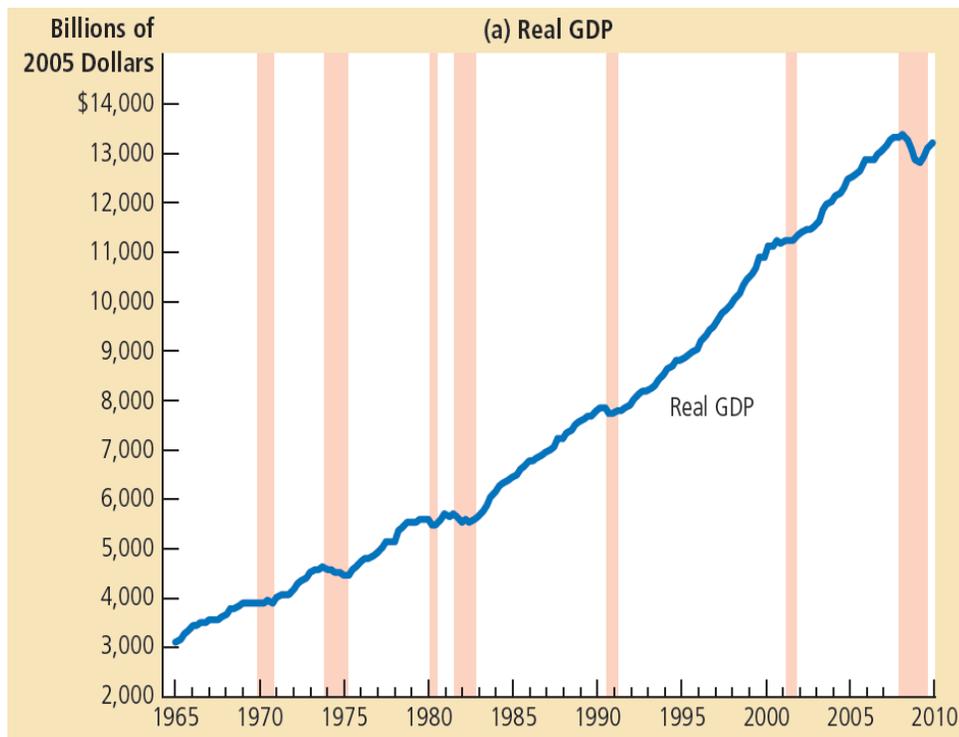
## Lecture 14: Aggregate Demand – Aggregate Supply (CORRESPONDS WITH CHAPTER 15)

### 1. Introduction

Short-run fluctuations in economic activity have occurred in all countries throughout history. As a starting point for understanding these year-to-year fluctuations, let us discuss some of their most important properties.

#### 1.1. Economic fluctuations are irregular and unpredictable

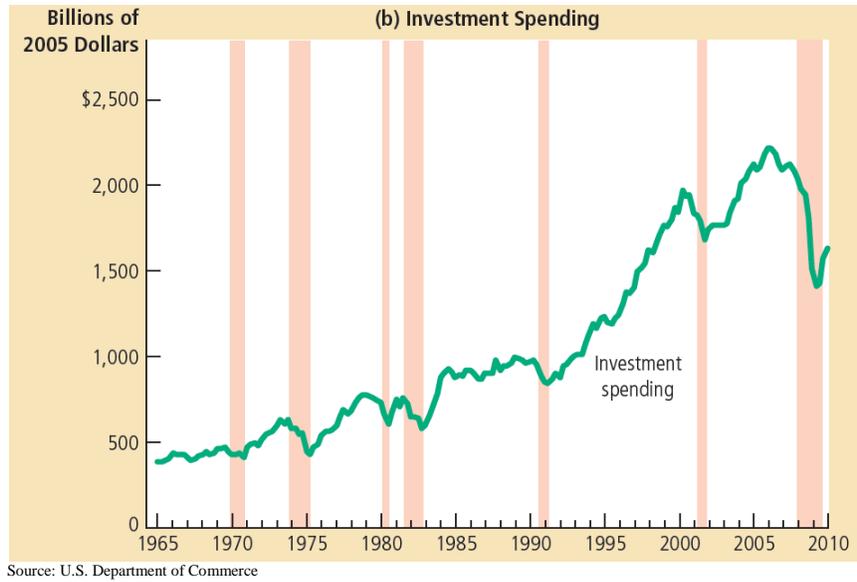
Fluctuations in the economy are often called *the business cycle*. Economic fluctuations correspond to changes in business conditions. These fluctuations are not at all regular and are almost impossible to predict. The figure below shows real GDP since 1965. The shaded areas represent recessions.



Source: U.S. Department of Commerce

#### 1.2. Most macroeconomic variables fluctuate together

Real GDP is most often examined to understand short-run changes in the economy. However, most macroeconomic variables that measure some type of income, spending, or production fluctuate closely together. The following figure shows how investment spending and unemployment change over the business cycle. Note that investment spending falls during recessions just as real GDP does, while unemployment rises.



### 1.2.1. As output falls, unemployment rises

Changes in the economy's output level will have an effect on the economy's utilization of its labor force. When firms choose to produce a smaller amount of goods and services, they lay off workers, which increases the unemployment rate. The figure below shows how the unemployment rate changes over the business cycle. Note that during recessions, unemployment generally rises. Note also that the unemployment rate never approaches zero, but instead fluctuates around its natural rate of about 5% to 6%.



### 1.3. Persistence in the trends

All of the above graph have persistence in either a downward or upward direction. Once a recession starts, it is difficult to turn the economy. Once expansions start, they are hard to stop.

## 2. The aggregate supply – aggregate demand model (AS-AD)

The model of short-run economic fluctuations focuses on the behavior of two variables. The first is the economy's output of goods and services, as measured by real GDP. The second is the aggregate price level, as measured by the CPI.

- Aggregate output is a real variable,  $Y$ .
- Output price is a nominal variable,  $P$ .

### 2.1. Aggregate demand (AD)

Aggregate demand is made up of four components:

1. **Consumer expenditures (C):**
2. **Planned Investment spending (I):**
3. **Government spending (G):**
4. **Net exports (NX):**

The following expression summarizes aggregate demand:

$$Y_t = C_t + I_t + G_t + NX_t$$

#### 2.1.1. Deriving AD

Since aggregate demand describes the relationship between the quantity of aggregate output demanded and prices, we need to demonstrate this. The simplest way to examine how prices affect aggregate output is to analyze each individual component.

- If all components respond in the same direction, then the aggregate demand responds in the same way.

Exercise 1 (wealth effect): Let us first begin with consumption. The experiment is as follows:

1. Hold the nominal amount of money constant.
2. Lower price. What is the effect on consumption?

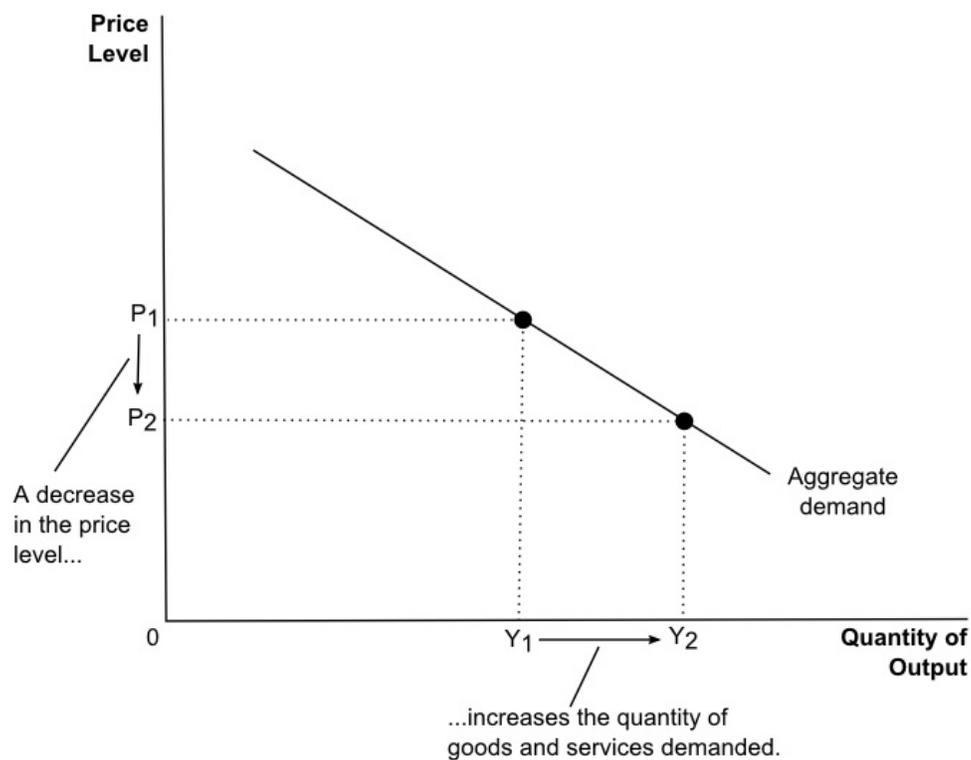
Exercise 2 (interest rate effect): We can do this same experiment for investment:

1. Hold the nominal amount of money constant.
2. Lower price. What is the effect on investment?

Exercise 3 (exchange rate effect): We can do this same experiment for net exports:

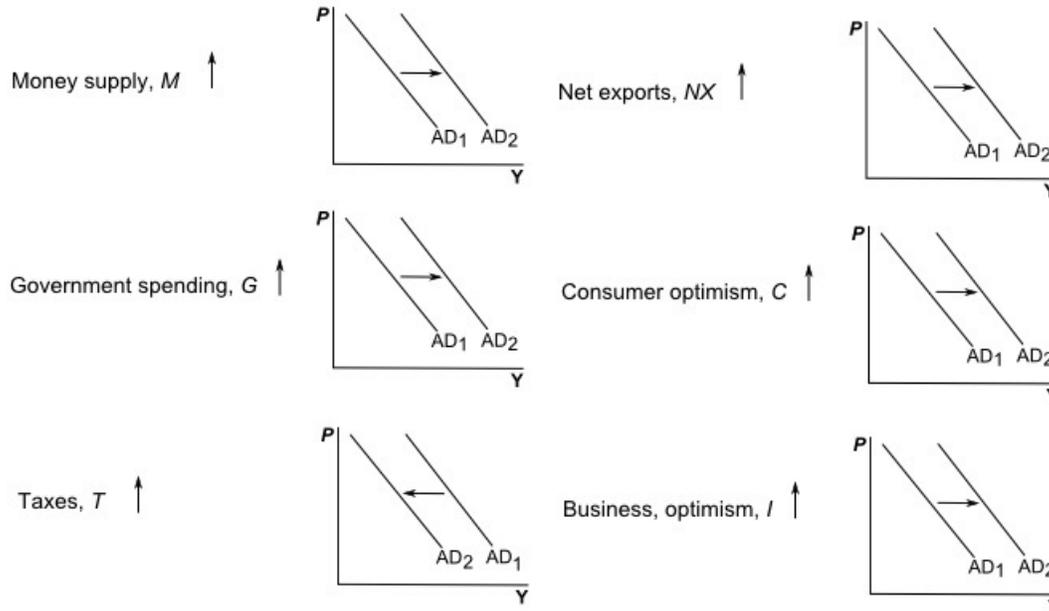
1. Hold the nominal amount of money constant.
2. Lower price. What is the effect on net export?

Exercise 4: What do Exercises 1 – 3 imply about the relationship between the (output) price level and aggregate output?



### 2.1.2. Shifts in AD

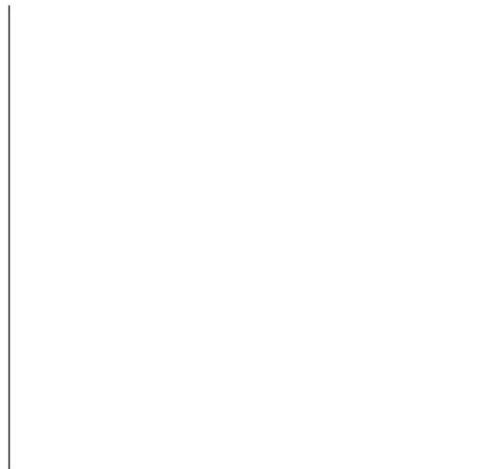
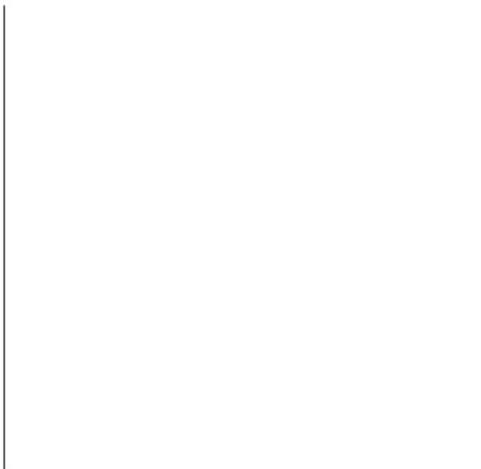
There are several factors that shift aggregate demand. At a given output price level, a rise in any component of GDP raises AD.



Exercise 5: The experiment is as follows. Increase the total amount of money in the economy and then ask:

At every price level, what happens to output?

At every output level, what happens to prices?

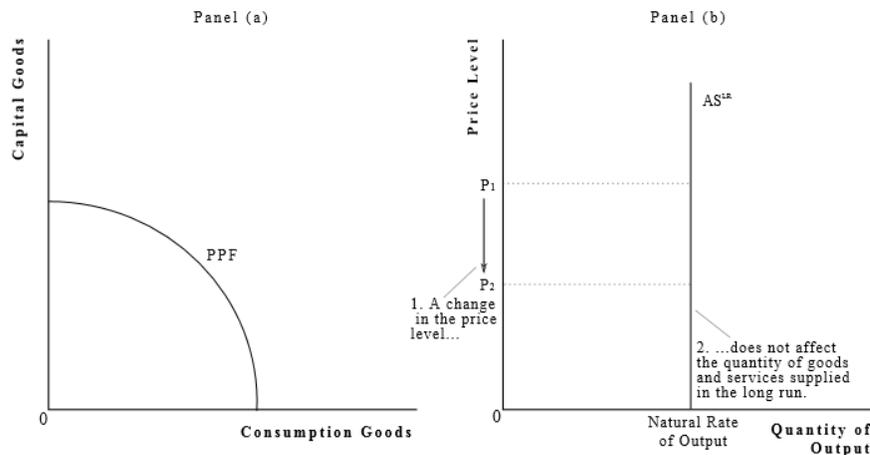


## 2.2 Aggregate supply (AS)

Aggregate supply describes the relationship between the quantity of output supplied and the price level. Because input prices take time to adjust, the AS curve differs in the short and long run. The long run refers to the amount of time required for all input prices to adjust.

Long-run aggregate supply curve ( $AS^{LR}$ ): Indicates production capabilities and is not influenced by output prices.

- Factors of production are fixed at any one point in time similarly to the PPF model.
  - Allocative efficient point on the PPF corresponds to the  $AS^{LR}$ .
  - Similar to the assumption that the PPF's frontier use full employment, so does  $AS^{LR}$ .
- Increases in price cannot shift the PPF or the  $AS^{LR}$  outward.

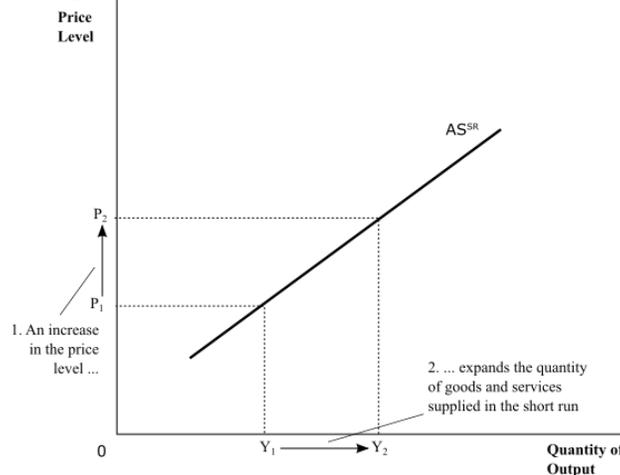


Short-run aggregate supply curve ( $AS^{SR}$ ): As the price level rises, suppliers produce more.

- Assume input prices are fixed in the short-run ( $\overline{ATC}$ ). This is referred to as a sticky price.
- As  $P$  increases, per unit profits to rise.

$$\text{Profit} = (P - \overline{ATC}) * Q$$

- Firms increase profits by producing more.
- Generates upward sloping  $AS^{SR}$ .

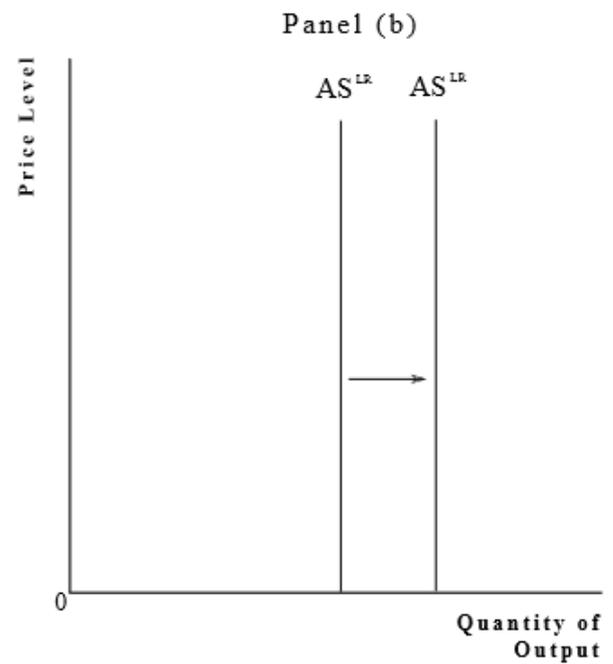
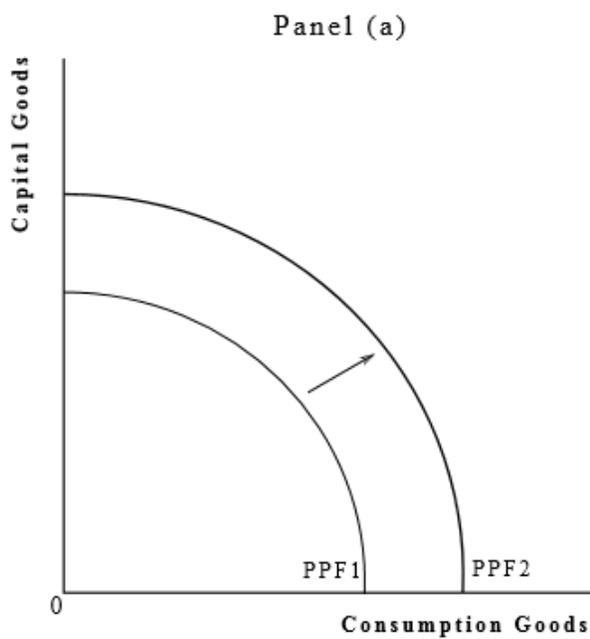


### 2.2.1. Factors that shift $AS^{LR}$

The long-run aggregate supply curve shifts due to a change in a factor of production:

- |                     |                  |
|---------------------|------------------|
| 1. Land             | 4. Labor         |
| 2. Physical capital | 5. Human capital |
| 3. Resources        | 6. Technology    |

As a factor of production increases, production possibility increases, thus shifting the long-run aggregate supply curve outward.



