Principles of Economics

Measuring the National Economy

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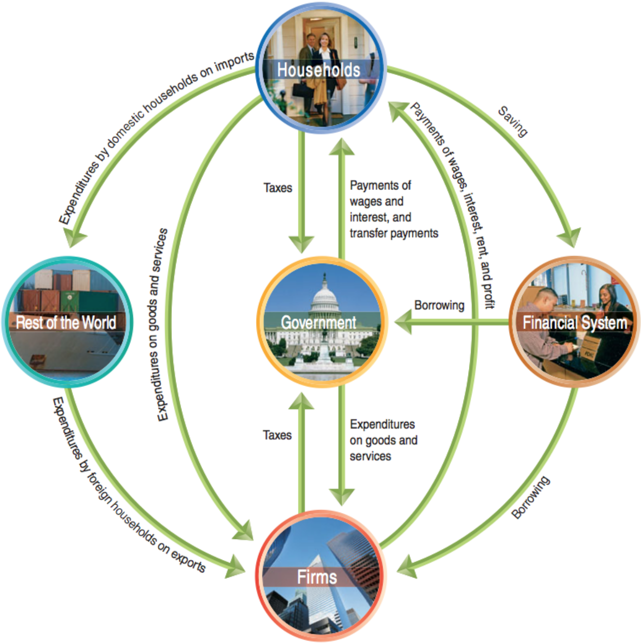
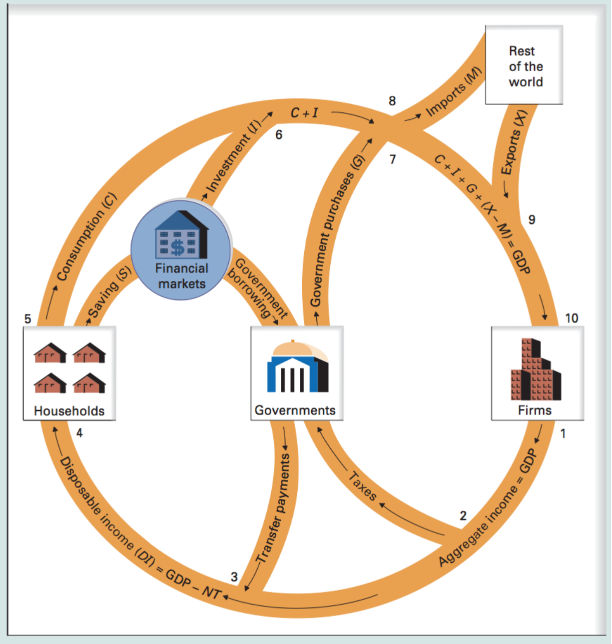

Households
Rest of the World
Government
Financial System
Firms
Expenditures by domestic households on imports
Expenditures on goods and services
Taxes
Payments of wages and interest, and transfer payments
Payments of wages, interest, rent, and profit
Saving
Borrowing
Taxes
Expenditures on goods and services
Expenditures by foreign households on exports
Borrowing


Rest of the world
Imports (M)
Exports (X)
C + I
C + I + G + (X – M) = GDP
Investment (I)
Consumption (C)
Saving (S)
Financial markets
Government borrowing
Government purchases (G)
Households
Governments
Firms
Disposable income (DI) = GDP – NT
Transfer payments
Taxes
Aggregate income = GDP
1
2
3
4
5
6
7
8
9
10

The Circular-Flow Diagram

- Firms use **factors of production** – labor, capital, natural resources, and entrepreneurship — to produce goods and services.
- Households supply the factors of production to firms in exchange for income.
- Income (**factor payments**) can be divided into four categories: wages, interest, rent, and profit.
- Firms pay wages to households in exchange for labor services, interest for the use of capital, and rent for natural resources such as land.
- Profit is the income that remains after a firm has paid wages, interest, and rent. Profit is the return to entrepreneurs for organizing the other factors of production and for bearing the risk of producing and selling goods and services.

The Circular-Flow Diagram

- Governments make payments of wages and interest to households in exchange for hiring workers and other factors of production.
- Governments also make **transfer payments** to households. Transfer payments include Social Security payments to retired and disabled people and unemployment insurance payments to unemployed workers.

The Circular-Flow Diagram

- Households spend some of their income on goods and services. Some of this spending is on domestically produced goods and services, and some is on foreign-produced goods and services.
- Households also use some of their income to pay taxes to the government[1].
- Some of the income earned by households is not spent on goods and services or paid in taxes, but is **saved**. Households save by holding cash, depositing in bank accounts, or buy stocks, bonds, and other assets.
  - Banks and financial markets[2] make up the financial system.
  - The flow of funds from households into the financial system makes it possible for the government and firms to borrow.

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[1] Note that firms also pay taxes to the government.

[2] Financial markets are markets for buying and selling financial assets such as stocks and bonds.

The Circular-Flow Diagram

- For the economy as a whole, income = expenditure.
  - Every dollar a buyer spends is a dollar of income for the seller.

Gross Domestic Product (GDP)

Definition (GDP)

The market value of all final goods & services produced within a country in a given period of time.

- GDP includes market production and some nonmarket production.
  - Nonmarket production: g&s that are not sold in the market, such as defense or education services provided by the government, or owner-occupied housing.
- GDP excludes nonproduction transactions:
  - Government transfer payments
  - Private transfer payments (e.g., gifts)
  - Financial market transactions (e.g., stocks and bonds)
  - Secondhand sales

Gross Domestic Product (GDP)

Definition (GDP)

The market value of all final goods & services produced within a country in a given period of time.

- Whenever possible, g&s are valued at their market prices.
- Some activities, such as home production and black market activities are not included in GDP because data are not available to accurately measure their value.

Gross Domestic Product (GDP)

Definition (GDP)

The market value of all final goods & services produced within a country in a given period of time.

- GDP includes only the value of final goods to avoid double accounting.
- **Final goods**: intended for the end user
- **Intermediate goods**: used as components or ingredients in the production of other goods
    - Car: final good; Car engine: intermediate good
    - Sugar: final good when directly consumed, intermediate good when used to produce candy, cake, etc.

Gross Domestic Product (GDP)

Definition (GDP)

The market value of all final goods & services produced within a country in a given period of time.

- Services: medical care, education, haircuts, etc.
- Goods:
  - **Nondurable goods** (e.g., food, clothing)
  - **Durable goods** (e.g., automobiles, furniture)

Gross Domestic Product (GDP)

Definition (GDP)

The market value of all final goods & services produced within a country in a given period of time.

- GDP is a measure of current production, not sales. It measures the value of the output produced in a given period of time[a], *regardless of when that output is sold*.

[a] usually a year or a quarter, depending on the period of accounting.

Gross Domestic Product (GDP)

Definition (GDP)

The market value of all final goods & services produced within a country in a given period of time.

- GDP measures the value of production that occurs within a country's borders, whether done by its own citizens or by foreigners located there.
  - Production of an American company in China counts toward Chinese GDP.

Gross Domestic Product (GDP)

Example

- Karen pays Doug to mow her lawn: GDP increases
- Karen then marries Doug: GDP falls

Example

When Volkswagen produces and sells a new car in the third quarter of 2016, the value of the car is included in the quarter's GDP. When one person sells a used car to another person in that same quarter, the value of the used car is not included in GDP.

Calculating GDP

Key identity

Production = Income = Expenditure

Approaches to calculating GDP:

- **Income approach**: total wages, interest, rent, and profits received by households for domestic production
- **Expenditure approach**: total expenditures on domestically produced goods and services by households, firms, government, and the rest of the world.
- **Production (value-added) approach**: total value-added of domestic production.
  - Value added = revenue - intermediate goods

Calculating GDP: Example

Aggregate spending on domestically produced final goods and services = $21,500

	American Ore, Inc.	American Steel, Inc.	American Motors, Inc.	Total factor income
Value of sales	$4,200 (ore)	$9,000 (steel)	$21,500 (car)	
Intermediate goods	0	4,200 (iron ore)	9,000 (steel)	
Wages	2,000	3,700	10,000	$15,700
Interest payments	1,000	600	1,000	2,600
Rent	200	300	500	1,000
Profit	1,000	200	1,000	2,200
Total expenditure by firm	4,200	9,000	21,500	
Value added per firm = Value of sales – cost of intermediate goods	4,200	4,800	12,500	

Total payments to factors = $21,500

Sum of value added = $21,500

j. mao

Calculating GDP: Example

A Pure Coffee Economy

Roaster			
	Wages		$15,000
	Taxes		$5,000
	Revenue		$35,000
	beans sold to public	$10,000	
	beans sold to coffeebar	$25,000	
Coffeebar			
	Wages		$10,000
	Taxes		$2,000
	Beans bought from roaster		$25,000
	Revenue from coffee sold to public		$40,000

Calculating GDP: Example

A Pure Coffee Economy

- Income approach
  - Total income = total wages (\$25,000) + total taxes (\$7,000) + total profits (\$18,000) = \$50,000
- Expenditure approach
  - Total expenditure = consumption expenditure on beans (\$10,000) + consumption expenditure on coffee (\$40,000) = \$50,000
- Value-added approach
  - Total value added = Roaster value added (\$35,000) + Coffeebar value added (\$15,000) = \$50,000

Expenditure Approach

GDP as total spending:

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

- Consumption (C)[a]: spending by households on g&s, not including spending on new houses.

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[a] Also called "Personal Consumption Expenditures (PCE)"

Expenditure Approach

GDP as total spending:

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

- Investment (I)[a,b]: spending by firms on new assets, including *tangible* and *intangible* assets, plus spending by households and firms on new houses.
- Types of assets
  - **Capital equipment** (e.g., machines, tools)
  - **Structure** (e.g., factories, office buildings, houses)
  - **Intellectual property products** (e.g., software, licenses, patents, copyrights)
  - **Inventory** (goods produced but not yet sold)

[a] Also called "Gross Private Domestic Investment"

[b] Note: "Investment" does not mean the purchase of financial assets like stocks and bonds.

Expenditure Approach

GDP as total spending:

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

- Investment is divided into three categories:
  - **Business fixed investment**: spending by firms on new machinery, office buildings, R&D, etc., used to produce other goods and services.
  - **Residential investment**: spending by households and firms on new houses.
  - **Inventory investment:** changes in business inventories.
    - If Ford has $200 million worth of unsold cars at the beginning of the year and $350 million worth of unsold cars at the end of the year, then the firm has spent $150 million on inventory investment during the year.

Expenditure Approach

GDP as total spending:

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

- Government Purchases (G): spending on g&s by the government (e.g., teachers' salaries, highways, defense spending).
  - Transfer payments are not included.

Expenditure Approach

GDP as total spending:

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

- Net Exports (NX): NX = Exports – Imports
  - Exports represent foreign spending on the economy's g&s.
  - Imports are the portions of C, I, and G that are spent on g&s produced abroad.
- $NX \begin{cases} > 0: & \text{Trade Surplus} \\ < 0: & \text{Trade Deficit} \end{cases}$

Housing in GDP

- The purchase of new houses is a part of residential investment[3], hence part of I.
- Housing services are a component of consumption (C).
  - For tenant-occupied housing, the value of the housing service = rent
  - For owner-occupied housing, the value of the housing service is *imputed* based on market rent, i.e. the rent charged for similar tenant-occupied housing.
    - i.e. the owner-occupant is treated as a rental business, in which the landlord rents to him or herself.
    - This imputation is necessary in order for GDP to be invariant when housing units shift between tenant occupancy and owner occupancy.

[3] The purchase of new office buildings is a part of business fixed investment.

Intellectual Property in GDP

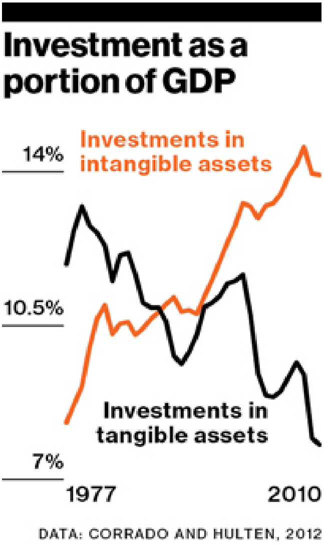
- IP products have the distinguishing features of fixed assets
  - They are produced using labor and other capital.
  - They have defined ownership rights.
  - They are used repeatedly in the production process and have a useful life of more than one year.
- Since most R&D is carried out in-house (called "own-account R&D"), their market value is not available. The value of own-account R&D is approximated by its cost, i.e. by spending on R&D activities.
  - The IPs of Hollywood blockbusters are under-valued and those of big-budget flops are over-valued, for example.

