



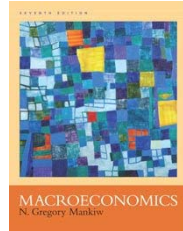
Intermediate Macroeconomics

ECON 302

Professor Yamin Ahmad

Lecture 1:

- Introduction
- National Income and Product Accounts



Syllabus



- Aplia Website:
 - <http://www.aplia.com>
 - Use course code: 8PXU-WN8B-K3RC
- Textbook:
 - Blanchard, Olivier (2010), Macroeconomics, 5th edition, Pearson/Prentice Hall. ISBN: 0-13-215986-4.
- Course Homepage:
 - <http://facstaff.uww.edu/ahmady/courses/econ302/>

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Topic 1: Introduction: Philosophy and Data; National Income and Product Accounts; Math Review; Business Cycles Facts and Theories

The Short Run:

2. A Basic Model: IS-LM
3. Aggregate Demand
4. Aggregate Supply
5. Macroeconomic Policy
6. Exchange Rates
7. The Open Economy (Mundell Fleming Model)

Time Permitting (more advanced theories):

8. Consumption Theory

The Long Run:

9. National Income Accounting
10. Growth Theory

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Some Key Questions of Macroeconomics

- Why do incomes grow? Why are some countries richer than others? Why do some grow faster than others?
- Why do incomes fluctuate? Can policy do anything about it?
- Why is there unemployment? Is it a necessary part of economic life? How is it affected by policy?
- What determines inflation?

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To address these questions we need to know...

- How individuals behave (“*microfoundations*”)
- How individuals interact (“*market structure*”)
- How government enters the picture (both the *feasibility of policy* and the *incentives facing policy makers*)

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Structure of Different Models

- **Models** embody assumptions about individual behavior, market structure and what is **exogenous** (including policy regime).
- Solution gives us the **endogenous variables** in terms of the **exogenous factors**.
- Models should be simple and focus on issue at hand. Do not need to be “realistic”, but should be consistent with the facts.
- Can switch between models according to context; no grand “true” model.

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Mathematical functions

- We use functional notation when we want to express the idea that one variable is determined by other variables.
 - For example, supply of pizzas is a function of the price of pizzas and the price of materials (price of inputs):

$$Q^s = S(P, P_m)$$

- In this example, the quantity supplied of pizza is the “**endogenous**” variable in the pizza supply model.
 - The price of pizza and the price of materials are “**exogenous**” for the pizza maker under perfect competition. He cannot influence those prices (assuming that he is not a monopoly seller of pizza!)

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More on Endogenous and Exogenous Variables

- Variables that are exogenous in some models might be endogenous in other models.
 - For example, in one macro model, we might take interest rates as exogenous.
 - But some economic models are designed exactly to explain interest rates.
- In some cases, a variable is exogenous in the building block of a more general model, but endogenous in the general model.
 - *Price of pizza is exogenous for the pizza supplier, but determined within our model of the pizza market.*

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Example: The Pizza market

- We can take the equations for supply of pizza, demand for pizza, and market equilibrium:

$$Q^s = S(P, P_m)$$

$$Q^d = D(P, Y)$$

$$Q^s = Q^d$$

- P and P_m are exogenous for the pizza supplier. P and Y are exogenous for the pizza demander.
- These three equations together determine Q^s , Q^d , and P endogenously. The exogenous variables for the pizza market are P_m and Y .

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Macroeconomic example

- We will model aggregate consumption as depending on “disposable” income:

$$C = C(Y - T)$$

- For consumers in this model, income and taxes are exogenous.
 - But aggregate income will be determined in our macro model.
- In most of our macro models, aggregate taxes will be exogenous, but sometimes they will be endogenous.
- In most of our models of consumer’s income is exogenous, but sometimes it is endogenous. Income depends on how many hours we work, for example.

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Simple Problem

Review how to solve endogenous variables:

- Task:** Solve for P and Q , in terms of P_m and Y :

$$Q = a + bP - cP_m \quad Q = d - eP + fY$$

- a , b , c , d , e , and f are “**parameters**”. For example, e tells us how much demand falls when the price rises.