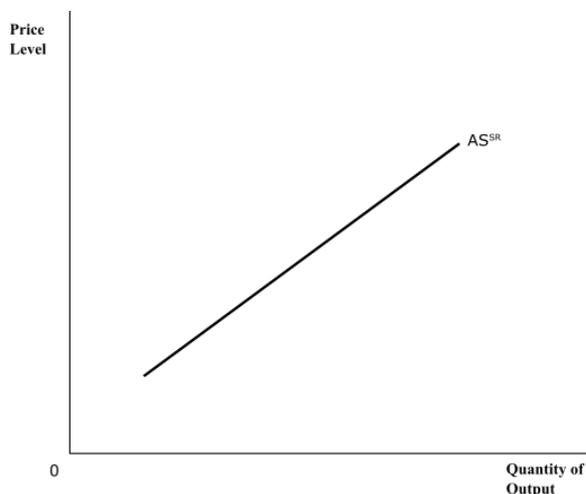
## 2.2.2. Factors that shift $AS^{SR}$

Exercise 6: To understand how  $AS^{SR}$  shifts, we fix output price ( $\bar{P}$ ) and ask how suppliers will respond to a change in input prices ( $ATC$ ).

$$Profit = (\bar{P} - ATC) \times Q$$

- $\downarrow ATC \Rightarrow \uparrow$  per unit profits  $\Rightarrow$  outward shift in  $AS^{SR}$ .
- $\uparrow ATC \Rightarrow \downarrow$  per unit profits  $\Rightarrow$  inward shift in  $AS^{SR}$ .

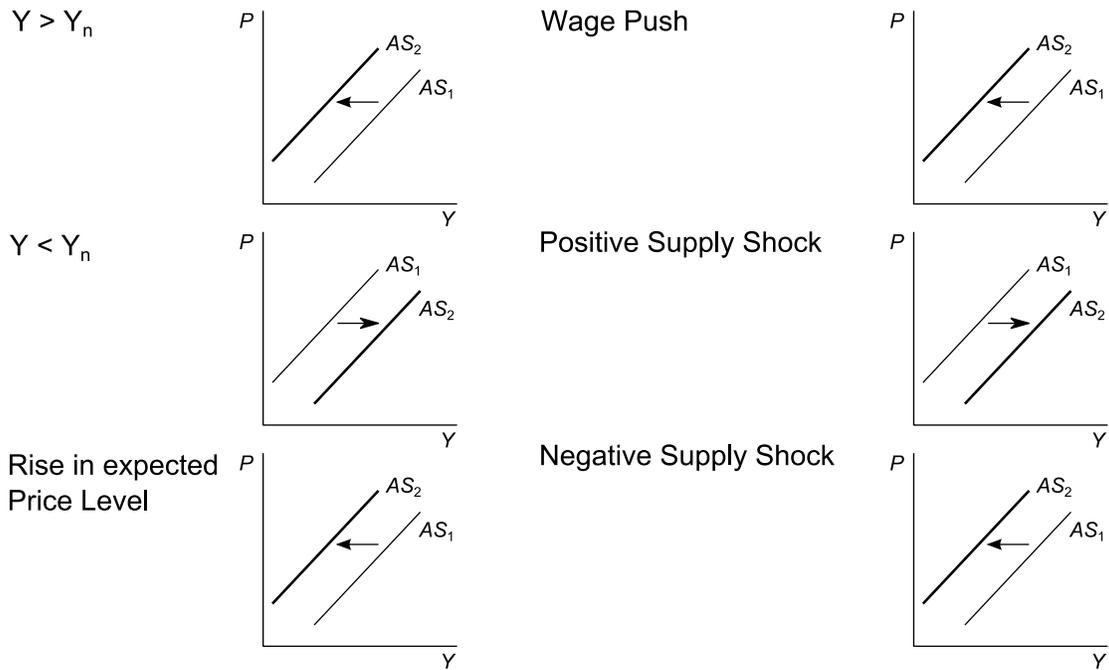
- 1.
- 2.
- 3.
- 4.



There are several reasons why costs of production change. These are:

- Business cycle
  - Expansions cause inputs to become more scarce, increasing their prices -  $AS^{SR}$  shifts leftward.
  - When employers find it difficult to find qualified workers.
    - Employers raise wages to attract needed workers.
    - Demand for labor  $>$  Supply of labor  $\Rightarrow$  wages and costs of production increase  $\Rightarrow$  profit per unit of output falls and the  $AS^{SR}$  shifts left.
  - Recessions cause inputs to become less scarce, decreasing their prices -  $AS^{SR}$  shifts rightward.
  - When employers find it easy to find qualified workers.
    - Demand for labor  $<$  Supply of labor  $\Rightarrow$  wages and costs of production fall  $\Rightarrow$  profit per unit of output rises and the  $AS^{SR}$  shifts right.
- Wage push
  - Striking and other employee demands for higher wages increases (or pushes) the cost of production upward ( $AS^{SR}$  shifts left).
- Change in production costs unrelated to wages (supply shocks)
  - Positive shock:  $AS^{SR}$  shifts rightward.
  - Negative shock:  $AS^{SR}$  shifts leftward.

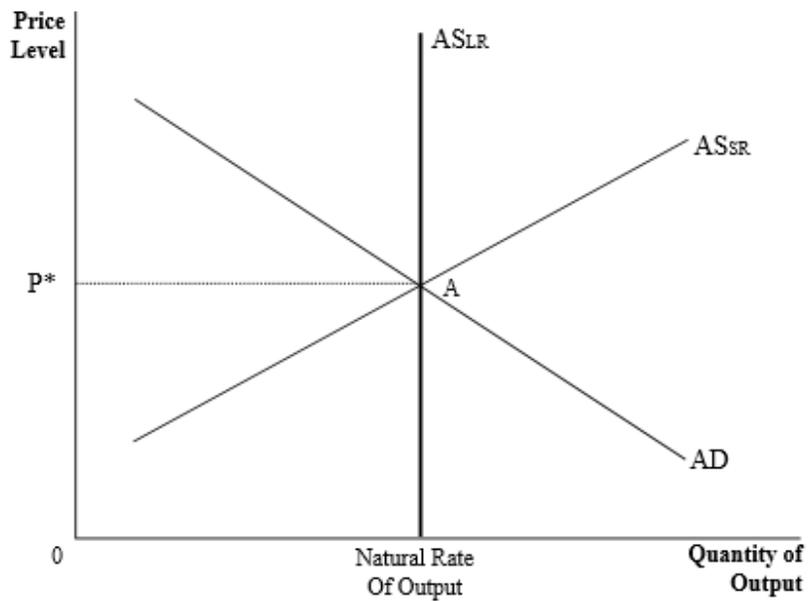
The following table provides a list of all factors that shift the short-run AS curve



### 2.3. Equilibrium in the Aggregate Demand – Aggregate Supply Model

Equilibrium occurs where  $Y_{AD} = Y_{AS}$ . However, there are two quantities of aggregate output, one for the short-run and one for the long-run.

$$Y_{AS}^{SR} = Y_{AD} \text{ and } Y_{AS}^{LR} = Y_{AD}$$

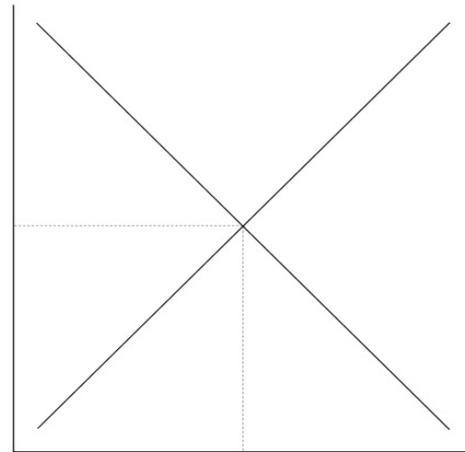


Even if  $Y_{AD} = Y_{AS}^{SR} = Y^*$ , output may move if  $Y^* \neq Y_n$ . There are two possibilities:

1. When  $Y > Y_n$  (during an expansion), labor markets are tight (low unemployment) and output is above the natural level. This causes production costs to rise at any given price level, which in turns causes firms to cut employment to raise profits.
  - This implies a leftward shift in  $AS^{SR}$ .

Exercise 7: Show the dynamics to the long-run equilibrium when  $Y > Y_n$ .

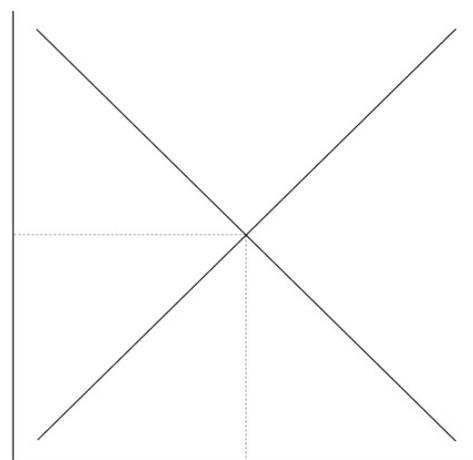
- 1.
- 2.
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2. When  $Y < Y_n$  (during a recession), labor markets are slack (high unemployment) and output is below the natural level. This causes production costs to fall at any given price level, which in turns causes firms to increase employment to raise profits.
  - This implies a rightward shift in  $AS^{SR}$ .

Exercise 8: Show the dynamics to the long-run equilibrium when  $Y < Y_n$ .

- 1.
- 2.
- 3.



### 2.3.1. The self-correcting mechanism

Regardless of where output is initially, it eventually returns to  $Y_n$ . This is called *the self-correcting mechanism*. When  $Y=Y_n$  (long-run equilibrium), labor markets are at their natural rate, and production costs are constant at any given price level. This implies resources are utilized at maximum efficiency. There are no additional adjustments in  $AS^{SR}$ .