Intellectual Property in GDP

	Before R&D Capitalization	Aftr R&D Capitaliztion	
		Output 1	Output 2 (R&D)
Final g&s	120	120	30
Intermediate g&s	40	30	10
Value added	80	90	20
Compensation of employees	60	40	20
Net operating surplus	20	50	0

Suppose spending on R&D includes \$20 in wages and \$10 in intermediate g&s. The table shows what happens before and after R&D is "capitalized," i.e. when R&D is counted as fixed investment.

Intellectual Property in GDP



Expenditure Approach

Example

- Debbie spends \$300 to buy her husband dinner at the finest restaurant in Boston.
  - Consumption and GDP rise by \$300.
- Sarah spends \$1200 on a new laptop to use in her publishing business. The laptop was built in China.
  - Investment rises by \$1200, net exports fall by \$1200, GDP is unchanged.
- Jane spends \$800 on a computer to use in her editing business. She got last year's model on sale for a great price from a local manufacturer.
  - Current GDP and investment do not change, because the computer was built last year.

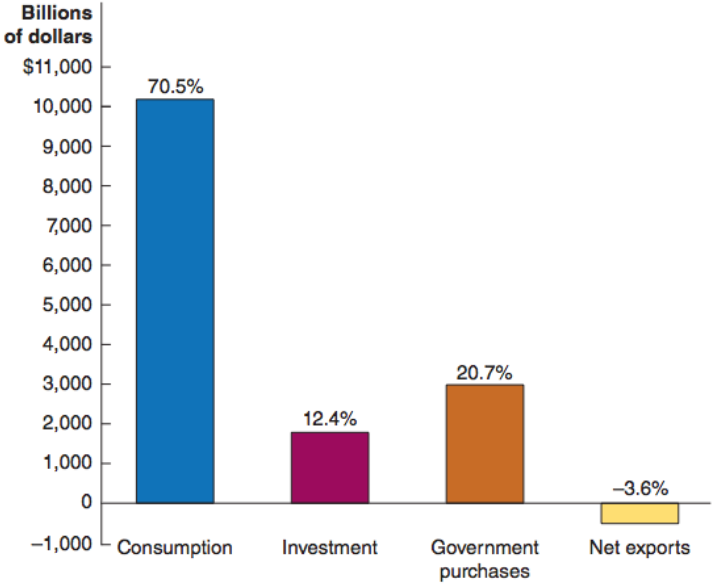
Expenditure Approach

Example

- General Motors builds \$500 million worth of cars, but consumers only buy \$470 million of them.
  - Consumption rises by \$470 million, inventory investment rises by \$30 million, and GDP rises by \$500 million.
- Volkswagen produces a new car in the third quarter of 2016 and sells it in the fourth quarter of 2016.
  - The value of the car is included in 2016 Q3 's GDP and is recorded as an addition to inventories.
  - In Q4, the sale of the car is recorded twice, both as a consumer expenditure and as a withdrawal from inventories. As no new production took place, 2016 Q4's GDP is not affected.

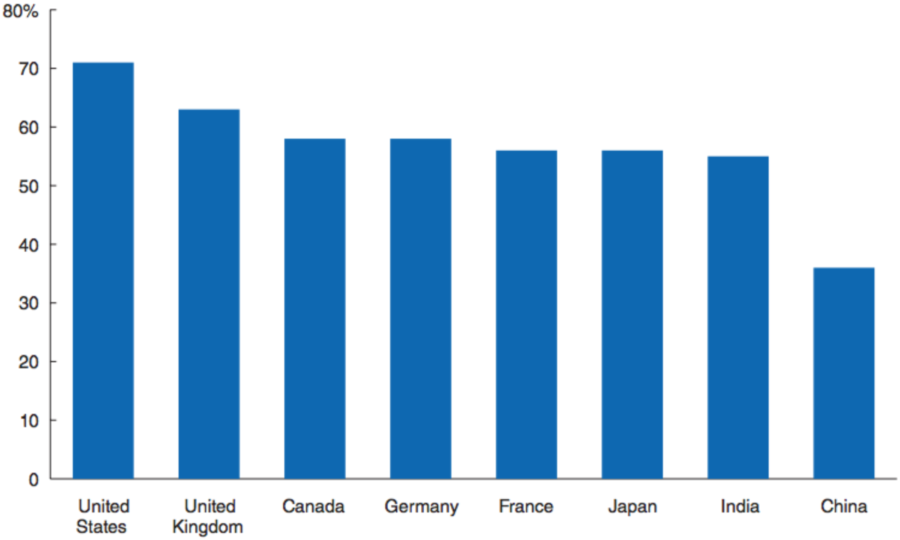
COMPONENTS OF GDP (billions of dollars)		
Consumption		$10,246
Durable goods	$1,086	
Nondurable goods	2,302	
Services	6,859	
Investment		1,795
Business fixed investment	1,390	
Residential construction	338	
Change in business inventories	67	
Government Purchases		3,003
Federal	1,223	
State and local	1,780	
Net Exports		–517
Exports	1,840	
Imports	2,357	
Total GDP		$14,527

U.S. GDP (2010)


Billions of dollars
$11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
–1,000
70.5%
12.4%
20.7%
–3.6%
Consumption
Investment
Government purchases
Net exports

U.S. GDP (2010)

Consumption as a Percentage of GDP



Income Approach

National Income:

$$NI = W + i + R + PR$$

- **Compensation of Employees** (W): wages, salaries, benefits[4]
- Profits (PR):
  - **Proprietor's Income**: income[4] of noncorporate businesses (e.g., barbers, lawyers)
  - **Corporate Profits**: includes corporate taxes, dividends, retained earnings.
- **Net Interest** (i): interest earned by households minus interest paid
- **Rental income** (R): income that landlords receive from renting, including imputed rent for owner-occupants[5]

[4] before tax

[5] Not including rental income earned by businesses – those go into profits.

Corporate Profits

U.S. COMPOSITE CORPORATION
Income Statement
2012
($ in millions)

Total operating revenues	$2,262
Cost of goods sold	1,655
Selling, general, and administrative expenses	327
Depreciation	90
Operating income	$ 190
Other income	29
Earnings before interest and taxes (EBIT)	$ 219
Interest expense	49
Pretax income	$ 170
Taxes	84
Current: $71	
Deferred: 13	
Net income	$ 86
Addition to retained earnings:	$ 43
Dividends:	43

Income Approach

GDP[6] = National Income + Depreciation + Indirect business taxes - Net factor payments

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- **Indirect business taxes**: taxes on production and imports (e.g., sales taxes), minus subsidies
- **Net factor payments** (NFP) = Income paid to domestic factors of production by the rest of the world - income paid to foreign factors of production by the domestic economy.
  - includes wages, interest, rent, and profits
  - e.g., interest payments received by citizens for their holding of foreign government bonds (+), dividend payments to foreign shareholders by domestic firms (-), wages earned by citizens working in foreign countries (+).

[6] In practice, GDP calculated the income approach is often called Gross Domestic Income (GDI). GDP (using the expenditure approach) = GDI in theory, although there are usually some statistical discrepancies.

National Income

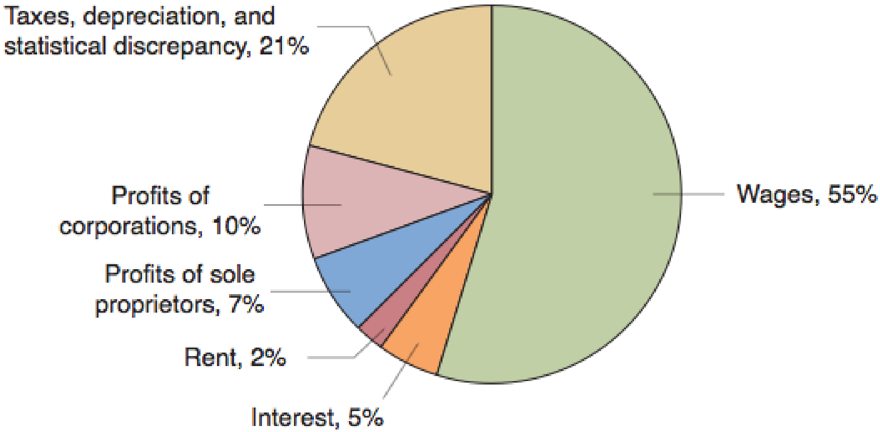
	Billion $US	% of Nat. Inc.
National Income	8,122.0	100.0%
Comp. of Employees	5,874.9	72.3%
Proprietors' Income	727.8	9.0%
Rental Income	137.9	1.7%
Corporate Profits	731.6	9.0%
Net Interest	649.8	8.0%

U.S. National Income (2001)

Income Approach

Income category		Percent of 1996 GDP	
Compensation of employees			58.7
Proprietor's income			6.8
Rental income of persons			1.7
Corporate profits			8.6
Net interest			5.3
Total = National income		81.2	
Plus Indirect business taxes			7.4
Equals Net National Product		88.6	
Plus depreciation (income paid to capital)			11.3
Equals Gross National Product		99.9	
Minus Net Factor Payments (NFP)			0.1
Payments in	3.0		
Payments out	3.1		
Equals Gross Domestic Product		100	

Income Approach



U.S. GDP (2010)

Labor and Capital Share

- Labor share: the fraction of total income that goes to labor
- Capital share: the fraction of total income that goes to capital

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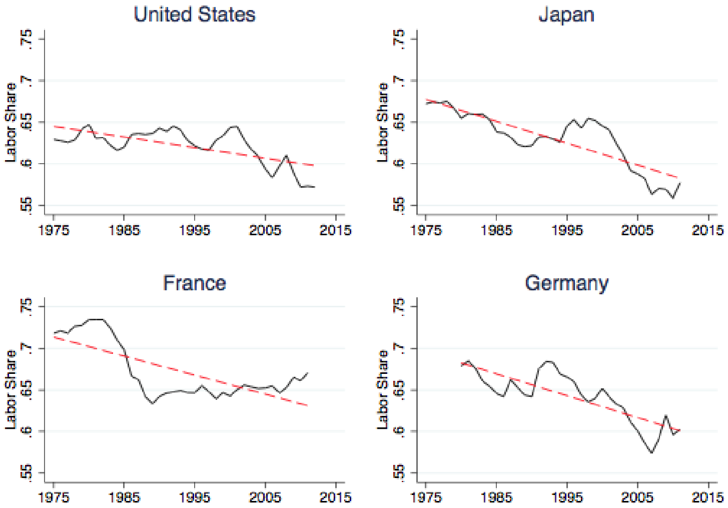
One way to measure labor and capital share:

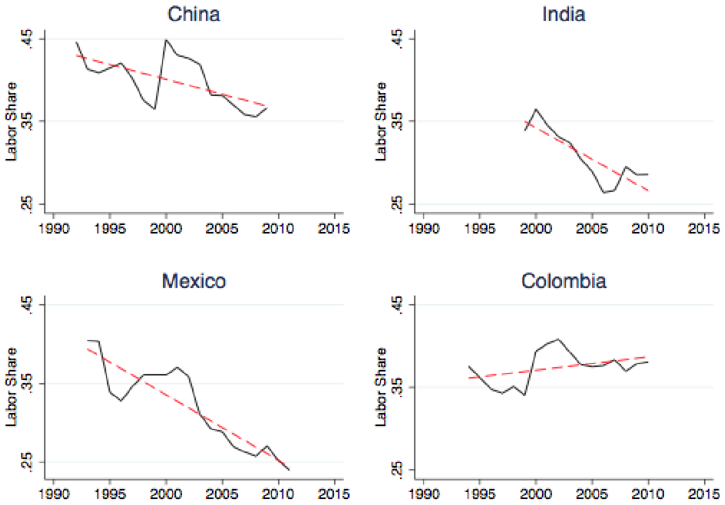
- Labor share $= \frac{\text{Labor Income}}{\text{National Income}}$
  - Labor income: compensation of employees + *imputed* labor share of proprietor's income
- Capital share $= \frac{\text{Capital Income}}{\text{National Income}}$
  - Capital income: corporate profits + interest + rent + *imputed* capital share of proprietor's income