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Common Strands Amongst Recent Macro Models:

- Individuals and firms **optimize**
- Rational Expectations** in the long run
- Prices flexible in the long run

Also frequently:

- Perfect Competition:** May be unrealistic, but often a useful simplification

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Controversial Issues

- Are prices flexible in the short run?
- How important are “frictions” and “mistakes” in the short run?
- Are market imperfections (**monopolistic competition**, etc.) important for understanding macroeconomic phenomena?

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Important Concepts...

- Gross Domestic Product (GDP)
- Components of GDP
- Gross National Product (GNP)
- Price Indices:
 - GDP Deflator
 - The Consumer Price Index (CPI)
- The Unemployment Rate

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Aggregate Output

- **National income and product accounts** are an accounting system used to measure of aggregate economic activity.
- The measure of **aggregate output** in the national income accounts is **gross domestic product**, or **GDP**.
- In the United States, the Bureau of Economic Analysis calculates GDP and components of the National Accounts ([NIPA Table 1.1.5](#))

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GDP: Production and Income

There are three ways of defining GDP:

1. GDP is the value of the final goods and services produced in the economy during a given period.
 - A **final good** is a good that is destined for final consumption.
 - An **intermediate good** is a good used in the production of another good.
2. GDP is the sum of the incomes in the economy during a given period.
3. GDP is the sum of value added in the economy during a given period.
 - **Value added** equals the value of a firm's production minus the value of the intermediate goods it uses in production.

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Gross Domestic Product: Expenditure and Income

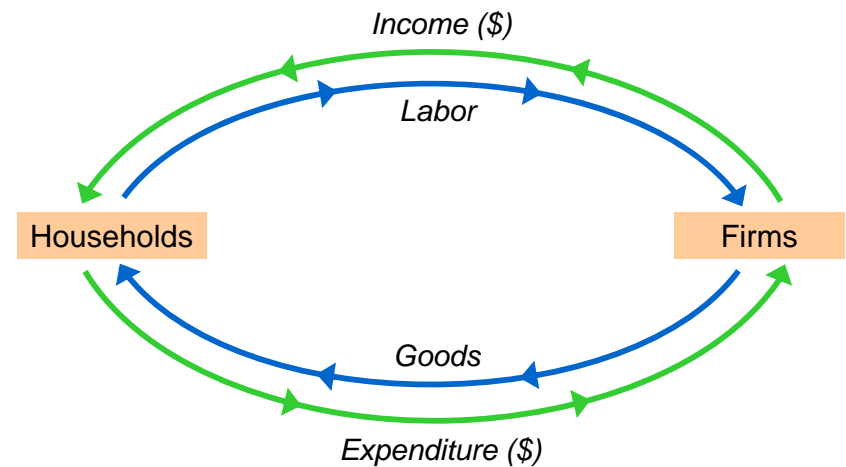
For first two definitions:

- Total expenditure on domestically-produced final goods and services.
- Total income earned by domestically-located factors of production.

Expenditure equals income because every dollar spent by a buyer becomes income to the seller.



The Circular Flow



Value Added Approach: (Exercise)

- A farmer grows a bushel of wheat and sells it to a miller for \$1.00.
- The miller turns the wheat into flour and sells it to a baker for \$3.00.
- The baker uses the flour to make a loaf of bread and sells it to an engineer for \$6.00.
- The engineer eats the bread.

*Compute & compare
value added at each stage of production
and GDP*



Final goods, value added, and GDP

- GDP = value of final goods produced
= sum of value added at all stages of production.
- The value of the final goods already includes the value of the intermediate goods...
- ... so including intermediate and final goods in GDP would be double-counting.
- Gross Domestic Product (at current prices)
= Value of goods and services
less cost of intermediate inputs
= $P_1Q_1 + P_2Q_2 + \dots + P_nQ_n$



The Expenditure Components of GDP

- **C**onsumption
- **I**ntermediate Investment
- **G**overnment spending
- **N**et e**X**ports



An important identity

$$Y = C + I + G + NX$$

\nearrow
 Value of
 Total
 Output

 {
 Aggregate
 Expenditure



The Components of Gross Domestic Product in 2010

	Billions of dollars	Percent of GDP
GDP (Y)	14,592	100
1. Consumption (C)	10,353	71
2. Investment (I)	1,769	12.1
Nonresidential	1,368	9.4
Residential	355	2.4
3. Government spending (G)	2,975	20.4
4. Net exports	-505	-3.5
Exports (X)	1,746	12.0
Imports (IM)	-2,252	-15.4
5. Inventory investment	45.3	0.3



