Principles of Economics

Measuring the National Economy

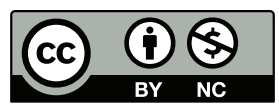
Jiaming Mao

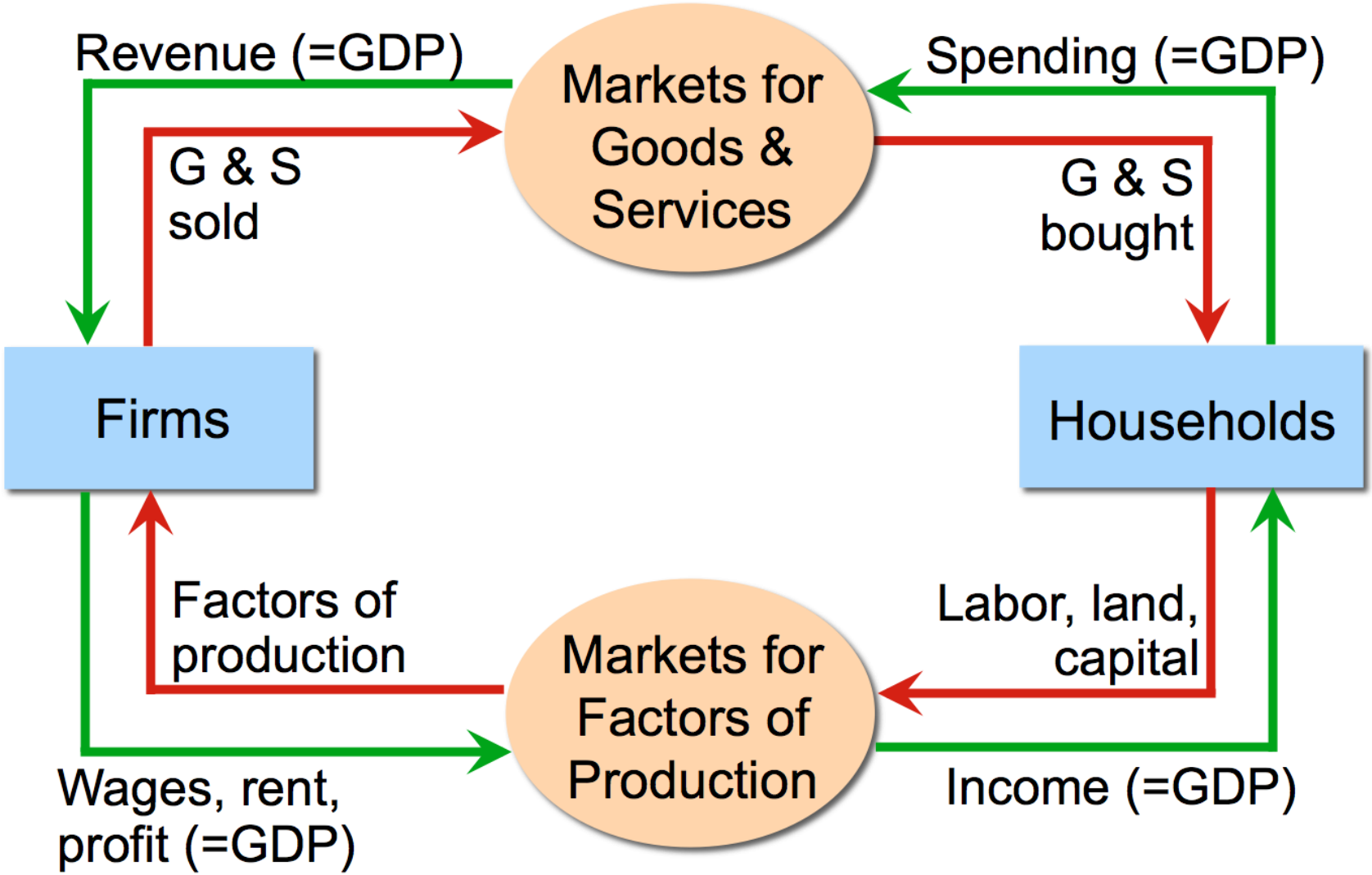
Xiamen University

This version: Fall 2018

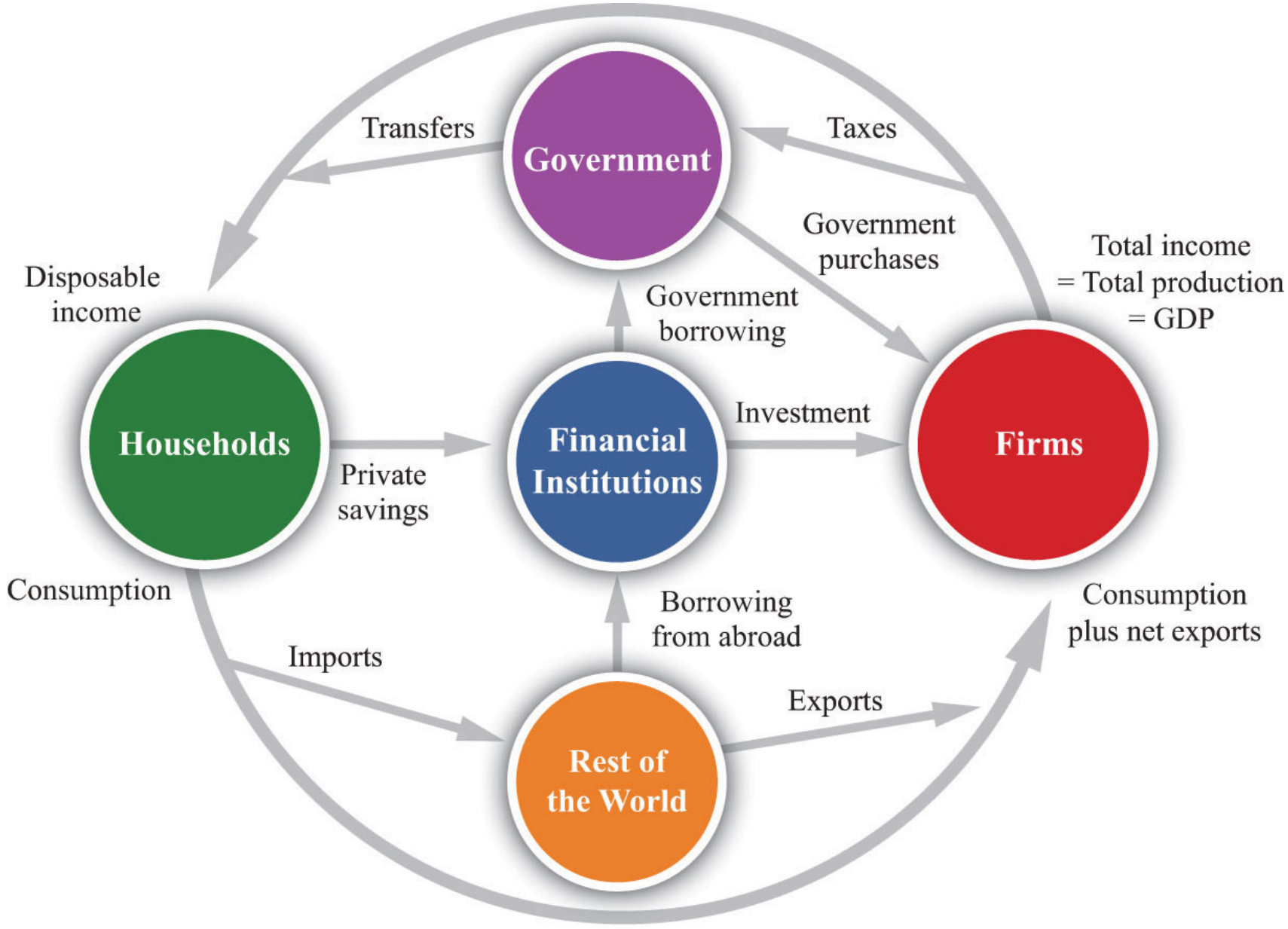
Contact: jmao@xmu.edu.cn

Course homepage: jiamingmao.github.io/principles-of-economics





The circular flow diagram of an economy: simple version



The circular flow diagram of an economy: complete version

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.

---

[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.
  - One person's spending is another person's income.