Labor Share in Selected Countries



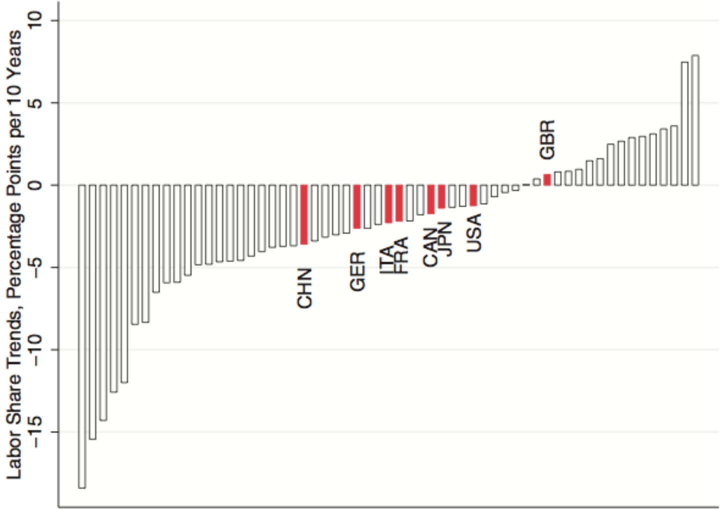
Labor share in the corporate sector.
Source: Karabarbounis and Neiman (2013)

Labor Share in Selected Countries



Labor share in the corporate sector.
Source: Karabarbounis and Neiman (2013)

Trends in Labor Share



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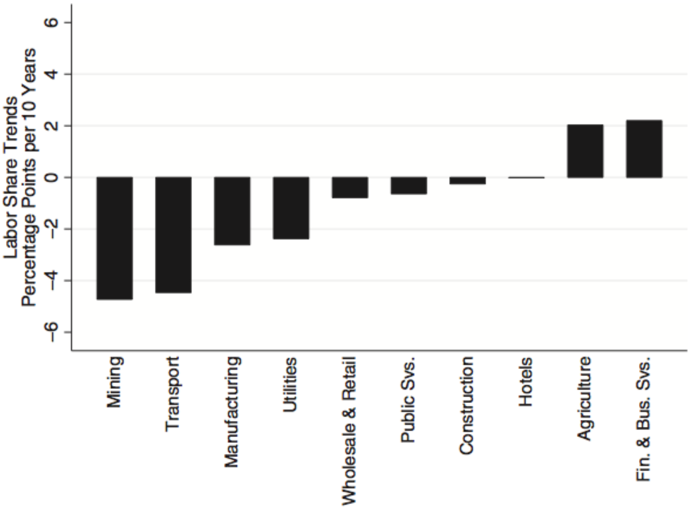
Trends in Labor Share



U.S. labor share by sector. Source: Karabarbounis and Neiman (2013)

Value-added Approach

Industries	Val. Add.	in % of GDP
Total Nom. GDP	10,082.2	100.0%
Agr., Forestry, Fish.	140.7	1.4%
Mining	139.0	1.4%
Construction	480.0	4.8%
Manufacturing	1,423.0	14.1%
Transp., Publ. Ut.	819,5	8.1%
Wholesale Trade	680,7	6.8%
Retail Trade	931.8	9.2%
Fin., Insur., Real Est.	2,076.9	20.6%
Services	2,226.6	22.1%
Government	1,281.3	12.7%
Stat. Disc.	-117.3	-1.2%

U.S. GDP (2001) (Billions of Dollars)

Gross National Product (GNP)

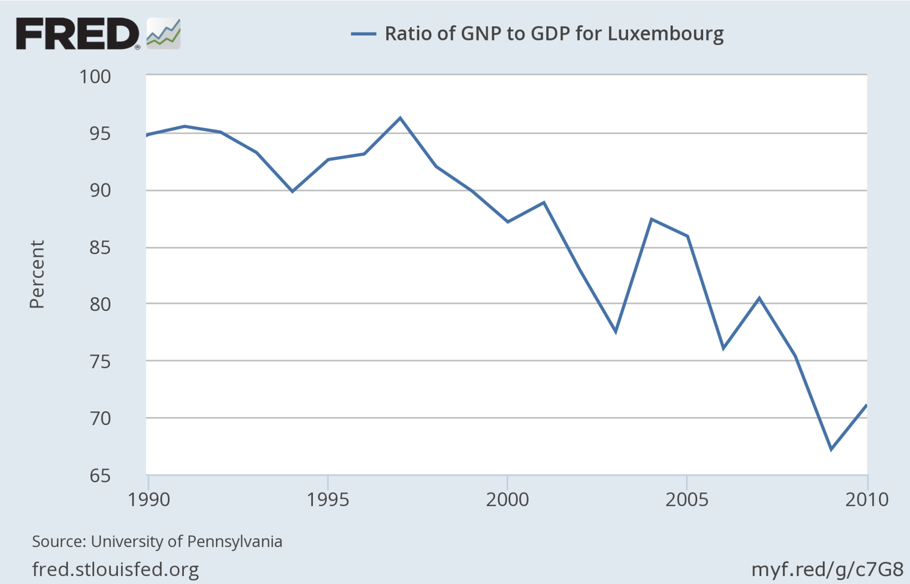
Definition (GNP)

The market value of all final goods & services produced by the means of production owned by a country's residents in a given period of time.

$$\text{GNP}^{a} = \text{GDP} + \text{NFP}$$

[a] Gross National Income (GNI) = GDI + NFP. GNP = GNI in theory.

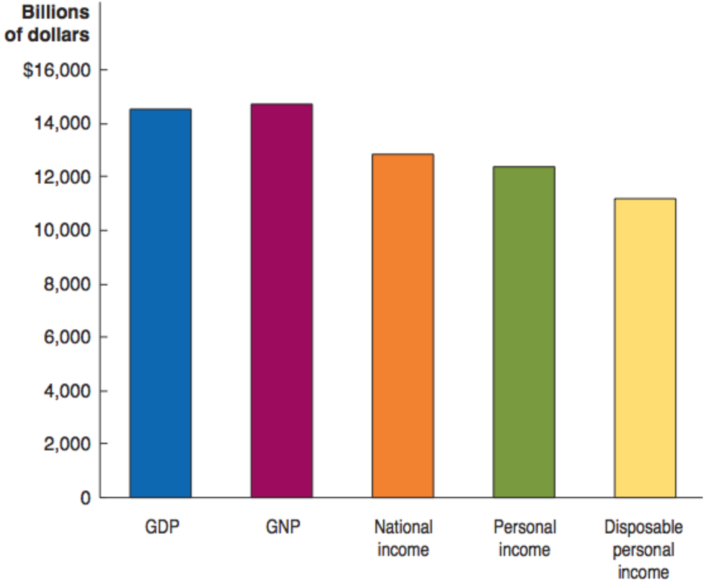
- If a county has similar inflows and outflows of income from assets, then GNP and GDP will be similar.
- If a country has, say, many companies owned by foreign shareholders, then GNP will be lower than GDP.


FRED
Ratio of GNP to GDP for Luxembourg
100
95
90
85
80
75
70
65
Percent
1990
1995
2000
2005
2010
Source: University of Pennsylvania
fred.stlouisfed.org
myf.red/g/c7G8

Other Measures of Income

- **Personal Income (PI)**
  - Personal income is income received by households[7]. PI = NI - Corporate retained earnings + Government transfer payments.
- **Disposable Personal Income**
  - Disposable personal income is equal to personal income minus personal tax payments. It is the best measure of the income households actually have available to spend.

[7] To be more precise, households and noncorporate businesses.



Selected Measures of U.S. Production and Income (2010)

Limitations of GDP Accounting

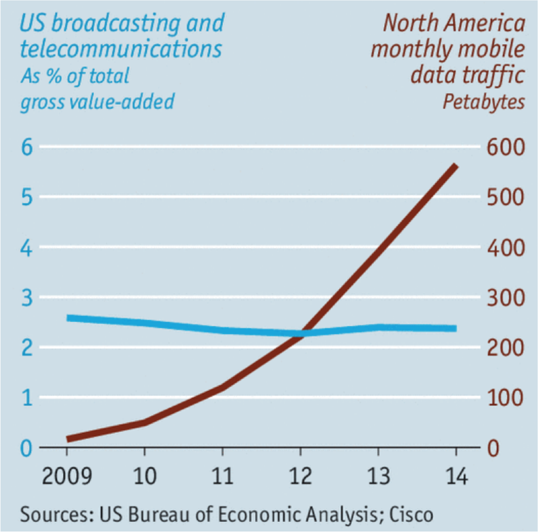
Challenges to GDP as a Measure of Production

- home production (e.g., unpaid childcare)
- underground economy
- quality adjustment
- "sharing economy"
- global value chains

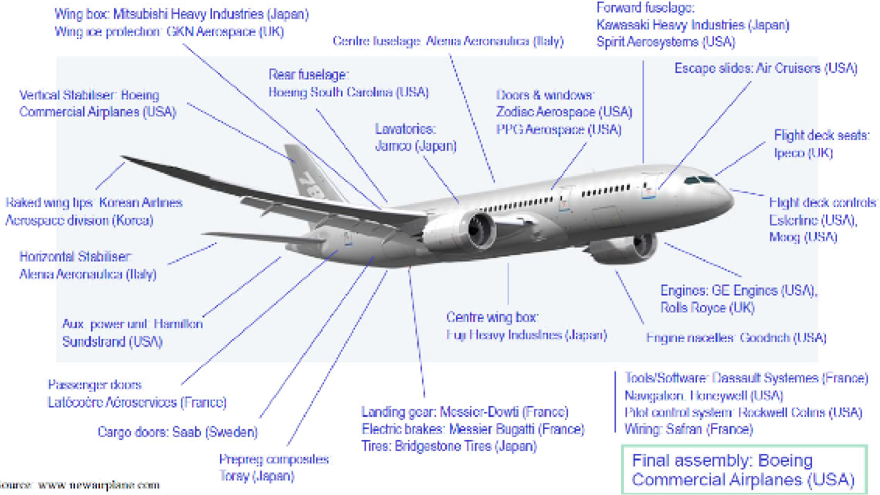
Country	Underground Economy as a Percentage of GDP
Bolivia	68 percent
Zimbabwe	63
Peru	61
Thailand	54
Mexico	33
Argentina	29
Sweden	18
Australia	13
United Kingdom	12
Japan	11
Switzerland	9
United States	8

Source: Friedrich Schneider. Figures are for 2002.

IBM Personal Computer model 5150 (1981)
Price: \$4,000 in 2015 dollar. CPU: Intel 8088 @ 4.77 MHz. Memory: 16 kB ~ 256 kB


US broadcasting and telecommunications
As % of total gross value-added
North America monthly mobile data traffic
Petabytes
6
5
4
3
2
1
0
600
500
400
300
200
100
0
2009
10
11
12
13
14
Sources: US Bureau of Economic Analysis; Cisco

Fragmentation of production: the example of the Boeing 787 Dreamliner



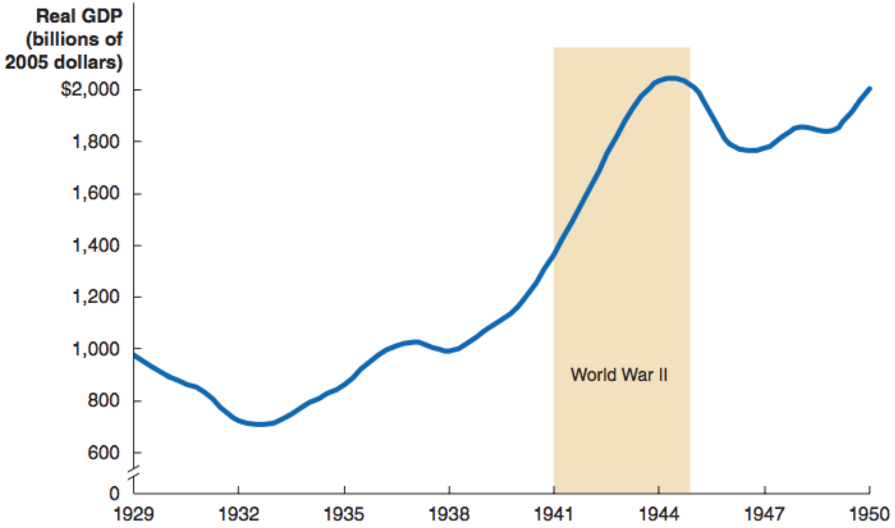
Source: www.newairplane.com

Limitations of GDP Accounting

Shortcomings of GDP as a Measure of Well-Being

GDP is intended as a measure of production, not a measure of well-being.