The Components of Gross Domestic Product in 2010

- **Consumption:** Approx 71% of US GDP
 - Includes expenditure on durables, which is like investment
- **Investment:** 15% of GDP
 - 12% private, 3% public. We shall ignore the latter;
 - Includes accumulation of inventories of unsold goods and work in progress (very volatile but small on average).
 - For comparison, in 2006, investment was approx 20% of GDP



The Components of Gross Domestic Product in 2010

- **Government Consumption:** 17% of GDP
 - Thus total public spending on goods and services is only 20% of GDP
 - Does not include spending on pensions, etc., which are like negative income taxes;
 - Including these transfer payments total public spending is approximately 35.6% of GDP.

- **Exports:** 12% of GDP

- **Imports:** 15.4% of GDP

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Consumption (C)

Definition: The value of all goods and services bought by households. Includes:

- **durable goods**
last a long time
ex: cars, home appliances
- **nondurable goods**
last a short time
ex: food, clothing
- **services**
work done for consumers
ex: dry cleaning, air travel.



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U.S. Consumption, 2010

	\$ billions	% of GDP
Consumption	\$10,353.5	71%
Durables	1,072.2	7.0
Nondurables	2,333.2	16.0
Services	6,948.1	47.6

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Investment (I)

Definition 1: Spending on [the factor of production] capital.

Definition 2: Spending on goods bought for future use

Includes:

- **Business Fixed Investment (Nonresidential)**
Spending on plant and equipment that firms will use to produce other goods & services.
- **Residential Fixed Investment**
Spending on housing units by consumers and landlords.
- **Inventory Investment**
The change in the value of all firms' inventories.

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U.S. Investment, 2010

	\$ billions	% of GDP
Investment	\$1,769.1	12.1%
Business fixed	1,368.3	9.4
Residential	355.5	2.4
Inventory	45.3	0.3

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Investment vs. Capital

Note: Investment is spending on new capital.

Example (assumes no depreciation):

- 1/1/2006:
economy has \$500b worth of capital
- during 2006:
investment = \$60b
- 1/1/2007:
economy will have \$560b worth of capital

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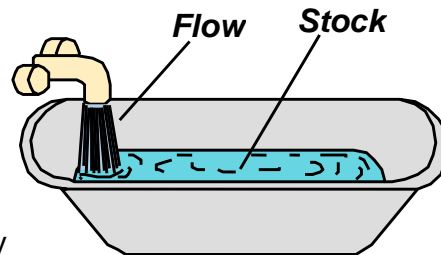
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Stocks vs. Flows

A **stock** is a quantity measured at a point in time.

E.g.,
“The U.S. capital stock was \$26 trillion on January 1, 2006.”



A **flow** is a quantity measured per unit of time.
E.g., “U.S. investment was \$2.5 trillion during 2006.”

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Stocks vs. Flows - examples

stock	flow
a person's wealth	a person's annual saving
# of people with college degrees	# of new college graduates this year
the Government Debt	the Government Budget Deficit
Capital	Investment

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Government spending (G)

- **G** includes all government spending on goods and services..
- **G** excludes transfer payments (e.g., unemployment insurance payments), because they do not represent spending on goods and services.