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 such as government services and owner-occupied housing are included in GDP.
- GDP excludes nonproduction transactions:
  - Government transfer payments
  - Private transfer payments (e.g., gifts)
  - Financial market transactions (e.g., stocks and bonds)
  - Second-hand 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, goods & services 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.
  - E.g., if Karen pays Doug to cook for her, the service is included in GDP. If Karen marries Doug and Doug cooks for her, the service is not included in GDP[a].

[a] Note: this is a limitation of GDP 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 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.

- 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.
  - E.g., production of an American company in China counts toward Chinese GDP.

Calculating GDP

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

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 new goods & services, *not* including spending on new houses.

[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 product** (e.g., software, patents**,** copyrights**)**
  - **Inventory**

[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 can be divided into three categories:
  - **Business fixed investment**: spending by firms on fixed assets[a].
  - **Residential investment**: spending by households and firms on new houses.
  - **Inventory investment:** changes in business inventories.
    - ★ Inventory investment can be positive or negative. If a company has x_0 worth of inventory at the beginning of the year and x_1 worth of inventory at the end of the year, then the company has spent $x_1 - x_0$ on inventory investment during the year.

[a] Capital equipment, structures, and IP products are called **fixed assets**: goods that are used repeatedly or continuously in production over a long period of time.

Expenditure Approach

GDP as total spending:

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

- Government Purchases (G): spending on new goods & services by the government (e.g., teachers' salaries, highways, defense spending)[a].
  - Transfer payments are not included.

[a] Many government produced goods and services do not have a market value. Therefore, their values are approximated by their costs – by how much government spends to produce them.

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 goods & services.
  - Imports are the portions of C, I, and G that are spent on goods & services produced abroad.

Fixed Asset in GDP

- Fixed assets are goods that are used repeatedly or continuously in production over an extended period of time.
- Just like intermediate goods, fixed assets are used in the production of other goods. However, they are counted as final rather than intermediate goods for the period in which they are produced, because their value is not (entirely) contained in the value of other final goods and services produced in the same period[3].

[3] i.e., intermediate goods are used in current production, while fixed assets are used in current and future production.

Inventory in GDP

- Inventories are assets as they can be used in a future period to produce goods and services.
- They can include not only finished final goods, but also intermediate goods and finished goods that are themselves intermediate goods to be used in production by other firms.
- However, new inventories at the end of a period are considered final goods *for that period*, because their value is not contained in the value of other final goods and services produced *in that period*.

Inventory in GDP

Example

A car company produces and sells a car to one of its retailers in 2000 for $18,000. The retailer sells the car the following year (2001) to a consumer for $20,000. GDP for 2000 and 2001 are:

GDP Account	2000	2001
Consumption	0	$20,000
Investment (Inventories)	$18,000	-$18,000
Total GDP	$18,000	$2,000

The 2000 GDP includes the value of production of the car by the car company, while 2001 GDP includes the value of services provided by the retailer in selling the car to the consumer.

Housing in GDP

- Houses are fixed assets that produce "housing services" to their occupants.
- The value of the housing service provided by a house is the rent people are willing to pay for it.
- The purchase of a new house is a residential investment (I)[4].
- 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[5].

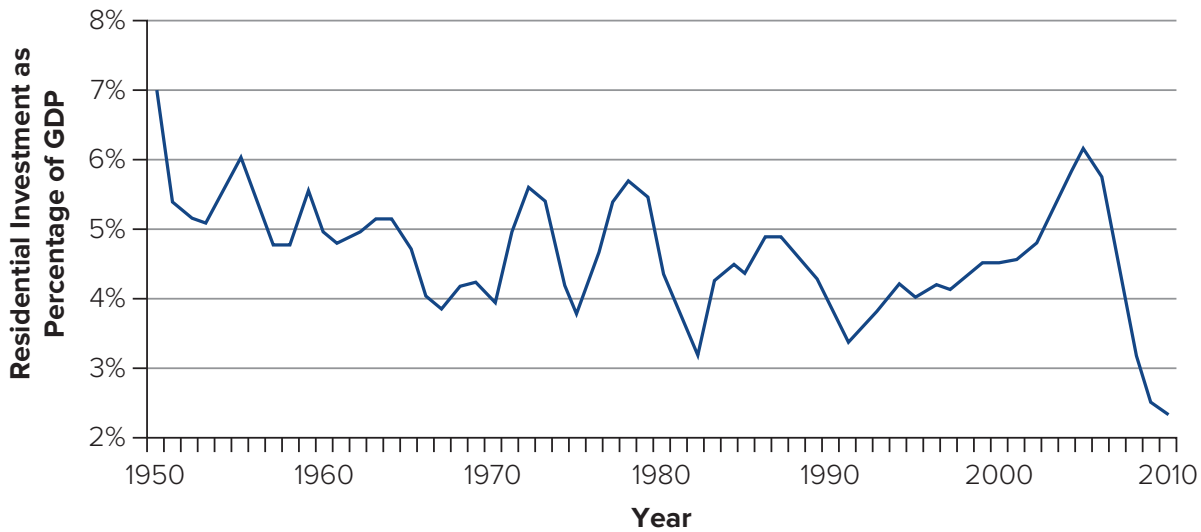
[4] The purchase of new office buildings is a part of business fixed investment.