- GDP does not value:
  - quality, variety
  - leisure
  - health
  - environment
  - freedom
  - etc.
- GDP is not concerned with equity.


Real GDP (billions of 2005 dollars)
$2,000
1,800
1,600
1,400
1,200
1,000
800
600
0
1929
1932
1935
1938
1941
1944
1947
1950
World War II

Measuring Change in Price

- How to measure changes in the general price level of an economy?

An Economy with One Good

	2000	2010
Haircut	\$10	\$15

Measuring Change in Price

- How to measure changes in the general price level of an economy?

An Economy with Two Goods

	2000	2010
Haircut	\$10	\$15
TV	\$1000	\$1200

Measuring Change in Price

- How to measure changes in the general price level of an economy?

An Economy with Two Goods

	1990		2010	
	P	Q	P	Q
Haircut	$10	100	$15	100
TV	$1000	1	$1200	1

Measuring Change in Price

- How to measure changes in the general price level of an economy?

An Economy with Two Goods

	1990		2010	
	P	Q	P	Q
Haircut	$10	100	$15	500
TV	$1000	1	$1200	2

Measuring Change in Price

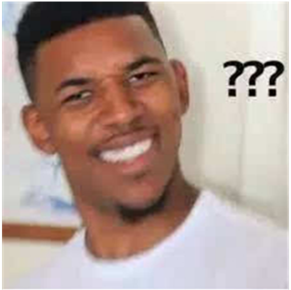
An Economy with Many Goods

	2000		2010	
	P	Q	P	Q
Haircut	$10	100	$15	500
TV	$1000	1	$1200	2
Cassette	$20	50	?	
Iphone	?		$600	10

Over time,

- new goods are invented.
- old goods become obsolete.

Obsolete Goods



Price Index

- How to measure changes in the general price level of an economy?
- Measure how much one has to spend to purchase the same amount of goods and services
- Let $\overline{p}_t$ be the **weighted average price** that consumers pay for a **fixed basket of goods and services** in time t.
- Weighted average:

$$\overline{p} = \sum_{i=1}^{N} w_i p_i, \quad \sum_{i=1}^{N} w_i = 1$$

  - Weight every good equally: $w_i = \frac{1}{N} \; \forall i$.
  - Weight each good by its quantity sold: $w_i = \frac{q_i}{\sum_{i=1}^{N} q_i}$

Price Index

- How to measure changes in the general price level of an economy?
- Measure how much one has to spend to purchase the same amount of goods and services.
- Let $\overline{p}_t$ be the **weighted average price** that consumers pay for a fixed **basket of goods and services** in time t.
- Define a **price index**:

$$\mathcal{P}_{t_0,t} = \frac{\overline{p}_t}{\overline{p}_{t_0}}, \; t = 1, 2, \ldots$$

  - $\mathcal{P}_{t_0,t}$ measures the price level in time t relative to time t_0.
  - t_0 is called **base period**, at which the price index equals 1.

Price Index

Price Indices

Consider a basket of 2 goods: A and B. Let $t_0 = 1$ be the base period.

- Laspeyres price index

$$\mathcal{P}^L_{1,t} = \frac{p^A_t q^A_1 + p^B_t q^B_1}{p^A_1 q^A_1 + p^B_1 q^B_1}$$

  - Use initial quantities as weight.

- Paasche price index

$$\mathcal{P}^P_{1,t} = \frac{p^A_t q^A_t + p^B_t q^B_t}{p^A_1 q^A_t + p^B_1 q^B_t}$$

  - Use final quantities as weight.

Measuring Change in the Cost of Living

- How to measure changes in the **cost of living**?
- Measure how much one has to spend to enjoy the same living standard or utility.
- A cost-of-living index is conceptually different from a price index: price indices may not accurately reflect changes in the cost of living.

Substitution bias

Consider a basket consisting of two goods: chicken and beef.

	beef		chicken	
	price	quantity	price	quantity
$t = 1$	\$4	10 lbs	\$4	20 lbs
$t = 2$	\$5	10 lbs	\$5	20 lbs
$t = 3$	\$9	5 lbs	\$6	25 lbs

From $t = 1$ to $t = 2$,

- Both Laspeyres and Paasche price index increase by 25%.

From $t = 2$ to $t = 3$,

- Increase in Laspeyres price index: 40%
- Increase in Paasche price index: 30%
- How much has the cost of living truly increased for consumers?

Substitution Bias

- Over time, some prices change more than others, i.e. *relative prices* change over time.
- Consumers substitute toward goods and services that become *relatively* cheaper.

Substitution Bias

- Laspeyres price index does not take into account substitution behavior[8] and thus tends to *overstate* increases[9] in the cost of living.
- Paasche price index takes into account substitution behavior but not utility change as a result of substitution[10] and thus tends to *understate* increases[11] in the cost of living.
- Other things being equal, due to substitution bias, Laspeyres price index tends to be too high as a cost-of-living index. Paasche price index tends to be too low as a cost-of-living index.

---

[8] i.e. Laspeyres price index *does not correct for* substitution bias.

[9] and understate decreases

[10] i.e. Paasche price index *over-corrects* substitution bias.

[11] and overstate decreases

Price Index

Price Indices

Consider a basket of 2 goods: A and B. Let $t_0 = 1$ be the base period.

- Fisher price index[a]

$$\mathcal{P}^F_{1,t} = \sqrt{\mathcal{P}^L_{1,t} \times \mathcal{P}^P_{1,t}}$$

- Chained Fisher price index

$$\mathcal{P}^C_{1,t} = \mathcal{P}^F_{1,2} \times \mathcal{P}^F_{2,3} \times \ldots \times \mathcal{P}^F_{t-1,t} = \prod_{s=2}^{t} \mathcal{P}^F_{s-1,s}$$

[a] Also called "Fisher Ideal price index"

Price Index

Compared with Laspeyres and Paasche price indices,

- Fisher price index better adjusts for substitution bias and is thus a better cost-of-living index.
- Chained Fisher price index, in addition, better adjusts for changing technology and consumer taste, which leads to new inventions and obsolete goods.
  - Laspeyres and Paasche price indices need to periodically update their base period in order to keep up with changes in the consumption basket.

Adjusting for Quality Change

- Improvements in the quality of goods and services, which increase welfare, are often unobserved or poorly measured.
- Due to the failure of capturing quality improvement, price indices tend to *overstate* increases[12] in the cost of living.
  - This is true for all afore-mentioned price indices.
- National Statistics Bureaus typically try to make some adjustment for quality changes, but it is hard to do.

[12] and understate decreases

Adjusting for Quality Change

Heart Treatment

- How expensive is to treat a Heart attack? (Cutler et al. (1998)).
  - mid-1980's: $12,000.
  - late-1990's: $20,000.
- Would you say there was a 66% (=20,000/12,000-1) raise in price?
- Let's take a look at life expectancy after treatment (and controlling for other variables):
  - mid-1980's: 5 years after heart attack.
  - late-1990's: 6 years after heart attack.
- Who much is one year of life worth to you?

CPI

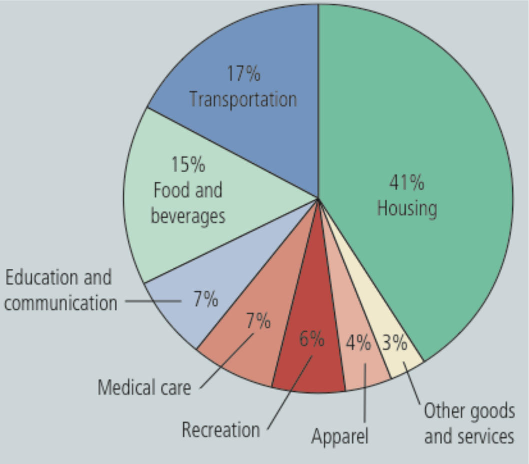
- The **consumer price index** (**CPI**) is a measure of the overall cost of the goods and services bought by a typical consumer.
  - The CPI is intended to monitor changes in the cost of living over time.
- How the CPI is produced:
  1. Fix the basket
     - In the U.S., CPI is produced by the Bureau of Labor Statistics (BLS). BLS surveys about 7,000 families about their spending habits, from which it determines the composition of a typical consumer's "shopping basket."
  2. Find the prices
     - BLS records the prices of about 80,000 items each month.
  3. Compute the basket's cost

The CPI Basket

BLS classifies all expenditure items into more than 200 categories, arranged into eight major groups:

- Food and beverages: cereal, milk, chicken, full service meals
- Housing: rent, owners' equivalent rent, bedroom furniture
- Apparel: shirts, sweaters, dresses, jewelry
- Transportation: new vehicles, airline fares, gas, car insurance
- Medical care: drugs, doctor's visit, hospital services
- Recreation: TV, toys, concerts, sports equipment
- Education and communication: college tuition, phone services, computer accessories
- Other goods and services

The CPI Basket



U.S. CPI Basket (2013). For more detailed categories and weights, see here.

CPI

- BLS currently publishes several CPIs:
  - The Consumer Price Index for All Urban Consumers (CPI-U)
  - The Chained Consumer Price Index for All Urban Consumers (C-CPI-U)
- CPI-U is a Laspeyres price index[13,14].
- C-CPI-U is a chained price index[15].

[13] Both CPI-U and C-CPI-U are on a 100-scale, i.e. they are equal to 100 in the base period.

[14] Unless otherwise noted, in the rest of this lecture, when we talk about CPI, we refer to CPI-U. This is because CPI-U remains the more well-known and widely-used CPI measure.

[15] Before 2015, C-CPI-U was calculated as a chained Fisher price index. Starting 2015, BLS calculates a chained "Constant Elasticity of Substitution (CES)" price index, which aims to better account for substitution behavior by consumers. For more detail, see here.

CPI

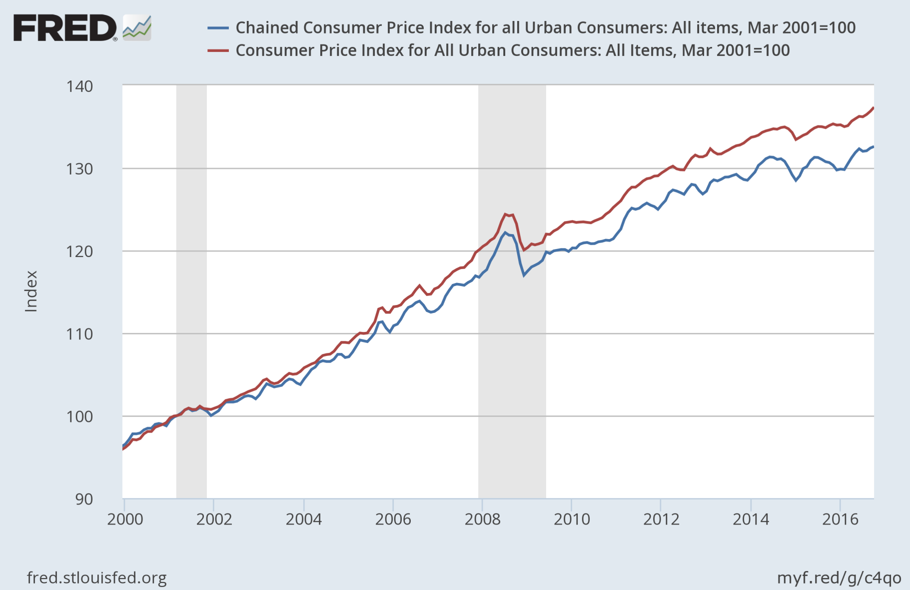
CPI basket: chicken and beef. Let $t = 1$ be the base period.