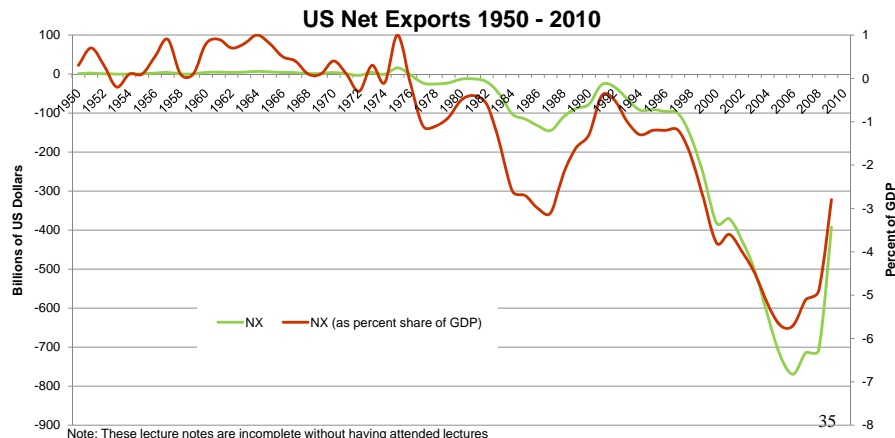
U.S. Government Spending, 2010

	\$ billions	% of GDP
Govt spending	\$2,975.1	20.4%
Federal	1186.3	8.1
Non-defense	380.7	2.6
Defense	805.6	5.5
State & local	1,788.8	12.3



Net exports: $NX = EX - IM$

Def: The value of total exports (**EX**) minus the value of total imports (**IM**).



A question for you:

Suppose a firm

- produces \$10 million worth of final goods
- but only sells \$9 million worth.

Does this violate the expenditure = output identity?



GDP:

An important and versatile concept

We have now seen that GDP measures

- total income
- total output
- total expenditure
- the sum of value-added at all stages in the production of final goods



GNP vs. GDP

- **Gross National Product (GNP):**
Total income earned by the nation's factors of production, regardless of where located.
 - **Gross Domestic Product (GDP):**
Total income earned by domestically-located factors of production, regardless of nationality.
- $$(GNP - GDP) = (\text{factor payments from abroad}) - (\text{factor payments to abroad})$$



Discussion question:

Which would you want to be bigger, GDP, or GNP?

Why?



U.S.A.	1.0%
Angola	-13.6
Brazil	-4.0
Canada	-1.9
Hong Kong	2.2
Kazakhstan	-4.2
Kuwait	9.5
Mexico	-1.9
Philippines	6.7
U.K.	1.6

(GNP – GDP) as a percentage of GDP selected countries, 2002



GNP per person

- In 2010, GDP for the US economy is around 14.6 trillion dollars, and GNP is about equal.
- There are 308.4 million people in the US
- So, GNP per person is \$47,341.
 - If you have four people in your family, you are “average” if your GNP is \$189,400.
 - How is this possible?

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Personal income

- **National income** is lower than GNP once we subtract off depreciation of capital. **Net National Product (NNP)** or **National Income** is about \$12.6 trillion
- Some National Income is retained by corporations. Personal income is \$12.2 trillion
 - This is still \$39,600 per person.
 - Or, it is \$79,000 per person in the labor force.
- “Median family income” in Wisconsin for a family of four is about \$75,000. For a family of two it is about \$55,000.

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To Summarize

- GDP = value of final goods produced
= sum of value added at all stages of production.
- Gross National Product = Sum of value added owned by domestic citizens
= GDP + Net income from abroad
- Net National Product = GNP – capital depreciation

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Real vs. Nominal GDP

- GDP is the value of all final goods and services produced.
- **Nominal GDP** measures these values using current prices.
- **Real GDP** measure these values using the prices of a base year.

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Measuring Output and Income

Real GDP:

- Real GDP = $P_1^B Q_1 + P_2^B Q_2 + \dots + P_n^B Q_n$
 (P_i^B = base year price)

- These are said to be at:
 - **market prices** if the P_i include sales taxes;
 - **factor cost** if the P_i exclude sales taxes.



Practice problem, part 1

	2006		2007		2008	
	P	Q	P	Q	P	Q
Apples	\$30	900	\$31	1,000	\$36	1,050
Oranges	\$100	192	\$102	200	\$100	205

- Compute nominal GDP in each year.
- Compute real GDP in each year using 2006 as the base year.