[5] i.e. the owner-occupant is treated as a rental business, in which the landlord rents to him or herself.

Residential Investment

Spending on construction of new homes and renovation of existing homes goes through big swings. This chart shows residential investment as a share of GDP.

Source: Bureau of Economic Analysis, www.bea.gov (as of April 2016).



Intellectual Property in GDP

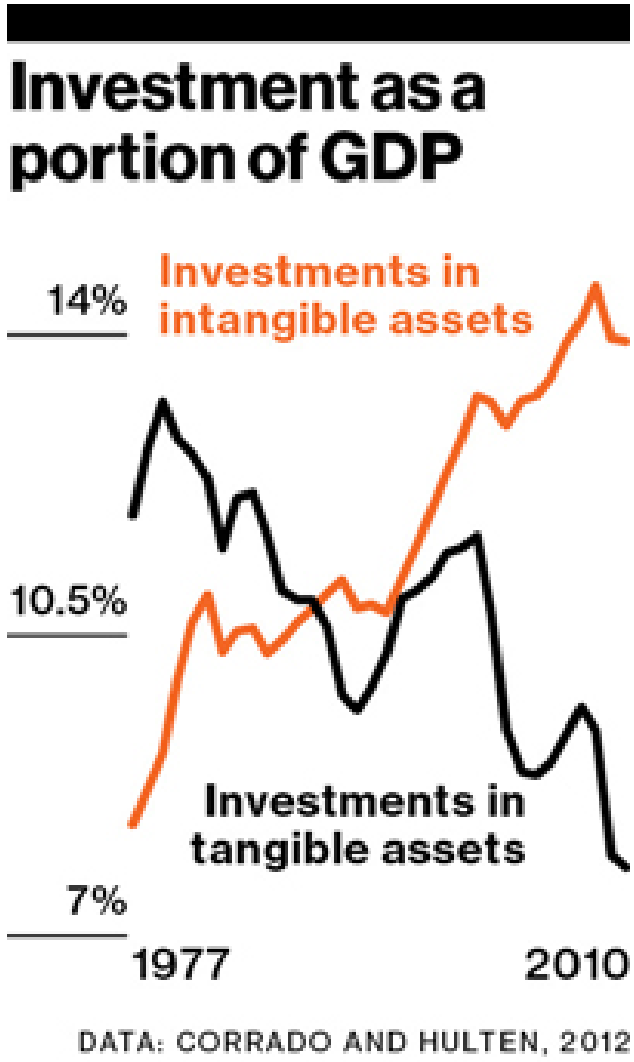
- IP products are a type of fixed assets:
  - They are produced using labor and other capital.
  - They have defined ownership rights.
  - They are used repeatedly in the production process for an extended period of time.
- Because many IP products are produced in-house by firm R&D (called "own-account R&D"), their market value is not available. In such cases, the value of these IP products are approximated by their costs – firm spending on R&D – in GDP accounting.