	beef		chicken	
	price	quantity	price	quantity
$t = 1$	\$4	10 lbs	\$4	20 lbs
$t = 2$	\$5	10 lbs	\$5	20 lbs
$t = 3$	\$9	5 lbs	\$6	25 lbs

- CPI-U: 100, 125, 175
- $\mathcal{P}^L_{1,2} = 1.25, \mathcal{P}^L_{2,3} = 1.40, \mathcal{P}^P_{1,2} = 1.25, \mathcal{P}^P_{2,3} = 1.30$
- $\mathcal{P}^F_{1,2} = 1.25, \mathcal{P}^F_{2,3} = 1.3491, \mathcal{P}^C_{1,2} = 1.25, \mathcal{P}^C_{1,3} = 1.6863$
- C-CPI-U[a]: 100, 125, 168.63

[a] Using chained Fisher formula

CPI

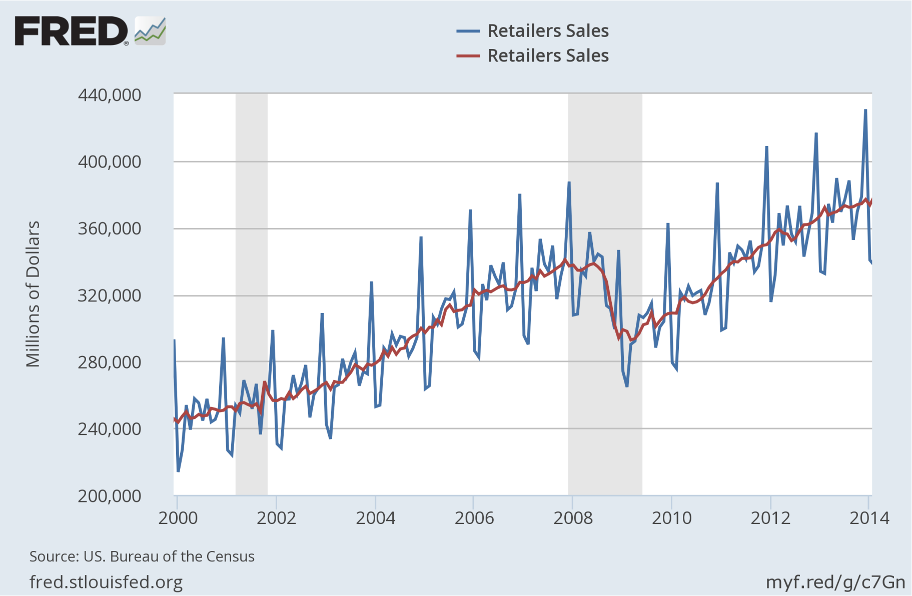


FRED
Chained Consumer Price Index for all Urban Consumers: All items, Mar 2001=100
Consumer Price Index for All Urban Consumers: All Items, Mar 2001=100
140
130
120
110
100
90
Index
2000
2002
2004
2006
2008
2010
2012
2014
2016
fred.stlouisfed.org
myf.red/g/c4qo

Seasonal Adjustment

Source: Monthly Retail Trade and Food Services (Definitions)
44000: Retail Trade: U.S. Total — Not Seasonally Adjusted Sales - Monthly [Millions of Dollars]
TXT XLS-V XLS-H Bar Chart Line Chart

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	226,791	223,971	253,439	249,062	268,658	260,315	251,504	266,460	236,210	265,188	262,004	298,666
2002	230,546	228,084	257,133	257,357	271,682	260,385	266,795	277,716	246,350	259,945	263,738	308,821
2003	242,278	233,487	264,542	266,001	281,497	271,258	279,342	285,235	265,353	273,805	272,430	327,750
2004	252,851	253,723	287,978	284,357	296,290	289,701	294,915	294,178	283,016	287,510	294,334	354,715
2005	263,516	265,367	306,433	302,100	311,345	317,432	316,949	321,481	300,513	302,293	311,827	370,906
2006	286,288	282,555	326,301	316,670	337,560	331,024	326,095	339,366	310,984	313,187	323,385	380,670
2007	295,576	290,359	336,214	322,252	353,505	338,494	334,126	349,532	317,450	331,374	342,279	388,095
2008	308,179	308,852	335,128	331,767	358,139	340,680	345,106	343,475	314,363	312,524	300,355	347,838
2009	275,192	265,674	291,377	293,401	308,986	307,620	310,390	316,079	289,579	301,923	305,487	364,700
2010	280,610	277,152	323,117	318,904	326,777	321,187	322,823	324,238	309,555	317,121	330,522	389,448
2011	300,703	302,073	347,545	341,487	351,680	349,306	343,747	354,731	335,985	339,716	354,117	411,906
2012	317,895	334,219	371,733	352,517	376,766	359,522	354,786	376,466	345,992	359,760	372,707	421,777
2013	338,451	337,382	379,556	368,725	395,897	375,384	382,904	394,456	358,058	375,769	384,546	437,087
2014	345,699	342,461	389,563	389,990	413,859	391,309	400,263	405,710	378,526	392,257	NA	NA



Blue: before seasonal adjustment; Red: after seasonal adjustment

BLS CPI Release

Schedule

Reference Month	Release Date	Release Time
December 2016	Jan. 18, 2017	08:30 AM
January 2017	Feb. 15, 2017	08:30 AM
February 2017	Mar. 15, 2017	08:30 AM
March 2017	Apr. 14, 2017	08:30 AM
April 2017	May. 12, 2017	08:30 AM
May 2017	Jun. 14, 2017	08:30 AM
June 2017	Jul. 14, 2017	08:30 AM
July 2017	Aug. 11, 2017	08:30 AM
August 2017	Sep. 14, 2017	08:30 AM
September 2017	Oct. 13, 2017	08:30 AM
October 2017	Nov. 15, 2017	08:30 AM
November 2017	Dec. 13, 2017	08:30 AM

BLS CPI Release

CONSUMER PRICE INDEX – OCTOBER 2016

The Consumer Price Index for All Urban Consumers (CPI-U) increased 0.4 percent in October on a seasonally adjusted basis, the U.S. Bureau of Labor Statistics reported today. Over the last 12 months, the all items index rose 1.6 percent before seasonal adjustment.

As in September, increases in the shelter and gasoline indexes were the main causes of the rise in the all items index. The gasoline index rose 7.0 percent in October and accounted for more than half of the increase in the all items index. The shelter index increased 0.4 percent for the second straight month.

The energy index increased 3.5 percent, its largest advance since February 2013. The indexes for fuel oil and gasoline were up 5.9 percent and 7.0 percent, respectively, while the indexes for electricity and natural gas saw relatively smaller increases of 0.4 percent and 0.9 percent. In contrast, the index for food was unchanged for the fourth consecutive month, as the food at home index continued to decline.

Real GDP

- If we want to know output growth over time, can we look at GDP?
  - Problem in comparing GDP over time: prices are not held constant.
  - GDP = total spending on goods and services. GDP $\uparrow$ means:
    1. The economy is producing a larger output of goods and services, or
    2. Goods and services are being sold at higher prices.
  - need a way to separate the price changes from the quantity changes.
- **Real GDP** is a measure of the quantity of output.
  - The calculation of real GDP aims to remove price changes from GDP.

Fixed-weight Real GDP

- The U.S. Bureau of Economic Analysis (BEA) changed its way of calculating real GDP in 1996.
- The following slides show the construction of **fixed-weight real GDP**, also called **constant price GDP**, which is how the BEA calculated real GDP before 1996.
- The fixed-weight real GDP values output using the prices of a base year.
- To distinguish from real GDP, we call GDP that values output using current prices **nominal GDP**.

	Pizza		Latte	
year	***P***	***Q***	***P***	***Q***
2011	$10	400	$2.00	1000
2012	$11	500	$2.50	1100
2013	$12	600	$3.00	1200

Compute nominal GDP in each year:

Increase:

2011: $10 x 400 + $2 x 1000 = $6,000

37.5%

2012: $11 x 500 + $2.50 x 1100 = $8,250

30.9%

2013: $12 x 600 + $3 x 1200 = $10,800

	Pizza		Latte	
year	***P***	***Q***	***P***	***Q***
2011	$10	400	$2.00	1000
2012	$11	500	$2.50	1100
2013	$12	600	$3.00	1200

Compute real GDP in each year, using 2011 as the base year:

Increase:

2011: $10 x 400 + $2 x 1000 = $6,000

20.0%

2012: $10 x 500 + $2 x 1100 = $7,200

16.7%

2013: $10 x 600 + $2 x 1200 = $8,400

year	*Nominal GDP*	*Real GDP*
2011	$6000	$6000
2012	$8250	$7200
2013	$10,800	$8400

In each year,

- nominal GDP is measured using the (then) current prices.
- real GDP is measured using constant prices from the base year (2011 in this example).

year	*Nominal GDP*		*Real GDP*	
2011	$6000		$6000	
		37.5%		20.0%
2012	$8250		$7200	
		30.9%		16.7%
2013	$10,800		$8400	

- The change in nominal GDP reflects both prices and quantities.
- The change in real GDP is the amount that GDP would change if prices were constant (i.e., if zero inflation).

Hence, real GDP is corrected for inflation.

The GDP Deflator

- The GDP deflator is a measure of the overall level of prices.
- Definition:

$$\text{GDP deflator} = 100 \times \frac{\text{nominal GDP}}{\text{real GDP}}$$

- One way to measure the economy's **inflation rate** is to compute the percentage increase in the GDP deflator from one year to the next.

year	Nominal GDP	Real GDP	GDP Deflator
2011	$6000	$6000	100.0
2012	$8250	$7200	114.6
2013	$10,800	$8400	128.6

14.6%

12.2%

Compute the GDP deflator in each year:

2011: 100 x (6000/6000) = 100.0

2012: 100 x (8250/7200) = 114.6

2013: 100 x (10,800/8400) = 128.6

	2011 (base yr)		2012		2013	
	P	*Q*	*P*	*Q*	*P*	*Q*
Good A	$30	900	$31	1000	$36	1050
Good B	$100	192	$102	200	$100	205

A. Compute nominal GDP in 2011.

$30 x 900 + $100 x 192 = <u>$46,200</u>

B. Compute real GDP in 2012.

$30 x 1000 + $100 x 200 = <u>$50,000</u>

	2011 (base yr)		2012		2013	
	P	*Q*	*P*	*Q*	*P*	*Q*
Good A	$30	900	$31	1000	$36	1050
Good B	$100	192	$102	200	$100	205

c. Compute the GDP deflator in 2013.

Nom GDP = \$36 x 1050 + \$100 x 205 = <u>\$58,300</u>

Real GDP = \$30 x 1050 + \$100 x 205 = <u>\$52,000</u>

GDP deflator = 100 x (Nom GDP)/(Real GDP)

= 100 x (\$58,300)/(\$52,000) = <u>112.1</u>

Contrasting the CPI and GDP Deflator

Imported consumer goods:

- included in CPI
- excluded from GDP deflator

Capital goods:

- excluded from CPI
- included in GDP deflator (if produced domestically)

The basket:

- CPI uses fixed basket
- GDP deflator uses basket of currently produced goods & services

This matters if different prices are changing by different amounts.

CPI vs. GDP deflator

In each scenario, determine the effects on the CPI and the GDP deflator.

A. Starbucks raises the price of Frappuccinos.

B. Caterpillar raises the price of the industrial tractors it manufactures at its Illinois factory.

C. Armani raises the price of the Italian jeans it sells in the U.S.

A. Starbucks raises the price of Frappuccinos.

The CPI and GDP deflator both rise.

B. Caterpillar raises the price of the industrial tractors it manufactures at its Illinois factory.

The GDP deflator rises, the CPI does not.

C. Armani raises the price of the Italian jeans it sells in the U.S.

The CPI rises, the GDP deflator does not.

Chain-weighted Real GDP

- Since 1996, the BEA has been calculating **chain-weighted real GDP**.

Quantity Index

Quantity Indices

Consider an economy of 2 goods: A and B. Let $t_0 = 1$ be the base period.