Real GDP controls for inflation

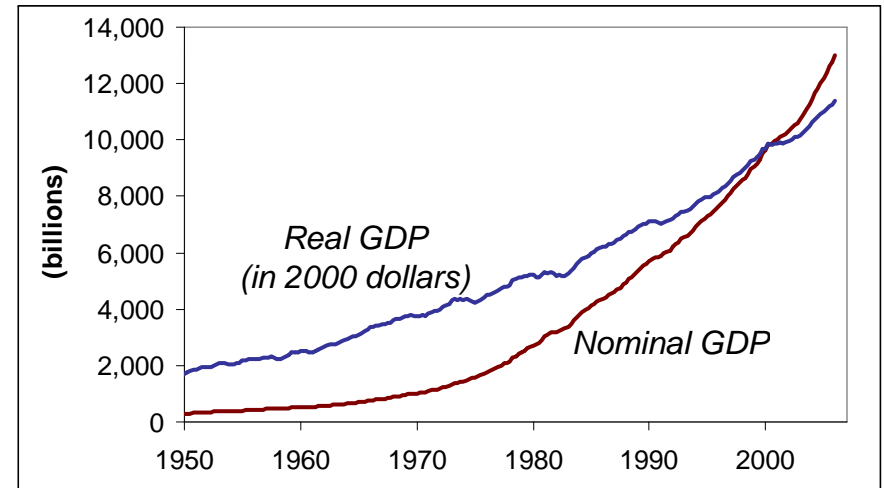
Changes in nominal GDP can be due to:

- changes in prices.
- changes in quantities of output produced.

Changes in real GDP can only be due to changes in quantities, because real GDP is constructed using constant base-year prices.



U.S. Nominal and Real GDP, 1950–2006





Nominal and Real GDP

- **Real GDP per capita** is the ratio of real GDP to the population of the country.
- **GDP growth** equals:

$$\frac{(Y_t - Y_{t-1})}{Y_{t-1}}$$

- Periods of positive GDP growth are called **expansions**.
- Periods of negative GDP growth are called **recessions**.

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Measuring the Price Level

- A **price index** expresses the “current” cost of a basket of goods and services as a percentage of (or, relative to) the cost of the same basket during some “base period.”
- A **Laspeyres** price index uses the quantities of the base period as the underlying basket.
 - E.g. CPI
- A **Paasche** price index uses the quantities of the current period as the underlying basket– so, the basket changes every period.
 - E.g. GDP Deflator calculated using “Base Year Methodology”

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Price Indices continued...

- For time periods after the base period, Laspeyres indexes tend to overstate inflation
- Paasche indexes tend to understate inflation.
- **Fisher’s** “ideal” index, is the (geometric) average of the Laspeyres and Paasche indexes
 - E.g. PCE (Personal Consumption Expenditure) deflator series which uses Chain Weighted Methodology

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GDP Deflator

- The **Inflation rate** is the percentage increase in the overall level of prices.
- One measure of the price level is the **GDP deflator**, defined as:

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

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Practice problem, part 2

	Nom. GDP	Real GDP	GDP deflator	Inflation rate
2006	\$46,200	\$46,200		<i>n.a.</i>
2007	51,400	50,000		
2008	58,300	52,000		

- Use your previous answers to compute the GDP deflator in each year.
- Use GDP deflator to compute the inflation rate from 2006 to 2007, and from 2007 to 2008.



Understanding the GDP deflator

Example with 3 goods

For good $i = 1, 2, 3$

P_{it} = the market price of good i in month t

Q_{it} = the quantity of good i produced in month t

$NGDP_t$ = Nominal GDP in month t

$RGDP_t$ = Real GDP in month t



Understanding the GDP deflator

$$\text{GDP deflator}_t = \frac{NGDP_t}{RGDP_t} = \frac{P_{1t}Q_{1t} + P_{2t}Q_{2t} + P_{3t}Q_{3t}}{RGDP_t}$$

$$= \left(\frac{Q_{1t}}{RGDP_t} \right) P_{1t} + \left(\frac{Q_{2t}}{RGDP_t} \right) P_{2t} + \left(\frac{Q_{3t}}{RGDP_t} \right) P_{3t}$$

The GDP deflator is a weighted average of prices.

The weight on each price reflects that good's relative importance in GDP.

Note that the weights change over time.



Two arithmetic tricks for working with percentage changes

1. For any variables X and Y ,
percentage change in $(X \times Y)$
 \approx percentage change in X
+ percentage change in Y

Eg: If your hourly wage rises 5% and you work 7% more hours, then your wage income rises approximately 12%.