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

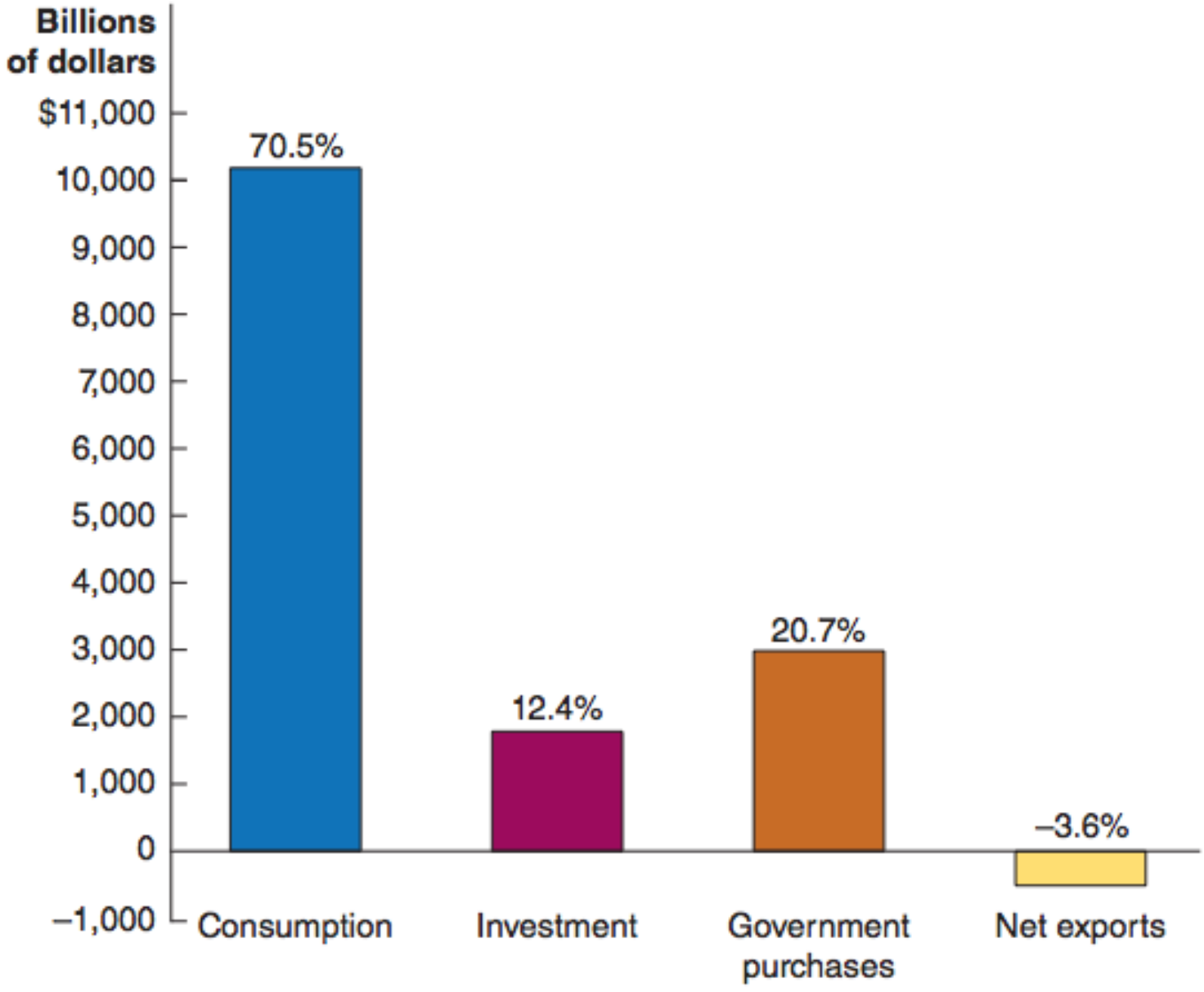
Suppose spending on R&D includes \$20 in wages and \$10 in intermediate g&s. The table shows what happens before and after R&D is "capitalized," i.e. when R&D is counted as fixed investment.