- Laspeyres quantity index

$$\mathcal{Q}^{L}_{1,t} = \frac{p^A_1 q^A_t + p^B_1 q^B_t}{p^A_1 q^A_1 + p^B_1 q^B_1}$$

  - Use initial prices as weight

- Paasche quantity index

$$\mathcal{Q}^{P}_{1,t} = \frac{p^A_t q^A_t + p^B_t q^B_t}{p^A_t q^A_1 + p^B_t q^B_1}$$

  - Use final prices as weight

Quantity Index

Quantity Indices

- Fisher quantity index

$$\mathcal{Q}^F_{1,t} = \sqrt{\mathcal{Q}^L_{1,t} \times \mathcal{Q}^P_{1,t}}$$

- Chained Fisher quantity index

$$\mathcal{Q}^C_{1,t} = \mathcal{Q}^F_{1,2} \times \mathcal{Q}^F_{2,3} \times \ldots \times \mathcal{Q}^F_{t-1,t} = \prod_{s=2}^{t} \mathcal{Q}^F_{s-1,s}$$

Chain-weighted Real GDP

- Fixed-weight real GDP = Nominal GDP of base year $\times$ Laspeyres quantity index
  - i.e., $RGDP_t^{fixed} = GDP_1 \times \mathcal{Q}_{1,t}^L$
- Chain-weighted real GDP = nominal GDP of base year $\times$ Chained Fisher quantity index
  - i.e., $RGDP_t^{chain} = GDP_1 \times \mathcal{Q}_{1,t}^C$

Example

	Year 1		Year 2	
	Quantity	Price	Quantity	Price
Computers	20	\$1,000	25	\$1,500
Bread	10,000	\$1.00	12,000	\$1.10

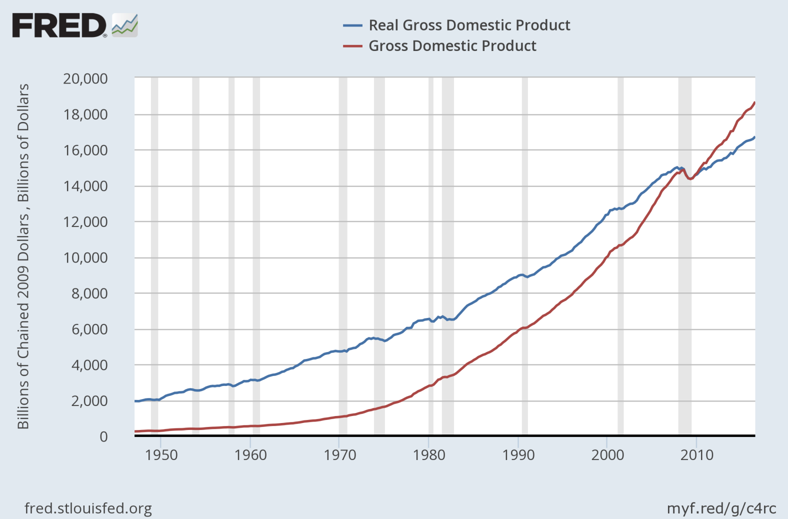
- Nominal GDP – yr 1: \$30,000, yr 2: \$50,700
- Real GDP (fixed-weight, yr 1 base) – yr 1: \$30,000, yr 2: \$37,000
- Real GDP (fixed-weight, yr 2 base) – yr 1: \$41,000, yr 2: \$50,700
- $\mathcal{Q}^L_{1,2} = 1.2333$, $\mathcal{Q}^P_{1,2} = 1.2367$, $\mathcal{Q}^C_{1,2} = \mathcal{Q}^F_{1,2} = 1.23496$
- Real GDP (chain-weight, yr 1 base) – yr 1: \$30,000, yr 2: \$37,048.80
- Real GDP (chain-weight, yr 2 base) – yr 1: \$41,053.96, yr 2: \$50,700

Example

	Year 1		Year 2	
	Quantity	Price	Quantity	Price
Computers	20	$1,000	25	$1,500
Bread	10,000	$1.00	12,000	$1.10

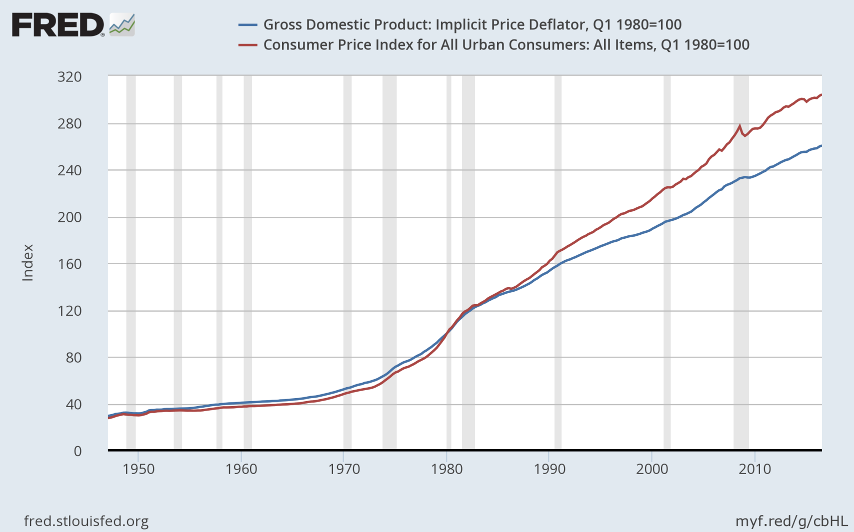
- GDP deflator (fixed-weight, yr 1 base) – yr 1: 100, yr 2: 137.03
- GDP deflator (fixed-weight, yr 2 base) – yr 1: 73.17, yr 2: 100
- GDP deflator (chain-weight, yr 1 base) – yr 1: 100, yr 2: 136.85
- GDP deflator (chain-weight, yr 2 base) – yr 1: 73.07, yr 2: 100

Real GDP



From 1947 to 2015, U.S. nominal GDP has increased by 7215%.
Real GDP (chain-weighted) has increased by 845%.

GDP Deflator vs. CPI



GDP Deflator based on chain-weighted real GDP

 j. mao

BEA GDP Release

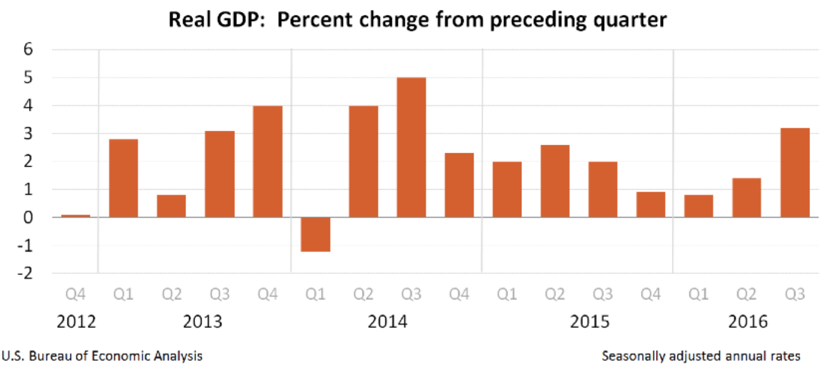
Schedule

Release Date:	Advance release: four weeks after quarter ends; Final release: three months after quarter ends
Release Time:	8:30am Eastern Standard Time
Coverage:	Previous quarter
Released By:	Bureau of Economic Analysis (BEA)

BEA GDP Release

Real gross domestic product increased at an annual rate of 3.2 percent in the third quarter of 2016 (table 1), according to the "second" estimate released by the Bureau of Economic Analysis. In the second quarter, real GDP increased 1.4 percent.

The GDP estimate released today is based on more complete source data than were available for the "advance" estimate issued last month. In the advance estimate, the increase in real GDP was 2.9 percent. With the second estimate for the third quarter, the general picture of economic growth remains the same; the increase in personal consumption expenditures was larger than previously estimated (see "Updates to GDP" on page 2).



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Calculating GDP Growth Rates

Real GDP								
		Quarterly GDP	Quarterly GDP Annualized	Calendar year GDP	Y-on-Y rate	Q-on-Q rate	Q-on-Q rate annualized	Annual rate
2000	Q1	100	400	414				
	Q2	102	408			2.00%	8.24%	
	Q3	105	420			2.94%	12.29%	
	Q4	107	428			1.90%	7.84%	
2001	Q1	109	436	442	9.00%	1.87%	7.69%	6.76%
	Q2	109	436		6.86%	0.00%	0.00%	
	Q3	110	440		4.76%	0.92%	3.72%	
	Q4	114	456		6.54%	3.64%	15.36%	

Calculating GDP Growth Rates

- BEA reports annualized quarterly GDP and real GDP.
- GDP growth rates are reported based on real GDP.
- Let G_Y be the real GDP of year Y. Let G_{Y,q_j}^{annual} be the annualized real GDP of year Y, quarter j. Then

$$G_Y = \frac{1}{4}\left(\sum_{j=1}^{4} G_{Y,j}^{annual}\right)$$

Calculating GDP Growth Rates

- Let g_Q^{YoY} denote quarter Q's **year-on-year growth rate**.

$$g_Q^{YoY} = \frac{G_Q}{G_{Q-4}} - 1$$

- Let $g_Q^{QoQ,annual}$ denote quarter Q's **quarter-on-quarter annualized growth rate**.

$$g_Q^{QoQ,annual} = \left(\frac{Y_Q}{Y_{Q-1}}\right)^4 - 1$$

- Most governments report $g_Q^{QoQ,annual}$, although some report g_Q^{YoY} [a].
- $g_Q^{QoQ,annual}$ better captures changing momentum in output growth.

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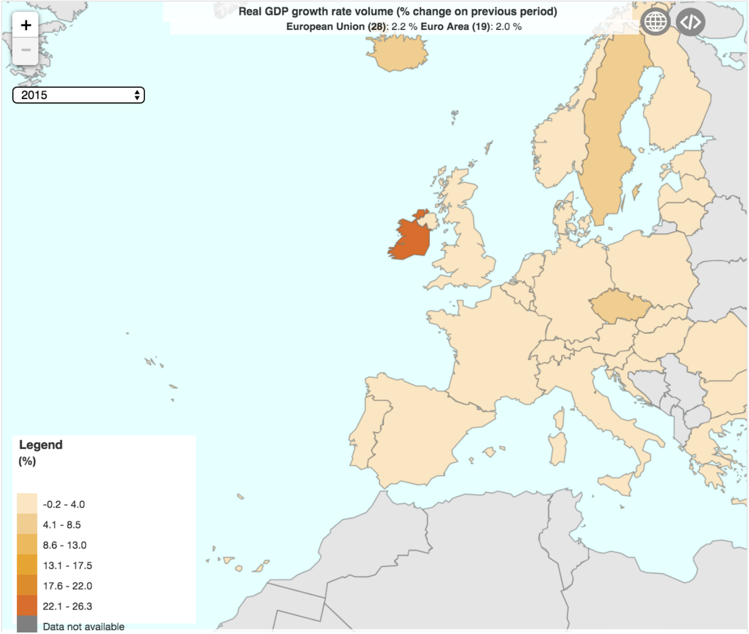
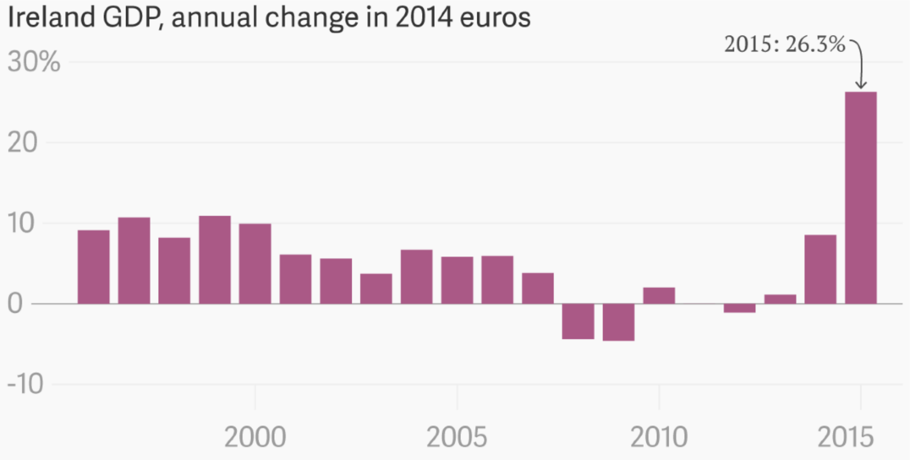
[a] Note: Governments typically apply seasonal adjustment to their GDP numbers as well. The resulting measure is called **"seasonally adjusted annual rate** (**SAAR**)", i.e. the numbers are first seasonally adjusted and then annualized.