Two arithmetic tricks for working with percentage changes

2. percentage change in (X/Y)
 \approx percentage change in X
 $-$ percentage change in Y

EX: GDP deflator = $100 \times \text{NGDP}/\text{RGDP}$.

If NGDP rises 9% and RGDP rises 4%,
 then the inflation rate is approximately 5%.

Some Calculus

- These “tricks” follow from using the Product and Quotient Rule in Calculus, as well as the total derivative

- If $Z = XY$

$$\text{then: } dZ = YdX + XdY$$

$$\Rightarrow \frac{dZ}{Z} = \frac{YdX}{XY} + \frac{XdY}{XY} = \frac{dX}{X} + \frac{dY}{Y}$$

- If $Z = \frac{X}{Y}$

$$\text{then: } dZ = \frac{YdX - XdY}{Y^2} = \frac{dX}{Y} - \frac{X}{Y^2}dY$$

$$\Rightarrow \frac{dZ}{Z} = \left(\frac{Y}{X}\right)\frac{dX}{Y} - \left(\frac{Y}{X}\right)\frac{X}{Y^2}dY = \frac{dX}{X} - \frac{dY}{Y}$$

Chain-Weighted Real GDP

- Over time, relative prices change, so the base year should be updated periodically.
- In essence, **chain-weighted real GDP** updates the base year every year, so it is more accurate than constant-price GDP.
- Textbooks usually use constant-price real GDP, because:
 - the two measures are highly correlated.
 - constant-price real GDP is easier to compute.

Consumer Price Index (CPI)

- A measure of the overall level of prices
- Published by the Bureau of Labor Statistics (BLS)
- Uses:
 - tracks changes in the typical household's cost of living
 - adjusts many contracts for inflation (“COLAs”)
 - allows comparisons of dollar amounts over time



How the BLS constructs the CPI

1. Survey consumers to determine composition of the typical consumer's "basket" of goods.
2. Every month, collect data on prices of all items in the basket; compute cost of basket
3. CPI in any month equals

$$100 \times \frac{\text{Cost of basket in that month}}{\text{Cost of basket in base period}}$$

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How is the "Basket" Determined?

- For the current CPI, this information was collected from the Consumer Expenditure Surveys for 2007 and 2008.
- In each of those years, about 7,000 families from around the country provided information each quarter on their spending habits in the interview survey.
- Another 7,000 families in each of these years kept diaries listing everything they bought during a 2-week period.
- Thus, over the 2 year period, expenditure information came from approximately 28,000 weekly diaries and 60,000 quarterly interviews used to determine the importance, or weight, of the more than 200 item categories in the CPI index structure.

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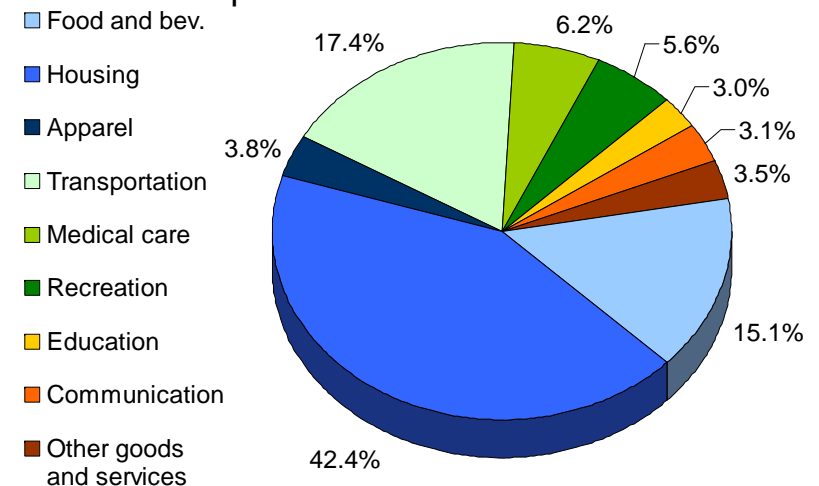
What Goods and Services show up in the CPI Basket?