Intellectual Property in GDP



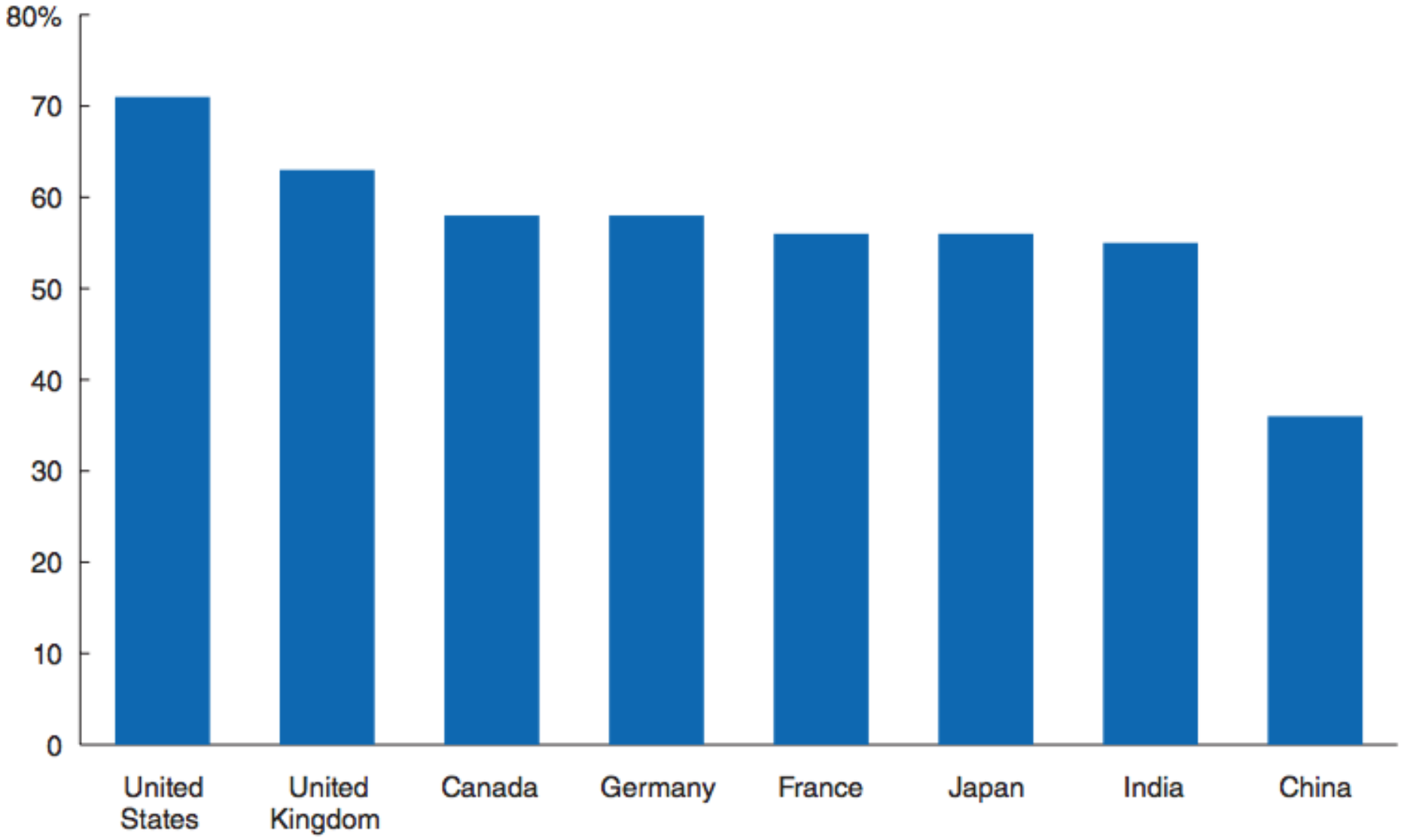
COMPONENTS OF GDP (billions of dollars)		
Consumption		$10,246
Durable goods	$1,086	
Nondurable goods	2,302	
Services	6,859	
Investment		1,795
Business fixed investment	1,390	
Residential construction	338	
Change in business inventories	67	
Government Purchases		3,003
Federal	1,223	
State and local	1,780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

U.S. GDP (2010)



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[6]
- **Profits** (PR):
  - **Proprietor's Income**: income[6] 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[7]

---

[6] pre-tax

[7] 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

j. mao

Income Approach

GDP[8] = National Income + Depreciation + Indirect business taxes - Net factor payments

---

- **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 (+).