- The *self-correcting mechanism* is the amount of time that it takes for the current level of output to return to long-run output,  $Y_n$ .

### Keynesians

- Government intervention may be needed during recessions to increase AD if consumers are not spending.
- In the long-run, we are all dead.

### Monetarists

- Government intervention is never required. Wages are sufficiently flexible and adjust quite rapidly.
- ❖ How long does it take to self-correct?

## 2.4. Government's responds to recessions

There are three main policy tools to improve an economy during recessions: 1) decrease taxes, 2) increase government spending, and 3) increase the supply of money. All have the effect of shifting the AD curve outward.

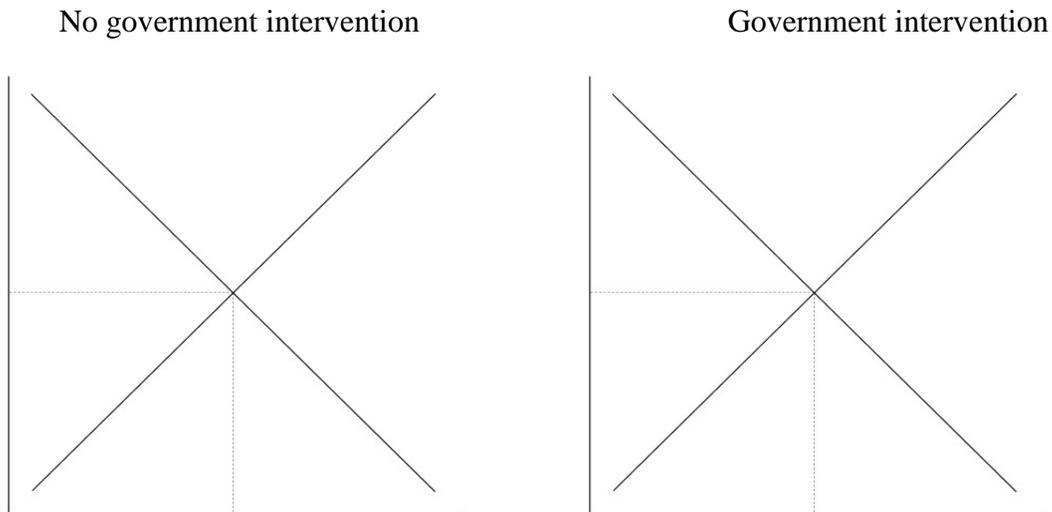
### 3. Shocks

We can now investigate how shocks affect prices and output.

#### 3.1. Demand shocks (animal spirits)

Demand-side recessions occur when there is a fall in aggregate demand. Keynes studied these types of recessions and suggested that ‘animal spirits’ or a lack of consumer and business confidence can explain such a shift.

Exercise 9: Suppose a negative demand shock occurs. What happens to AD, AS (SR and LR), prices, employment, and output?

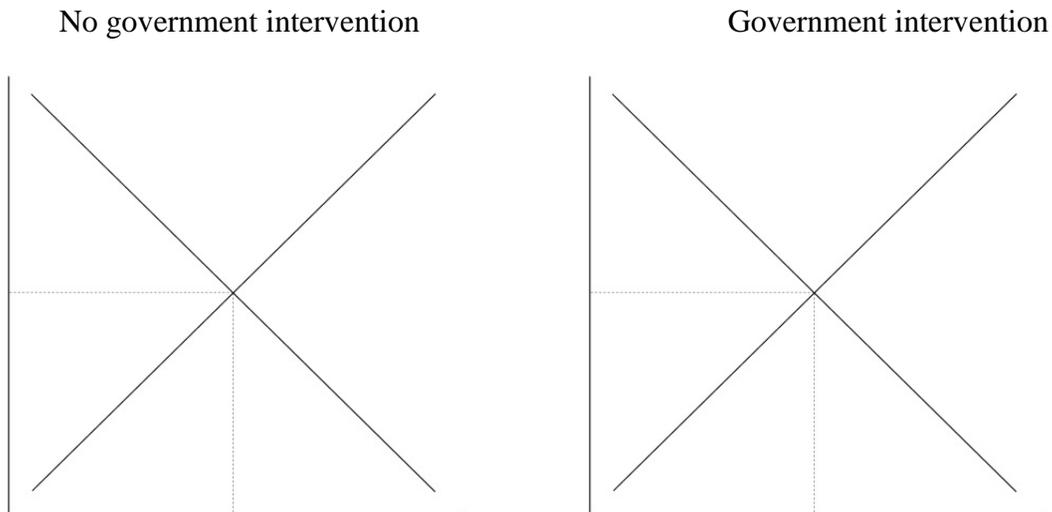


**Conclusion:**

### 3.2. Negative supply shock (real business cycle theory)

Supply-side recession occurs from increases in the cost of production. The real business cycle theory suggests that changes in productivity and technology cause aggregate supply in the short run to shift.

Exercise 10: Suppose a temporary negative supply shock occurs. What happens to  $AD$ ,  $AS_{SR}$ ,  $AS_{LR}$ , prices, employment, and output?



**Conclusion:**

#### 4. Austrian Business Cycle Theory

The previous AD – AS model assumes that business cycles occur naturally when the short-run AS curve shifts left resulting in lower prices and lower output than the natural rate. That is, recessions are unpredictable and naturally occur regardless of market forces and government intervention.

This conceptualization of why recessions occur may not fully capture all of the behavior of the decision makers. One theory on the cause of recessions (and the business cycle) is the Austrian Business Cycle Theory (ABCT) originally developed by Ludwig von Mises in the *Theory of Money and Credit*. According to the Ludwig Von Mises Institute, the ABCT is explained as follows:

1. Banks expand credit well beyond their own assets and buy the funds of their clients, often supported or encouraged by the setting of low interest rates by a central bank.
2. Increased borrowing for capital projects stimulates economic activity. Projects which would not have been funded now appear profitable.
3. Increase demand for production materials and for labor and their prices rise, which, in turn, leads to an increase in prices of consumption goods.
4. The means of production and labor which have been diverted to the new enterprises have to be taken away from others productive enterprises.
5. As long as the expansion of credit continues, the credit-laden sector will grow, but malinvestment form.
6. At some point, lack of profitability of the malinvestment topples the credit-laden sector and potentially the macroeconomy.

This cycle is at times referred to as the boom-bust cycle where the boom creates a bust in the economy. This is exactly opposite of the classical economics view that busts occur and government intervention is required to create a boom. In the ABCT, government intervention is causing the boom which leads to the bust.

## 5. In-class exercises

1. Explain whether each of the following events will increase, decrease, or have no effect on long-run aggregate supply.

- a. The United States experiences a wave of immigration.
- b. Congress raises the minimum wage to \$15 per hour.
- c. Intel invents a new and more powerful computer chip.
- d. A severe hurricane disrupts factories along the East Coast.

2. Explain why the following statements are false.

- a. “The aggregate-demand curve slopes downward because it is the horizontal sum of the demand curves for individual goods.”
- b. “The long-run aggregate-supply curve is vertical because economic forces do not affect long-run aggregate supply.”
- c. “If firms adjusted their prices every day, then the short-run aggregate-supply curve would be horizontal.”
- d. “Whenever the economy enters a recession, its long-run aggregate-supply curve shifts to the left.”

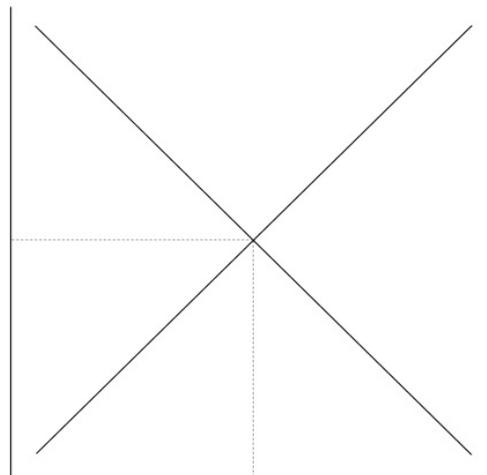
3. Explain whether each of the following events shifts the short-run aggregate-supply curve, the long-run aggregate-supply curve, the aggregate-demand curve, all, some, or none. *Hint*: refer to the pages in the lecture that provide the influences (shifters) of  $AD$ ,  $AS^{LR}$ , and  $AS^{SR}$ .

- a. Households decide to save a larger share of their income.
  
  
  
  
  
  
  
  
  
  
- b. Oil pipeline leak causes the Keystone XL pipeline to shutdown.
  
  
  
  
  
  
  
  
  
  
- c. Increased job opportunities overseas cause many people to leave the country.

4. For each of the following events, explain the short-run and long-run effects on output and the price level, assuming policymakers take no action.

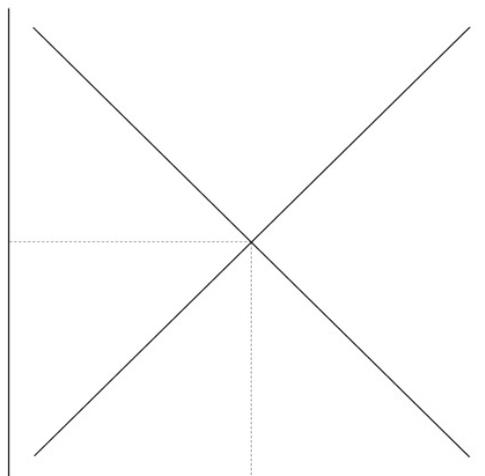
- a. The stock market declines sharply, reducing consumers' wealth.

- 1.
- 2.
- 3.
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- 6.