1. **FOOD AND BEVERAGES** (breakfast cereal, milk, coffee, chicken, wine, full service meals, snacks)
2. **HOUSING** (rent of primary residence, owners' equivalent rent, fuel oil, bedroom furniture)
3. **APPAREL** (men's shirts and sweaters, women's dresses, jewelry)
4. **TRANSPORTATION** (new vehicles, airline fares, gasoline, motor vehicle insurance)
5. **MEDICAL CARE** (prescription drugs and medical supplies, physicians' services, eyeglasses and eye care, hospital services)
6. **RECREATION** (televisions, toys, pets and pet products, sports equipment, admissions);
7. **EDUCATION AND COMMUNICATION** (college tuition, postage, telephone services, computer software and accessories);
8. **OTHER GOODS AND SERVICES** (tobacco and smoking products, haircuts and other personal services, funeral expenses).

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The composition of the CPI's "basket"



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Exercise: *Compute the CPI*

Basket contains 20 pizzas and 10 compact discs.

Prices:

	pizza	CDs
2002	\$10	\$15
2003	\$11	\$15
2004	\$12	\$16
2005	\$13	\$15

For each year, compute

- the cost of the basket
- the CPI (use 2002 as the base year)
- the inflation rate from the preceding year

Understanding the CPI

Example with 3 goods

For good $i = 1, 2, 3$

C_i = the amount of good i in the CPI's basket

P_{it} = the price of good i in month t

E_t = the cost of the CPI basket in month t

E_b = the cost of the basket in the base period

Understanding the CPI

$$\begin{aligned} \text{CPI in month } t &= \frac{E_t}{E_b} = \frac{P_{1t}C_1 + P_{2t}C_2 + P_{3t}C_3}{E_b} \\ &= \left(\frac{C_1}{E_b} \right) P_{1t} + \left(\frac{C_2}{E_b} \right) P_{2t} + \left(\frac{C_3}{E_b} \right) P_{3t} \end{aligned}$$

The CPI is a weighted average of prices.

The weight on each price reflects that good's relative importance in the CPI's basket.

Note that the weights remain fixed over time.

Reasons why the CPI may overstate inflation

- **Substitution bias:** The CPI uses fixed weights, so it cannot reflect consumers' ability to substitute toward goods whose relative prices have fallen.
- **Introduction of new goods:** The introduction of new goods makes consumers better off and, in effect, increases the real value of the dollar. But it does not reduce the CPI, because the CPI uses fixed weights.
- **Unmeasured changes in quality:** Quality improvements increase the value of the dollar, but are often not fully measured.

The size of the CPI's bias

- In 1995, a Senate-appointed panel of experts estimated that the CPI overstates inflation by about 1.1% per year.
- So the BLS made adjustments to reduce the bias.
- Now, the CPI's bias is probably under 1% per year.

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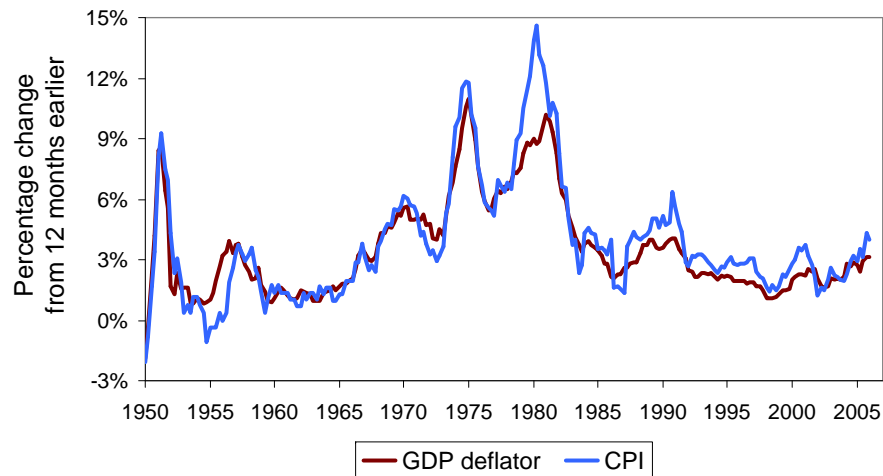
CPI vs. GDP Deflator

- Prices of capital goods
 - included in GDP deflator (if produced domestically)
 - excluded from CPI
- Prices of imported consumer goods
 - included in CPI
 - excluded from GDP deflator
- The basket of goods
 - CPI: fixed
 - GDP deflator: changes every year

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Two measures of inflation in the U.S.