Real GDP growth rate volume (% change on previous period)
European Union (28): 2.2 % Euro Area (19): 2.0 %
2015
Legend
(%)
-0.2 - 4.0
4.1 - 8.5
8.6 - 13.0
13.1 - 17.5
17.6 - 22.0
22.1 - 26.3
Data not available

j. mao

Ireland and its 26 Percent Growth



Ireland and its 26 Percent Growth

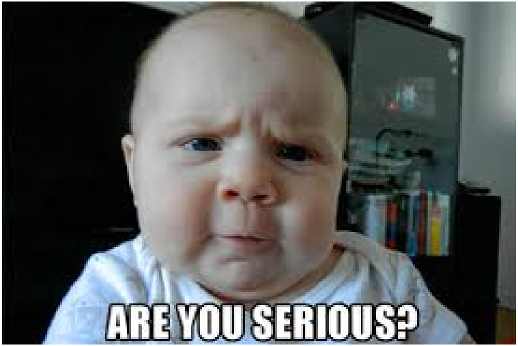
National Income (Constant market prices, chain linked annually and referenced to 2014) €m

Gross Product	2009	2010	2011	2012	2013	2014	2015
GDP	174,639	178,190	178,118	176,153	178,089	193,160	243,914
GNP	143,963	149,379	143,434	142,903	149,658	163,445	193,986
GNI	145,646	150,952	144,983	144,372	150,794	164,488	195,169

Annual percentage changes in national income (Constant market prices)

Gross Product	2010	2011	2012	2013	2014	2015
GDP	2.0	0.0	-1.1	1.1	8.5	26.3
GNP	3.8	-4.0	-0.4	4.7	9.2	18.7
GNI	3.6	-4.0	-0.4	4.4	9.1	18.7

Ireland and its 26 Percent Growth



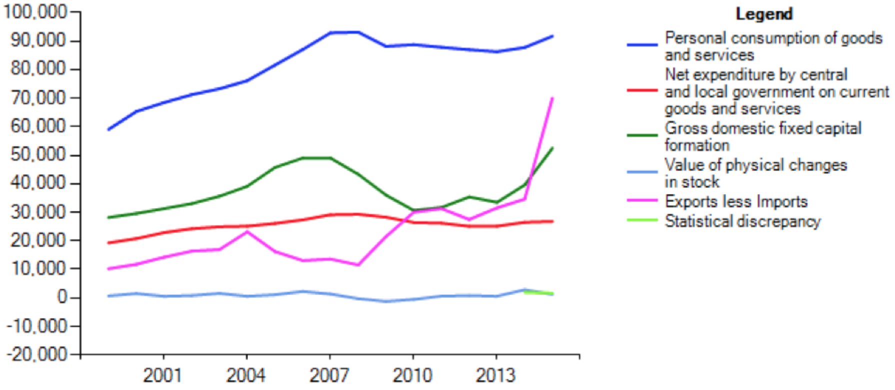
Ireland and its 26 Percent Growth

- Ireland has a small open economy dominated by foreign direct investment — particularly from U.S. technology and pharmaceutical companies.
- *Attraction to multinational enterprises (MNEs)*: 12.5% corporate tax rate + new knowledge box tax incentive of 6.25% on IP-derived income.

Ireland and its 26 Percent Growth

- **IP Transfer**
  - Transfer of IP by MNEs to their affiliates in Ireland, often done through artificially low transfer pricing.
  - Sales generated from the use of IP now contribute to Irish GDP.
- **Corporate inversion**: a process through which MNEs, mostly U.S. firms, become Irish through merger with Irish firms.
  - Medtronic's merger with Covidien ($48 billion)
  - Allergan's merger with Actavis ($70 billion)
  - Pfizer's attempted merger with Allergan ($160 billion, called off)
- **Contract manufacturing**

Ireland and its 26 Percent Growth



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Ireland and its 26 Percent Growth

- The modern framework of GDP accounting was first developed in the 1930s by the U.S. department of commerce under Simon Kuznets, and is thus a product of the "manufacturing age," where production was mainly done through physical capital, land, and labor.
- Ireland's example highlight, among other things, the challenges that the rise of the service sector, the globalization of value chains, and the increasing importance of intellectual property in production have posed for national GDP accounting.

Ireland and its 26 Percent Growth

- Instead of GDP, (disposable) personal income tells perhaps a better story of the economic growth that Irish residents actually experience.
  - Real disposable income grew by 4.6% in Ireland in 2015.
  - Irish GDP per capita is 24% above the OECD average. Irish household disposable income per capita is 22% points below the OECD average.

PCEPI

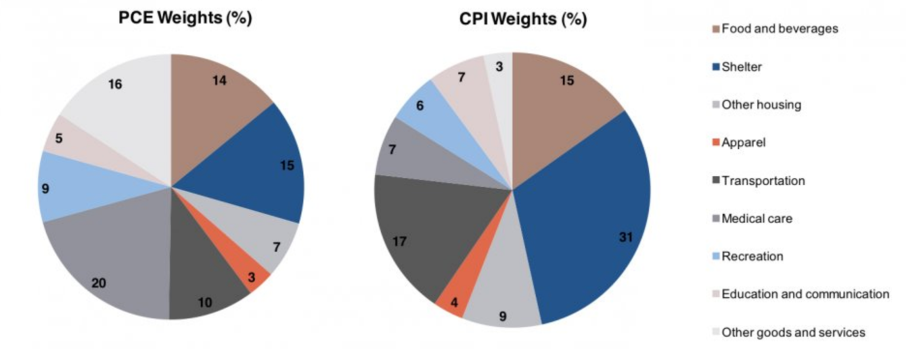
- The **Personal Consumption Expenditure Price Index** (PCEPI), also referred to as the **PCE deflator**, is a price index based on the consumption (C) component of GDP.
- In the U.S., PCEPI is published by the BEA and is a chained Fisher price index.
  - Basket: g&s included in the C component of GDP.
  - Because PCEPI is a chained index, the basket is continuously updated, reflecting changing consumption patterns.

PCEPI vs. CPI

- CPI is based on household surveys. PCEPI is based on retail-sales data used to calculate the consumption component of GDP.
  - Household surveys could be less reliable.
- PCEPI includes a broader range of expenditures than CPI: CPI captures what households spend *out-of-pocket* for a common basket of goods and services. PCEPI includes all goods and services purchased by households either directly or indirectly.
  - CPI includes only healthcare expenses paid out of pocket by consumers. PCEPI includes healthcare expenses paid for by government and employer-provided insurance.
  - Housing service (shelter) accounts for a larger share in the CPI. This is because the larger scope of goods in the PCEPI dilutes the importance of housing service, while in household surveys, housing service is typically one of the most important expenditures, giving that category more weight in the CPI.

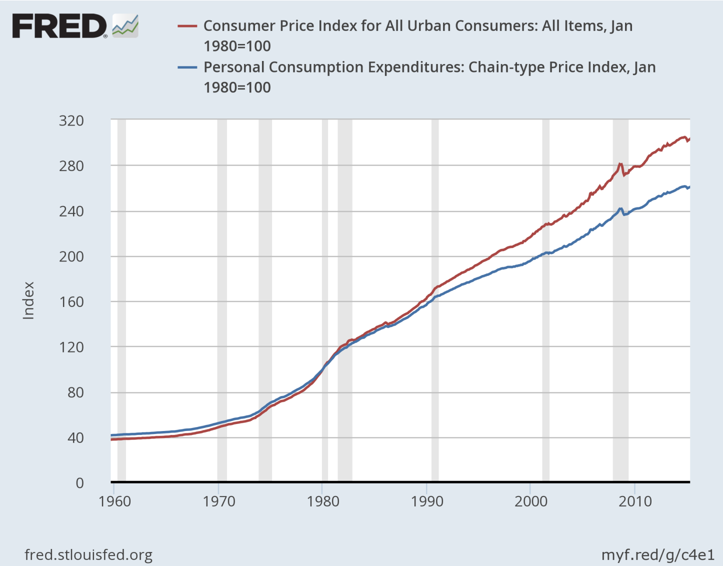
PCEPI vs. CPI

Chart 18: PCE vs CPI – weight comparisons



Source: Haver Analytics, SG Cross Asset Research/Economics

PCEPI vs. CPI



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PPI

- The **Producer Price Index** (PPI) is a price index that measures the prices received by producers.
  - Constructed using selling prices reported by firms.
  - Does not represent prices at the consumer level
  - Focuses on the whole output of domestic producers, including intermediate goods and capital goods[16].
  - U.S. PPI is produced by the BLS and is a Laspeyres index[17].

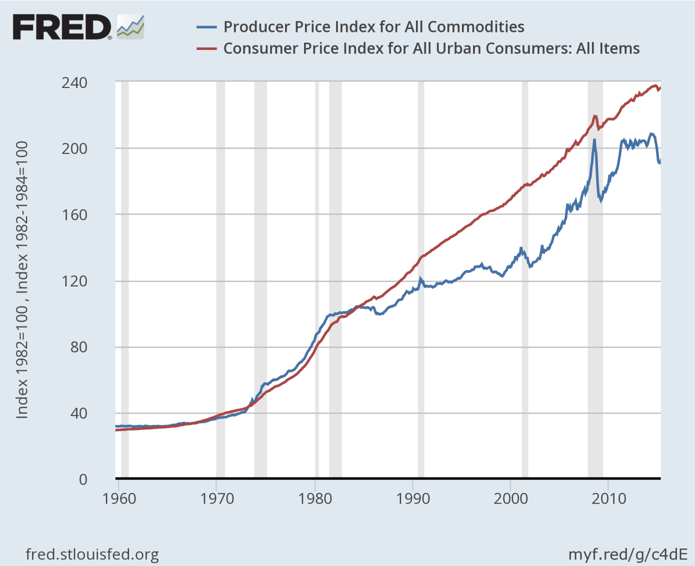
[16] Capital goods are final goods used as investment.

[17] Currently, the U.S. PPI does not cover all sectors. It covers 100% of mining and manufacturing, and about 70% of services, and 34% of construction.

PPI vs. CPI

- PPI is based on prices received by producers. CPI is based on prices paid out-of-pocket by consumers. Hence sales taxes are included in CPI but not PPI.
- CPI includes imports. PPI does not. PPI includes exports. CPI does not.
- CPI includes owner-occupied housing. PPI does not.
- PPI includes government purchases. CPI does not.

PPI vs. CPI


FRED
Producer Price Index for All Commodities
Consumer Price Index for All Urban Consumers: All Items
Index 1982=100 , Index 1982-1984=100
240
200
160
120
80
40
0
1960
1970
1980
1990
2000
2010
fred.stlouisfed.org
myf.red/g/c4dE

Inflation

- **Inflation**: increase in the general price level of an economy
- **Deflation**: decrease in the general price level of an economy
- **Inflation rate** (π): percentage increase in the price level from the previous period

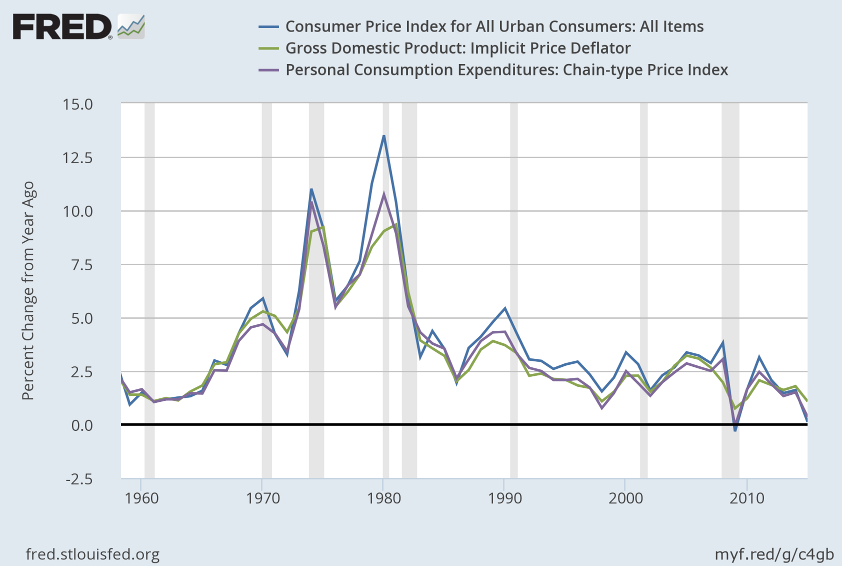
$$\pi_t = \frac{\mathcal{P}_t}{\mathcal{P}_{t-1}} - 1$$

  , where $\mathcal{P}_t$ is a price index.
  - $\pi > 0$: inflation
  - $\pi < 0$: deflation

Inflation

- Inflation rate can be measured using different price indices:
  - CPI
  - PCEPI
  - PPI
  - GDP Deflator
- The CPI inflation rate (based on CPI-U) is the most well-known and widely-used.