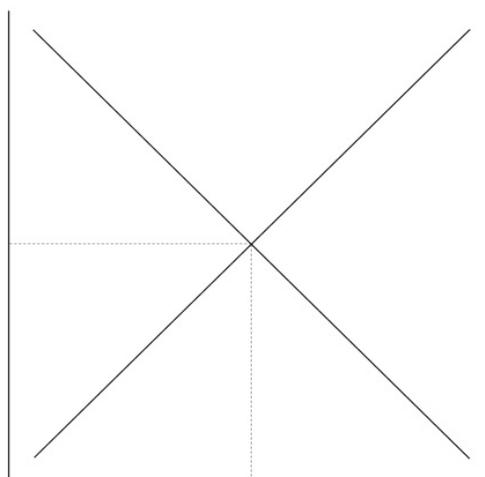
b. The federal government increases spending on national defense.

- 1.
- 2.
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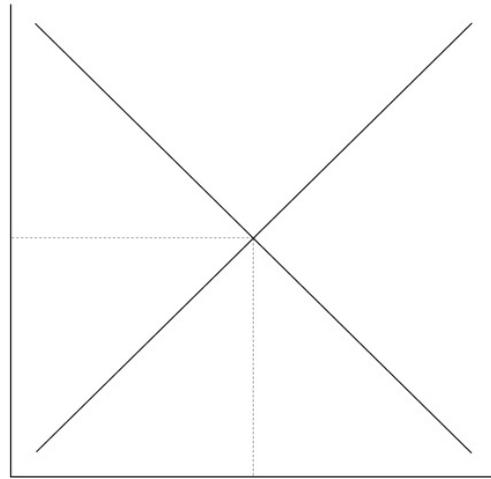
c. A technological improvement raises productivity.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.



d. A recession overseas causes foreigners to buy fewer U.S. goods.

- 1.
- 2.
- 3.
- 4.
- 5.



## Lecture 15: Policy Analysis (CORRESPONDS WITH CHAPTER 16)

Because output prices are sticky in the short-run, this permits government fiscal and monetary policy to stimulate the economy (through increases in aggregate demand). In this lecture, we study how changes in monetary and fiscal policy stimulate AD through changes in the money supply. We also study the dynamics of fiscal stimulus.

### 1. The money model

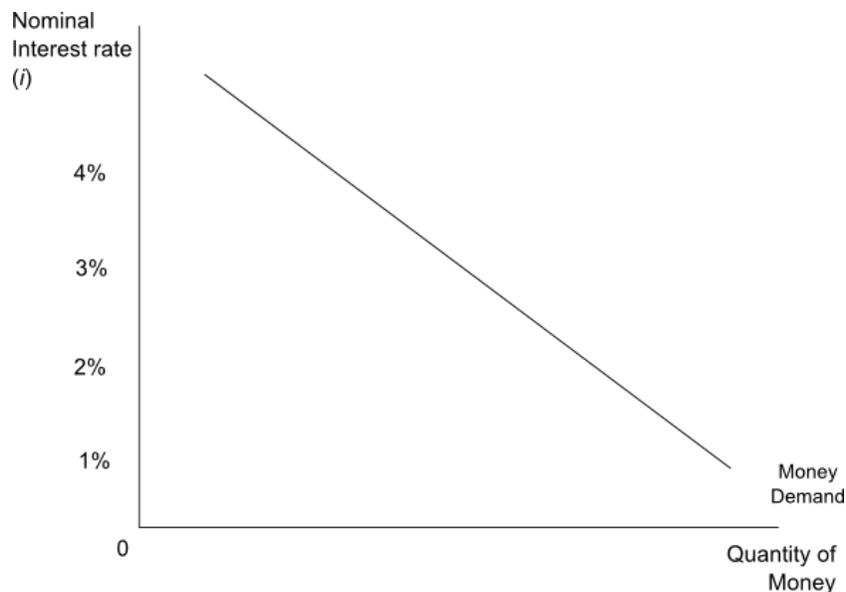
The supply and demand for money determines the value of money in the short-run.

- The quantity of money is currency in circulation and non-interest bearing deposits used for *transaction purposes*.
- The price of money is the opportunity cost of holding money instead of using this money to buy interest-bearing assets (such as savings, bonds, and stocks).
  - Equal to the short-run nominal interest rate,  $i$ .
  - Given that inflation is typically extremely low in the short-run, the nominal interest rate approximates the real interest rate. That is, in the short-run,  $i = r$ .

#### 1.1.1. Demand for money

The demand for money reflects how much wealth people want to hold in the form of money.

- The higher the opportunity cost of holding money, the less money people will hold for *transaction purposes*.

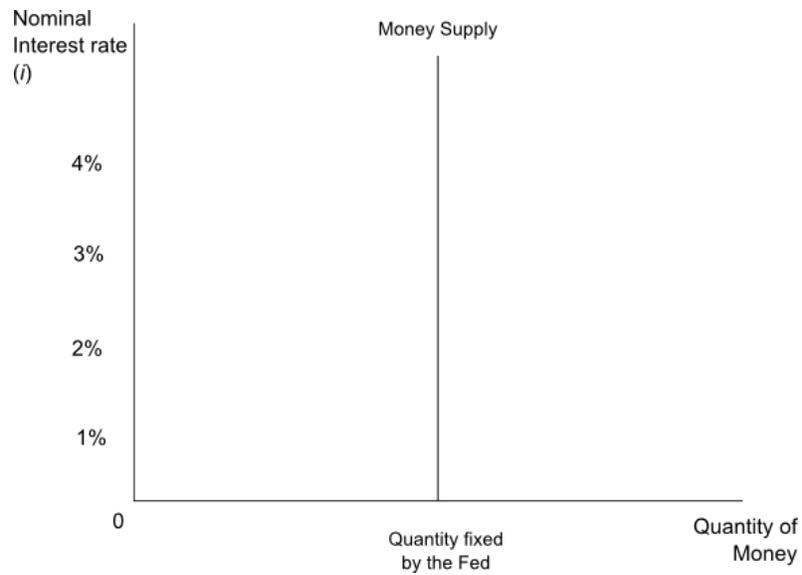


**As the interest rate rises, individuals reduce money holdings and increase asset holdings.**

### 1.1.2. Supply of money

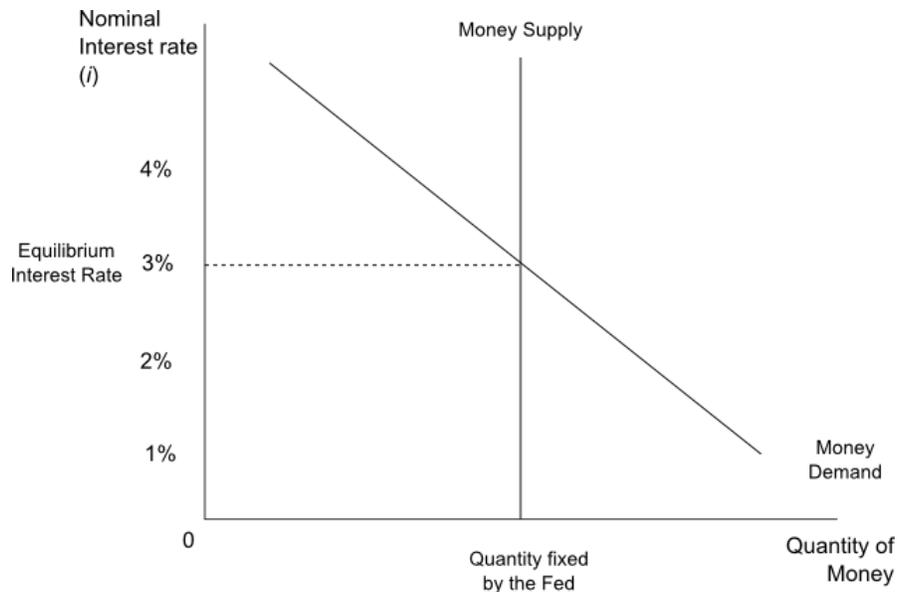
The central bank controls the quantity of money supplied through monetary policy.

- The central bank adjusts total reserves in the banking system and this directly links to the money supply through the fractional reserve banking system.
- The money supply is fixed and independent of the interest rate.



### 1.1.3. Equilibrium

Equilibrium in the market for money is found at the intersection of supply and demand.



- At an interest rate of 4%, excess supply exists.
  - Individuals desire to hold less money, and more interest-bearing assets.
- At an interest rate of 2%, excess demand exists:
  - Individuals desire to hold more money, and less interest-bearing assets.

### 1.1.4. Shifts in demand

Money demand depends on the following influences.

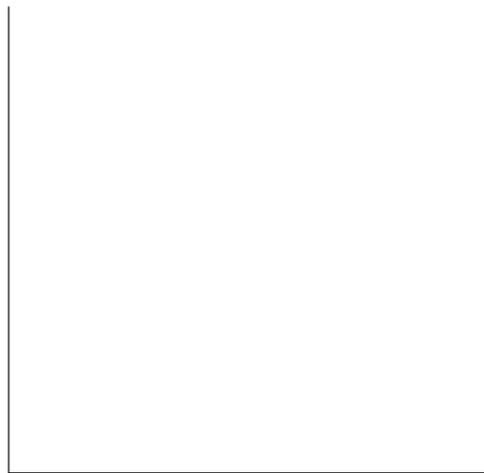
- 1) Price level: as prices rise, individuals require more money to buy the same basket of goods.
- 2) Real GDP: as income goes up, individuals desire to hold more money.
- 3) Financial innovation: as liquidity becomes easier to attain, individuals hold less money. Examples include ATMs, credit cards, debit cards, automatic transfers from savings to checking, internet banking, and bill pay. These innovations slow how often money is used to conduct transaction (the velocity of money,  $V$ ).

### 1.1.5. Shifts in Supply

Changes in the supply of money are caused by monetary policy.

1. Open market purchase
  2. Reserve requirement ratio
  3. Discount rate
- When the Fed conducts expansionary monetary policy, such as an *open-market purchase*, it increases the supply of money.
  - When the Fed conducts contractionary monetary policy, such as an *open-market sale*, it decreases the supply of money.