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Measuring Unemployment

- Surveys asking people if they are looking for work (Labour Force Survey in UK, Current Population Survey in US)
- People registered for unemployment benefit (not as good as survey, but available over longer time period)
- Most economic data is usually an imperfect measure of the desired theoretical concept.

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Categories of the population

- **Employed (E)**
working at a paid job
- **Unemployed (U)**
not employed but looking for a job
- **Labor Force (L)**
the amount of labor available for producing goods and services; **all employed plus unemployed persons**
➤ $L = E + U$
- **Not in the labor force**
not employed, not looking for work

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Two important labor force concepts

- **Unemployment rate**
percentage of the labor force that is unemployed:

$$u = \frac{U}{L}$$

- **Labor Force Participation Rate**
the fraction of the adult population that “participates” in the labor force

$$= \frac{\text{labor force}}{\text{population of working age}}$$

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Exercise: *Compute labor force statistics*

U.S. adult population by group, June 2010

Number employed	=	139.1 million
Number unemployed	=	14.6 million
Adult population	=	237.8 million

Use the above data to calculate

- the labor force
- the number of people not in the labor force
- the labor force participation rate
- the unemployment rate

Note: These lecture notes are incomplete without having attended lectures

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Exercise: *Compute percentage changes in labor force statistics*

Suppose

- population increases by 1%
- labor force increases by 3%
- number of unemployed persons increases by 2%

Compute the percentage changes in

the labor force participation rate:

the unemployment rate:

Note: These lecture notes are incomplete without having attended lectures

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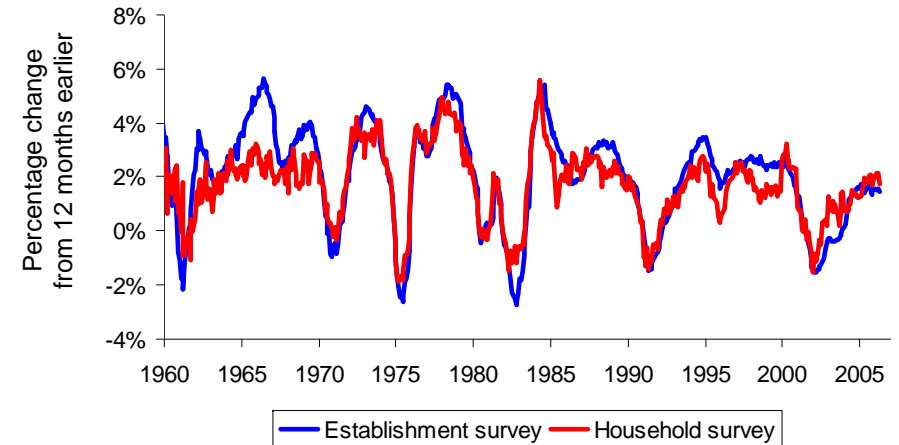
The establishment survey

- The BLS obtains a second measure of employment by surveying businesses, asking how many workers are on their payrolls.
- Neither measure is perfect, and they occasionally diverge due to:
 - treatment of self-employed persons
 - new firms not counted in establishment survey
 - technical issues involving population inferences from sample data

Note: These lecture notes are incomplete without having attended lectures

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Two measures of employment growth



Note: These lecture notes are incomplete without having attended lectures

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Summary

1. Gross Domestic Product (GDP) measures both total income and total expenditure on the economy's output of goods & services.
2. Nominal GDP values output at current prices; real GDP values output at constant prices. Changes in output affect both measures, but changes in prices only affect nominal GDP.
3. GDP is the sum of consumption, investment, government purchases, and net exports.

Note: These lecture notes are incomplete without having attended lectures

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Summary

4. The overall level of prices can be measured by either
 - the Consumer Price Index (CPI), the price of a fixed basket of goods purchased by the typical consumer, or
 - the GDP deflator, the ratio of nominal to real GDP
5. The unemployment rate is the fraction of the labor force that is not employed.

Note: These lecture notes are incomplete without having attended lectures

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Next Time:

Review of Mathematics

Business Cycle Facts and Theories