Inflation



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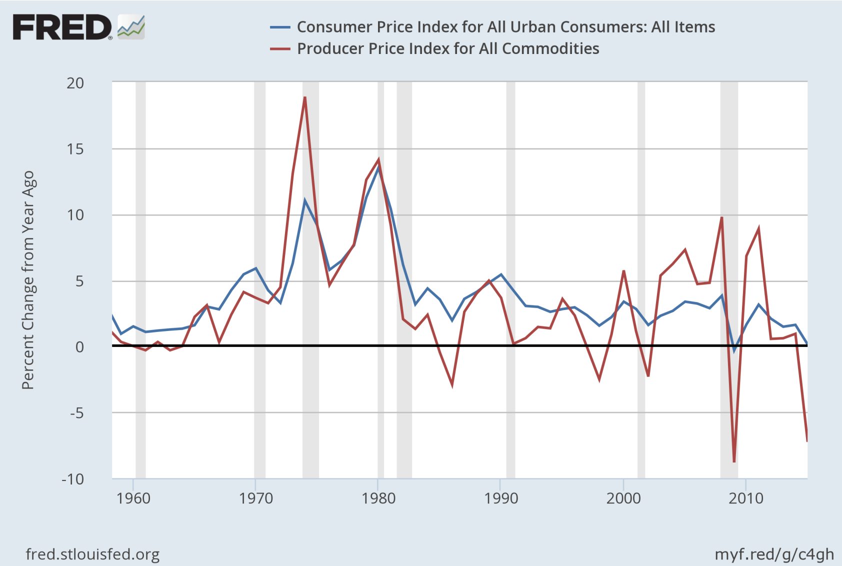
Inflation

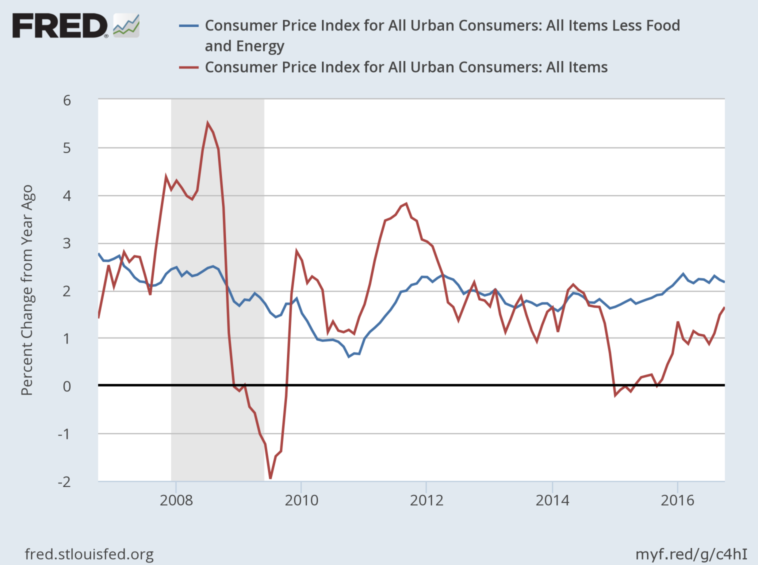


FRED
Consumer Price Index for All Urban Consumers: All Items
Producer Price Index for All Commodities
Percent Change from Year Ago
20
15
10
5
0
-5
-10
1960
1970
1980
1990
2000
2010
fred.stlouisfed.org
myf.red/g/c4gh

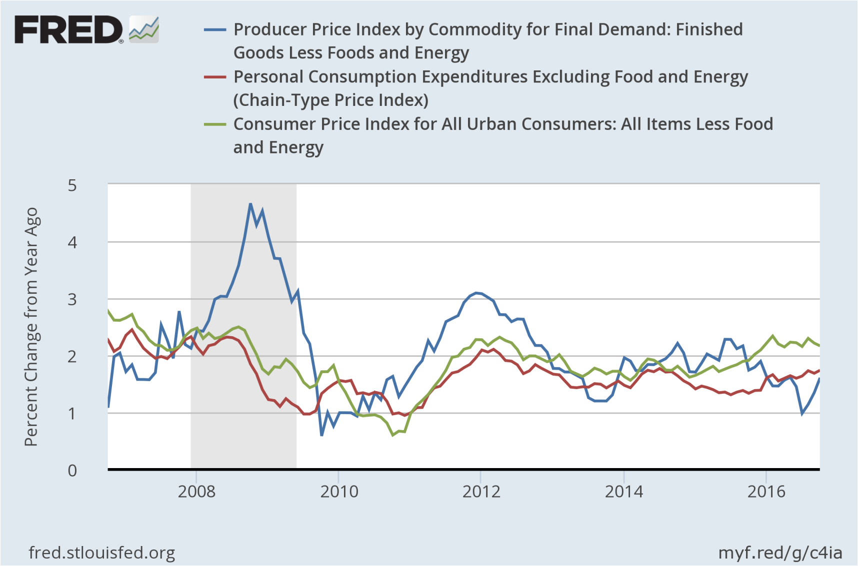
Core Inflation

- Because food and energy prices tend to be volatile, we often subtract them from the overall index in order to see the more stable long term trend in prices. The resulting inflation rate measure is called **core inflation rate**.
  - The normal/non-core inflation rate is also called **headline inflation rate**.
- The U.S. Federal Reserve uses core PCEPI inflation as its primary inflation measure.

Core Inflation



Core Inflation



Correcting Variables for Inflation:
Comparing Dollar Figures from Different Times

- Inflation makes it harder to compare dollar amounts from different times.
- Example: the minimum wage
  - $1.25 in Dec 1963
  - $7.25 in Dec 2013
- Did min wage have more purchasing power in Dec 1963 or Dec 2013?
- To compare, use CPI to convert 1963 figure into "2013 dollars"…

Correcting Variables for Inflation: Comparing Dollar Figures from Different Times

$$\text{Amount in today's dollars} = \text{Amount in year } T \text{ dollars} \times \frac{\text{Price level today}}{\text{Price level in year } T}$$

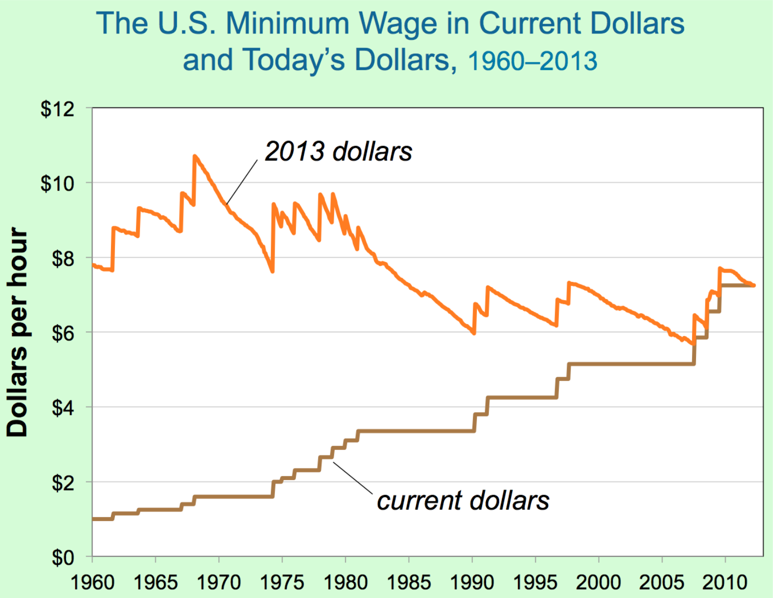
- In our example,
  - "year *T*" is 12/1963, "today" is 12/2013
  - Min wage was \$1.25 in year *T*
  - CPI = 30.9 in year *T*, CPI = 234.6 today

The minimum wage in 1963 was \$9.49 in 2013 dollars.

$$\$9.49 = \$1.25 \times \frac{234.6}{30.9}$$

Correcting Variables for Inflation: Comparing Dollar Figures from Different Times

- Researchers, business analysts, and policymakers often use this technique to convert a time series of current-dollar (nominal) figures into constant-dollar (real) figures.
- They can then see how a variable has changed over time after correcting for inflation.
- Example: the minimum wage…



The U.S. Minimum Wage in Current Dollars and Today's Dollars, 1960–2013
2013 dollars
current dollars
Dollars per hour
$12
$10
$8
$6
$4
$2
$0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010

Comparing tuition increases

Tuition and Fees at U.S. Colleges and Universities		
	1990	2013
Private non-profit 4-year	$9,340	$30,094
Public 4-year	$1,908	$8,893
Public 2-year	$906	$3,264
CPI	130.7	232.6

Instructions: Express the 1990 tuition figures in 2013 dollars, then compute the percentage increase in real terms for all three types of schools. Which type experienced the largest increase in real tuition costs?

	1990	2013	% change
CPI	130.7	232.6	78.0%
Private non-profit 4-year (current $)	$9,340	$30,094	
Private non-profit 4-year (2010 $)	$16,622	$30,094	81.1%
Public 4-year (current $)	$1,908	$8,893	
Public 4-year (2010 $)	$3,396	$8,893	161.9%
Public 2-year (current $)	$906	$3,264	
Public 2-year (2010 $)	$1,612	$3,264	102.4%

Correcting Variables for Inflation: Indexation

A dollar amount is **indexed** for inflation if it is automatically corrected for inflation by law or in a contract.

U.S. Box Office Domestic Sales

Rank	Title(click to view)	Studio	Lifetime Gross	Year^
1	**Star Wars: The Force Awakens**	BV	**$936,662,225**	2015
2	**Avatar**	Fox	**$760,507,625**	2009^
3	**Titanic**	Par.	**$658,672,302**	1997^
4	**Jurassic World**	Uni.	**$652,270,625**	2015
5	**Marvel's The Avengers**	BV	**$623,357,910**	2012
6	**The Dark Knight**	WB	**$534,858,444**	2008^
7	**Finding Dory**	BV	**$486,294,347**	2016
8	**Star Wars: Episode I - The Phantom Menace**	Fox	**$474,544,677**	1999^
9	**Star Wars**	Fox	**$460,998,007**	1977^
10	**Avengers: Age of Ultron**	BV	**$459,005,868**	2015

U.S. Box Office Domestic Sales: Adjusted for Inflation

Rank	Title (click to view)	Studio	**Adjusted Gross**	Unadjusted Gross	Year^
1	**Gone with the Wind**	MGM	**$1,739,604,200**	$198,676,459	1939^
2	**Star Wars**	Fox	**$1,533,609,700**	$460,998,007	1977^
3	**The Sound of Music**	Fox	**$1,226,196,400**	$158,671,368	1965
4	**E.T.: The Extra-Terrestrial**	Uni.	**$1,221,365,800**	$435,110,554	1982^
5	**Titanic**	Par.	**$1,166,435,200**	$658,672,302	1997^
6	**The Ten Commandments**	Par.	**$1,127,910,000**	$65,500,000	1956
7	**Jaws**	Uni.	**$1,102,758,600**	$260,000,000	1975
8	**Doctor Zhivago**	MGM	**$1,068,806,300**	$111,721,910	1965
9	**The Exorcist**	WB	**$952,258,800**	$232,906,145	1973^
10	**Snow White and the Seven Dwarfs**	Dis.	**$938,490,000**	$184,925,486	1937^