Exercise 1: Suppose the market for money is in equilibrium and then the Fed conducts an open market purchase. What happens to the short-run real interest rate after such a monetary injection?



### Short-run Dynamics

- 1) Feds increase the quantity of money.
  - 2) Individuals find they are holding more money than the quantity demanded (excess supply).
  - 3) Individuals save less.
  - 4) Short-run nominal interest rate falls.
- ❖ Does the *real* interest rate necessarily fall as well?

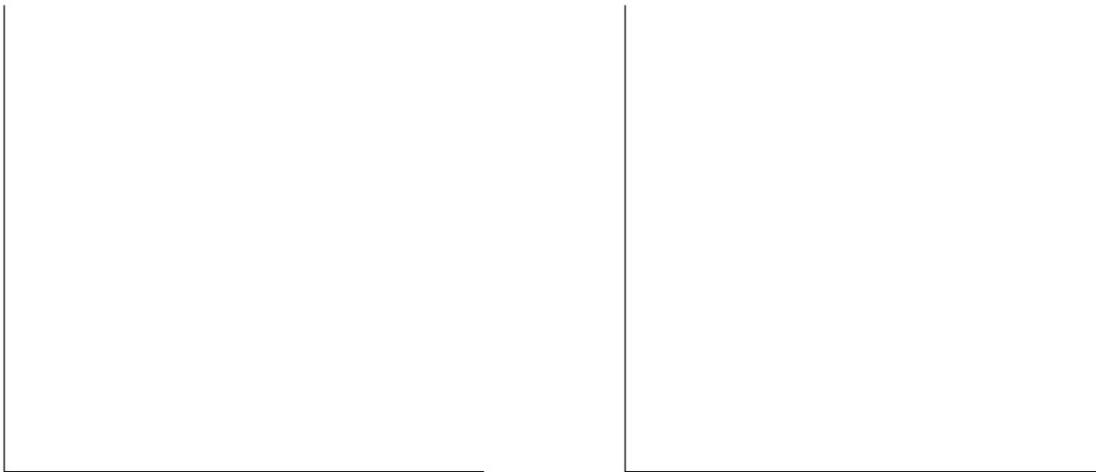
## 1.2. Combining the money model with the AD-AS model

Recall that in the preceding lecture, the aggregate demand curve was downward sloping due to three effects:

1. The wealth effect
2. The interest rate effect (biggest effect for large open economies)
3. The exchange rate effect

That is, an increase in price through these channels causes the quantity of goods and services demanded to increase. To understand this transmission mechanism more fully, we use the money market along with the AD-AS model.

Exercise 2: Suppose that the price level increases. What happens to aggregate demand?



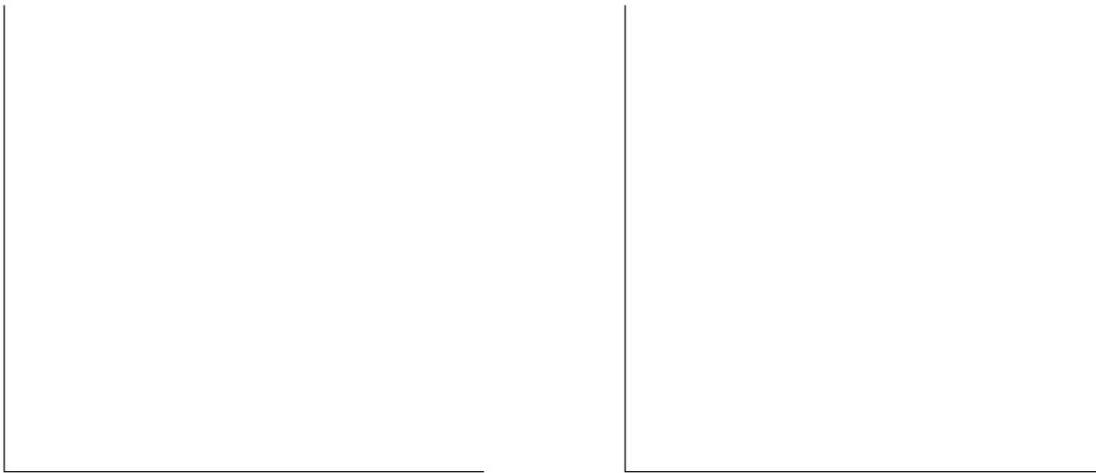
- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**Conclusion:**

### 1.3. Monetary Policy

This model can be used to study how changes in the money supply affect aggregate demand. That is, suppose policymakers desire to stimulate the economy, how does increasing the money supply stimulate it?

Exercise 3: Suppose the central bank increases the money supply. What is the short-run effect on the interest rate, investment, output, and the price level?



- 1.
- 2.
- 3.
- 4.

**Conclusion:**

The above exercise makes it clear that monetary policy can be described either in terms of the money supply or in terms of the interest rate.

## 1.4. Fiscal policy

Through lowering taxes or increasing government spending, aggregate demand will increase. When the government purchases goods, there are two macroeconomic effects that make the size of the shift in AD differ from the original amount of government spending or taxes.

- The fiscal multiplier effect from government spending or taxes cause increases in income and thereby increases in consumer spending.
  - The fiscal multiplier effect results in an additional shift outward in aggregate demand when expansionary fiscal policy is conducted.
- The crowd-out effect is caused by the contractionary reaction of the private sector due to higher interest rates.
  - The crowd-out effect results in additional shifts inward in aggregate demand when expansionary fiscal policy is conducted.

The overall change in AD from a change in G:

$$\Delta AD = \text{multiplier effect} - \text{crowdout effect}$$

where  $\Delta$  is represents a change in a variable

### 1.4.1. The fiscal multiplier effect

An important number in the formula for the fiscal multiplier is the marginal propensity to consume (MPC) – the fraction of extra income that a household consumes rather than saves.

To gauge the impact on aggregate demand of a change in government purchases, we follow the effect step by step.

Exercise 4: Suppose the government spends \$20 billion on new planes. Assuming that MPC = 0.75, what is the size of the fiscal multiplier effect on AD?

The effect on aggregate demand from a change in government spending can be summarized as:

$$\text{fiscal multiplier effect} = \Delta G / (1 - \text{MPC})$$

where  $\Delta$  is represents a change in a variable.

### 1.4.1.1. Changes in taxes

Changes in taxes work similarly to changes in government spending. However, there are caveats:

1. The permanency of the tax change profoundly impacts the efficacy of the policy.
2. Tax impacts are not as large as government purchases since the initial purchase is never made.
3. The initial tax change is a government transfer and excluded from a change in  $G$  when calculating GDP using the expenditure approach.

Exercise 5: Suppose the MPC is 0.75. If the government decreases taxes by \$20 billion, then what is the size of the fiscal multiplier effect on AD?

The effect on aggregate demand from a change in taxes can be summarized as:

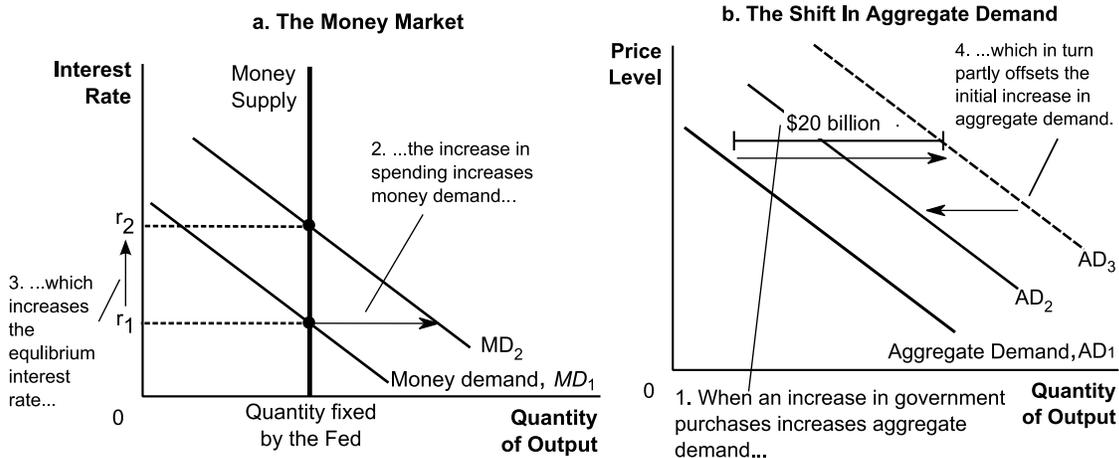
$$\text{fiscal multiplier effect} = -\Delta T * \text{MPC} / (1 - \text{MPC})$$

where  $\Delta$  is represents a change in a variable.

The fiscal multiplier effect for a change in the tax is equal to the fiscal multiplier effect for a change in government spending minus the initial tax change.

### 1.4.2. The crowding-out effect

The multiplier effect seems to suggest that when the government buys goods, the resulting expansion in aggregate demand is necessarily larger than the amount of the government's purchase. The crowding-out effect may offset the increase in aggregate demand.



#### The crowding-out effect works as follows:

1. When the government buys products and services from companies, profits and employment increase causing an increase in aggregate demand.
2. Owners and workers at these firm will see an increase in income. If they desire to buy more, they need to increase their money holdings. Shifts money demand outward.
3. The increase in money demand pushes the interest rate up.
4. An increase in the interest rate causes the *AD* curve shifts back because:
  - a. Consumption goes down as individuals save more.
  - b. Investment goes down.
  - c. *NCO* goes down (since domestic residences are buying fewer foreign assets and foreigners are buying fewer domestic assets). Since  $NCO = NX \Rightarrow NX$  decreases.

**Conclusion:** The crowding-out effect causes a decrease in aggregate demand. The overall effect of expansionary policy is the difference between the increase in *AD* from the multiplier effect minus the decrease in *AD* from the crowd out effect.

## **2. Stabilizing the economy?**

One might wonder if fiscal policy should be used to stabilize the economy. This analysis suggests that there may be some impact on the economy. While the monetary policy presented seems to indicate that increasing the money supply is a great way of increasing the AD, the costs of inflation in the near future is quite real.

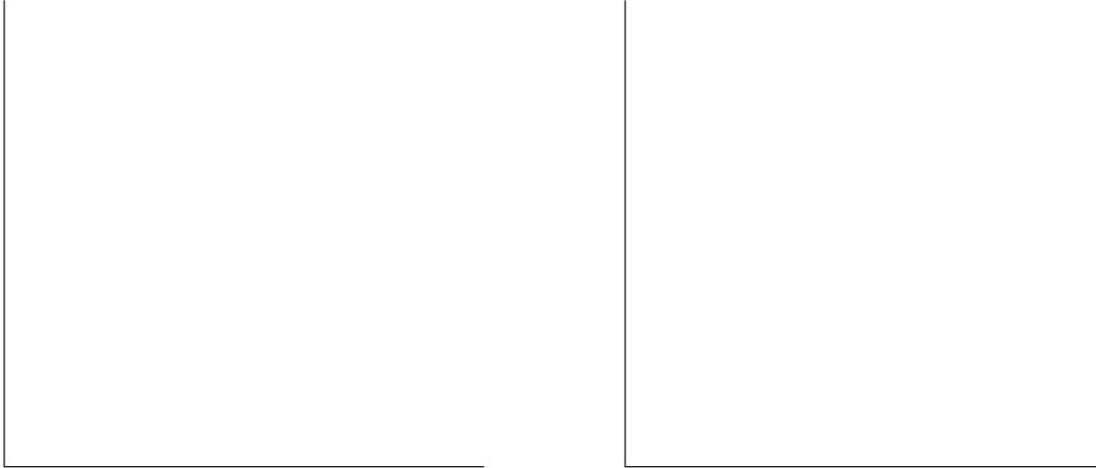
As there is no consensus in the field of when and how the government should intervene, I would suggest that the field is not mature enough to make any accurate statement on stabilizing or stimulating the economy.

There are some automatic stabilizers that turn on during a recession that stimulate aggregate demand. These are:

1. Tax system – progressive tax system decreases tax bill for lower earnings.
2. Unemployment benefits – those that have lost their job can obtain income supplements through the government.

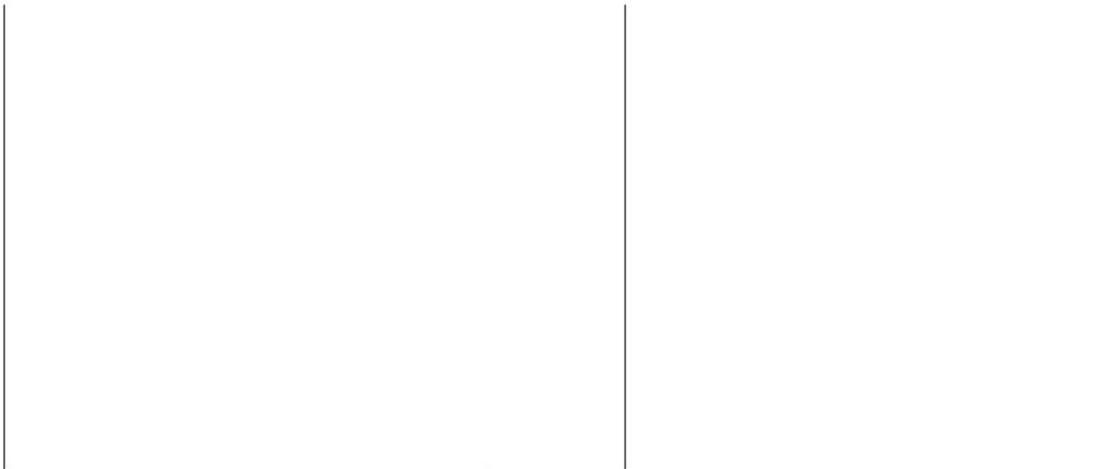
Exercise 6: Suppose government spending increases. Would the effect on aggregate demand be larger if the Fed took no action in response or if the Fed were committed to maintaining a fixed interest rate? Explain.

No central bank intervention



- 1.
- 2.
- 3.
- 4.
- 5.

Central bank intervention

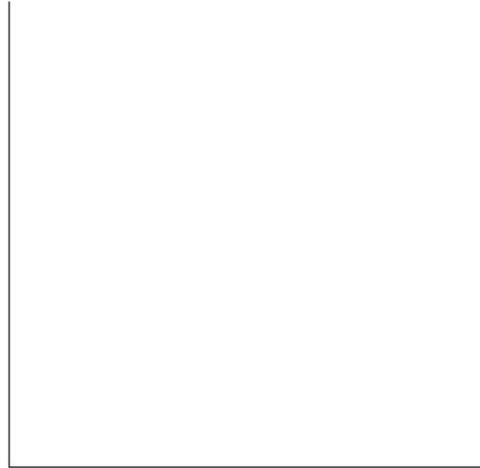
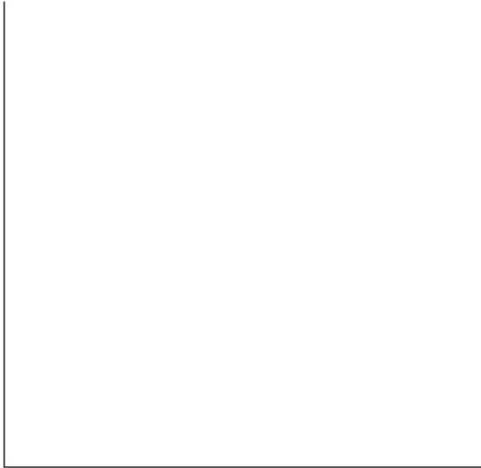


- 6.
- 7.
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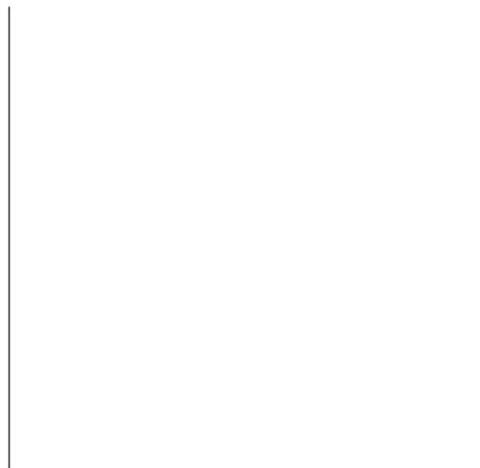
**Conclusion:**

### 3. In-class exercises

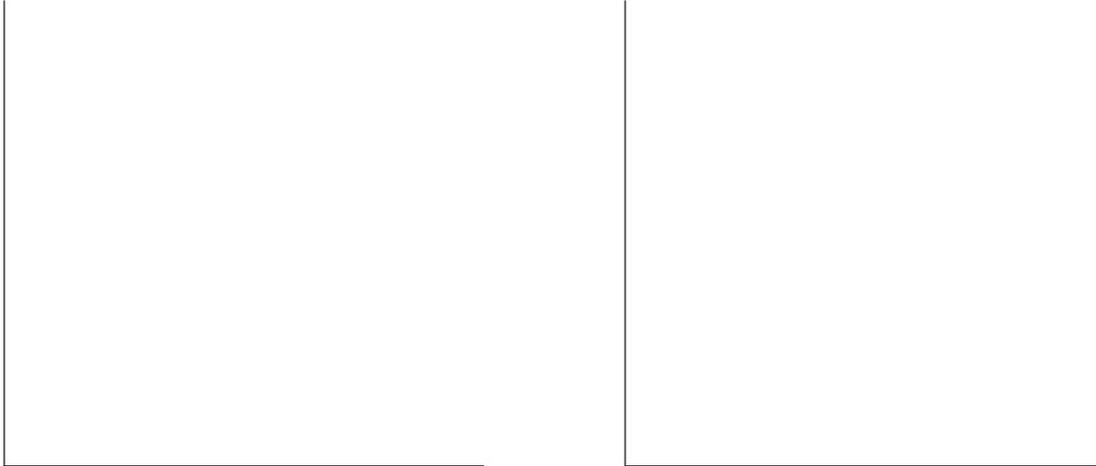
1. Suppose banks install automatic teller machines on every block and, by making cash readily available, reduce the amount of money people want to hold.
  - a. Assume the Fed does not change the money supply. According to the theory of liquidity preference, what happens to the interest rate? What happens to aggregate demand?



- b. If the Fed wants to stabilize aggregate demand, how should it respond?



2. The economy is in a recession with high unemployment and low output.
- a. Use aggregate demand and aggregate supply to illustrate the current situation.



- b. Identify monetary policy that would restore the economy to its natural rate.
- c. Draw the money market to illustrate the effect of the monetary policy. Show the resulting change in the interest rate.
- d. Complete the above AD-AS graph to demonstrate the effect of monetary policy on output and the price level. Explain in words.



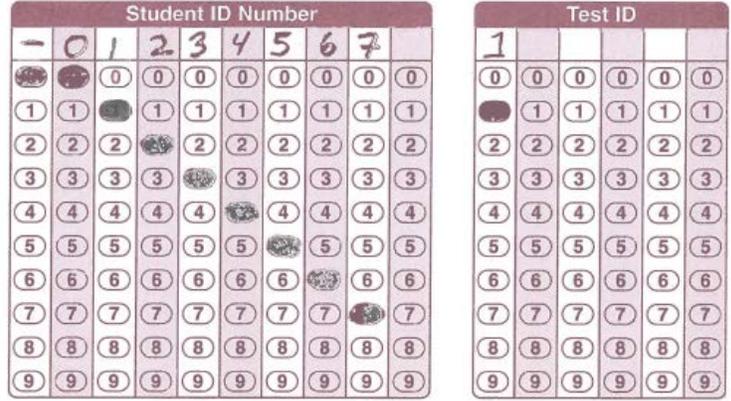
## Exam I Information

Bring: Pencils, calculator, ID

Do not use: cellphone, headphones, books, notes

### Procedure

1. On bubble sheet:
  - a. Write your name
  - b. Write and bubble in student ID
  - c. Write and bubble test ID.
2. Show ID and turn in bubble sheet.
3. Keep your exam.



### Reminders

- Eyes on your own exam.
- 32 multiple choice questions.
- Provided with an equation sheet (at the back of this packet).
- Identify the choice that best completes the statement or answers the question.
- Answers on bubble sheet are the only ones that I count.
- The time allotted for this exam is the entire class time.
- Distribution of questions is approximately equal across Lectures below.

#### Lecture 1: Introduction

- Three macroeconomic indicators
- Long-run vs. short-run
- Federal budget

#### Lecture 2: Production

- PPF
- Technological progress (both types)

#### Lecture 3: Trade

- Opportunity cost
- Absolute and comparative advantage
- Gains and losses from trade
- Trade myths

#### Lecture 4: Supply and Demand

- Demand: law and shifters
- Supply: law and shifters
- Market equilibrium, surplus, and shortage

#### Lecture 5: GDP

- Definition
- $GDP = Y = C + I + G + NX$
- Nominal vs. Real GDP
- GDP as a measure of well being

#### Lecture 6: Production and Growth

- Varieties of growth experience
- What is productivity?
- Determinants of productivity
- The role of government policy
- Chain weight GDP growth

#### Lecture 7: Measuring the Cost of Living

- Calculating CPI and inflation
- CPI vs. GDP deflator
- Comparing prices in different years
- Real vs. nominal interest rates
- GDP deflator and inflation

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## Exam II Information

Bring: Pencils, calculator, ID

Do not use: cellphone, headphones, books, notes

### Procedure

1. On bubble sheet:
  - a. Write your name
  - b. Write and bubble in student ID
  - c. Write and bubble test ID.
2. Show ID and turn in bubble sheet.
3. Keep your exam.

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### Reminders

- Eyes on your own exam.
- 32 multiple choice questions.
- Provided with an equation sheet (at the back of this packet).
- Identify the choice that best completes the statement or answers the question.
- Answers on bubble sheet are the only ones that I count.
- The time allotted for this exam is the entire class time.
- Distribution of questions is approximately equal across Lectures below.

#### Lecture 8: Unemployment

- What does unemployment measure
- Classification of laborers
- Measuring employment statistics
- Bias in unemployment statistics
- Types of unemployment

#### Lecture 10: The Monetary System

- Functions of money
- The Federal Reserve System
- Balance sheet analysis
- Fractional reserve banking
- Monetary policy

#### Lecture 9: Savings, Investment, and the financial system

- What are financial institutions?
- Savings, investment, and financial institutions
- Loanable funds model
- Real cost of borrowing
- How are savings, investment, and interest rates affected by government policies

#### Lecture 11: Money Growth and Inflation

- What isn't a consequence of inflation
- Classical theory of inflation
  - Quantity theory of money
- Consequences of inflation
- Monetary neutrality
- Hyperinflation
- Tax distortions and the real after tax return

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## Final Exam Information

Bring: Pencils, calculator, ID

Do not use: cellphone, headphones, books, notes, etc.

### Procedure

1. On bubble sheet:
  - a. Write your name
  - b. Write and bubble in student ID
  - c. Write and bubble test ID.
2. Show ID and turn in bubble sheet.
3. Keep your exam.

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

### Reminders

- Use all three study guides.
- Eyes on your own exam.
- 42 multiple choice questions.
- Provided with an equation sheet (at the back of this packet).
- Identify the choice that best completes the statement or answers the question.
- Answers on bubble sheet are the only ones that I count.
- The time allotted for this exam is 1 hour and 50 minutes.
- Comprehensive final on all material covered in course.
- Distribution of questions is approximately:
  - 25% from Lectures 1 – 7
  - 25% from Lecture 8 – 11
  - 50% from Lectures 12 – 15

Lecture 1–11: See previous exam overviews.

- Effects of trade policy on economy

Lecture 12: Open-economy Concepts

- $NX = EX - IM$ 
  - Downward sloping
  - Shifters
- $NCO = CO - CI$ 
  - Downward sloping
  - Shifters
- $NCO = NX$
- Law of one price

Lecture 14: AD-AS

- Wealth, interest, and exchange rate effects
- Equilibrium (SR and LR)
- Shifters of AD,  $AS^{SR}$ , and  $AS^{LR}$
- Government intervention

Lecture 13: Open-economy Model

- Loanable funds model w/ NCO
- Foreign currency exchange model
- Equilibrium in two both markets

Lecture 15: Policy Analysis

- Money Model
- Shifters of MS and MD
- Effects of government intervention
- Fiscal policy
  - Multiplier effect
  - Crowd-out effect

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## Equation Sheet

$$\frac{\text{Output of good}_1}{\text{Input of good}_1} = \frac{\text{Output of good}_2}{\text{Input of good}_2}$$

$$OC_{\text{Good}_1} = \frac{\text{loss in quantity of good}_2}{\text{gain in quantity of good}_1}$$

$$OC_{\text{good}_2} = \frac{1}{OC_{\text{Good}_1}}$$

$$Q_s = Q_d = Q^*$$

$$Y_t = C_t + I_t + G_t + NX_t$$

$$NX_t = EX_t - IM_t$$

$$Y_t = Inc_t + Dep_t + T_t + NFP_t$$

$$Y_t = f(A_t, k_t, h_t, R_t)$$

$$NGDP_t = P_t^1 \times Q_t^1 + P_t^2 \times Q_t^2 + \dots + P_t^n \times Q_t^n$$

$$RGDP_t(\text{BY}) = P_{\text{BY}}^1 \times Q_t^1 + P_{\text{BY}}^2 \times Q_t^2 + \dots + P_{\text{BY}}^n \times Q_t^n$$

$$g(RGDP_t) = \left( \frac{RGDP_t}{RGDP_{t-1}} - 1 \right) \times 100$$

$$RGDPP_t = \underbrace{\frac{RGDP_t}{\text{Workers}_t}}_{\text{Productivity}} \cdot \underbrace{\frac{\text{Workers}_t}{\text{Population}_t}}_{\text{LFPR}} = \frac{RGDP_t}{\text{Population}_t}$$

$$g(RGDP_t^{CW}) = (g_t^{BY_1} \times g_t^{BY_2} \times \dots \times g_t^{BY_m})^{1/m}$$

$$RGDP_t = RGDP_{t-1} \times (1 + g(RGDP_t^{CW}))$$

$$g(RGDP_t) = g(NGDP_t) - g(\text{Prices}_t)$$

$$g(RGDPP_t) = g(RGDP_t) - g(\text{Population}_t)$$

$$\text{Total cost}_t = P_t^1 \times Q_{\text{BY}}^1 + P_t^2 \times Q_{\text{BY}}^2 + \dots + P_t^n \times Q_{\text{BY}}^n$$

$$CPI_t = \frac{\text{Total Cost}_t}{\text{Total Cost}_{\text{BY}}} \times 100$$

$$\pi_t = g(\text{Prices}_t) = \left( \frac{CPI_t}{CPI_{t-1}} - 1 \right) \times 100$$

$$\text{GDP deflator}_t = \frac{NGDP_t}{RGDP_t} \times 100$$

$$\pi_t = g(\text{Prices}_t) = \left( \frac{\text{GDP deflator}_t}{\text{GDP deflator}_{t-1}} - 1 \right) \times 100$$

$$\text{Dollars}_t = \text{Amount in year } T \text{ dollars} \times \frac{CPI_t}{CPI_T}$$

$$\text{Region A dollars} = \text{Region B dollars} \times \frac{CPI_A}{CPI_B}$$

$$E(r) = i - E(\pi) \quad \text{if expected inflation}$$

$$r = i - \pi \quad \text{if actual inflation}$$

$$\text{Income}_{\text{FY}} = \text{Income}_{\text{CY}} \times (1 + x)^{(\text{FY} - \text{CY})}$$

## Equation Sheet Con.

$$LF_t = EMP_t + UNEMP_t$$

$$LFPR_t = LF_t / POP_t * 100$$

$$unemp\ rate_t = UNEMP_t / LF_t * 100$$

$$S = I \text{ if } NX = 0 \text{ (closed economy)}$$

$$\underbrace{S}_{\text{National savings}} = \underbrace{Y - C - T}_{\text{Private savings}} + \underbrace{T - G}_{\text{Public savings}}$$

$$r_{AT} = i(1 - \tau) - \pi \quad \text{if } \pi < 10\%$$

$$r_{AT} = \frac{i(1 - \tau) - \pi}{100\% + \pi} \quad \text{if } \pi \geq 10\%$$

$$M = C + D$$

$$MB = C + R$$

$$m = \frac{1}{rrr}$$

$$RR = rrr \times D$$

$$R = RR + ER$$

$$D = m \times (R - ER)$$

$$\text{Assets} = \text{Liability} + \text{Bank Capital}$$

$$LR = \text{Assets} / \text{Bank Capital}$$

$$M_t \times V_t = P_t \times Y_t$$

$$g(M) + g(V) = g(\text{Price}) + g(\text{RGDP})$$

$$G_t = T_t + B_t + M_t$$

$$NCO = CO - CI$$

$$NCO = NX$$

$$S = I + NCO$$

$$RER_{f,d} = NER \times \frac{\text{price}_d}{\text{price}_f}$$

$$Y_{AD} = Y_{AS}^{SR} = Y^*$$

$$\text{fiscal multiplier effect} = \Delta G / (1 - MPC)$$

$$\text{fiscal multiplier effect} = -\Delta T \times MPC / (1 - MPC)$$

$$\Delta AD = \text{fiscal multiplier effect} - \text{crowdout effect}$$