[8] 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

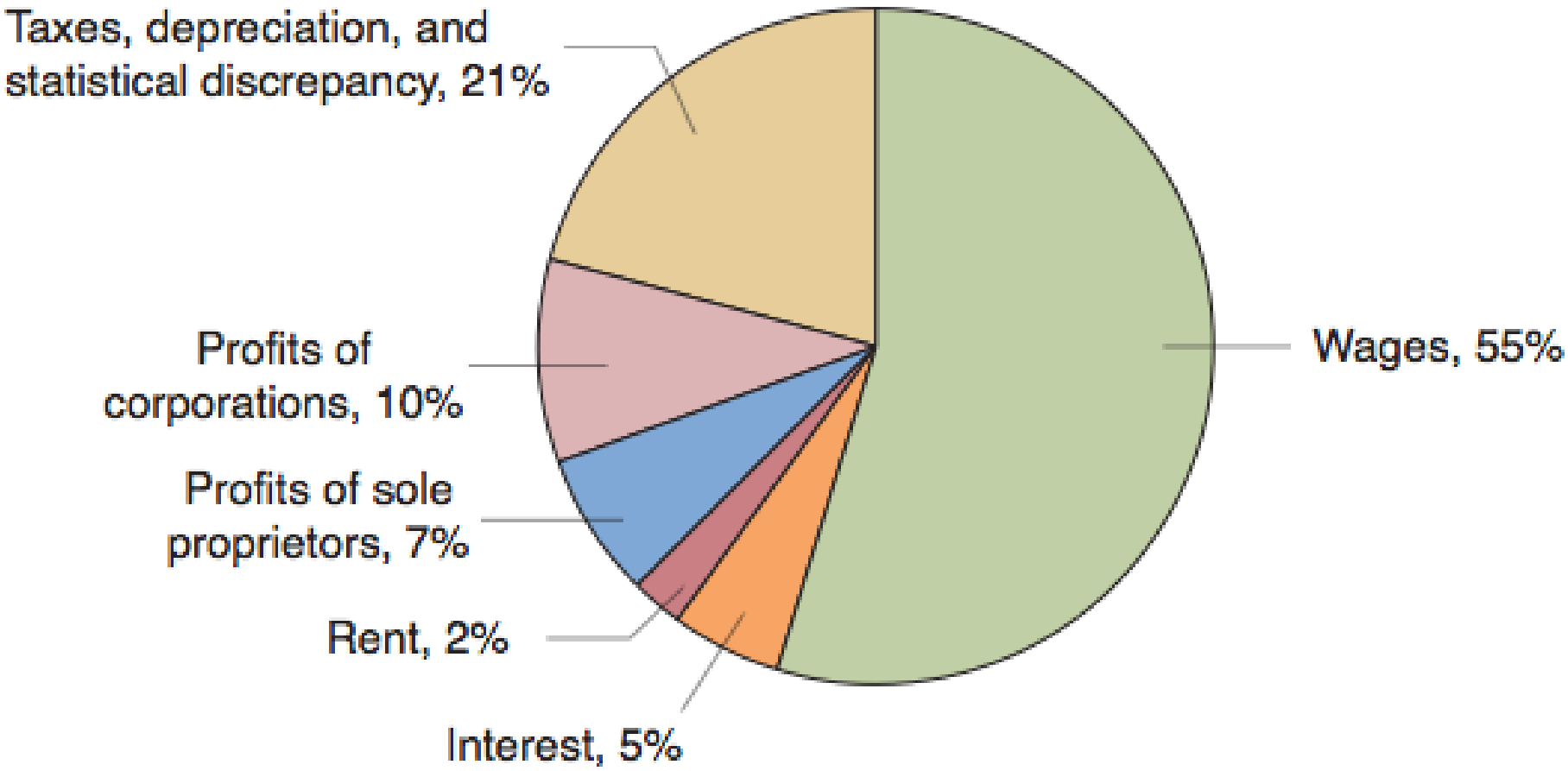
	Billion $US	% of Nat. Inc.
National Income	8,122.0	100.0%
Comp. of Employees	5,874.9	72.3%
Proprietors' Income	727.8	9.0%
Rental Income	137.9	1.7%
Corporate Profits	731.6	9.0%
Net Interest	649.8	8.0%

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

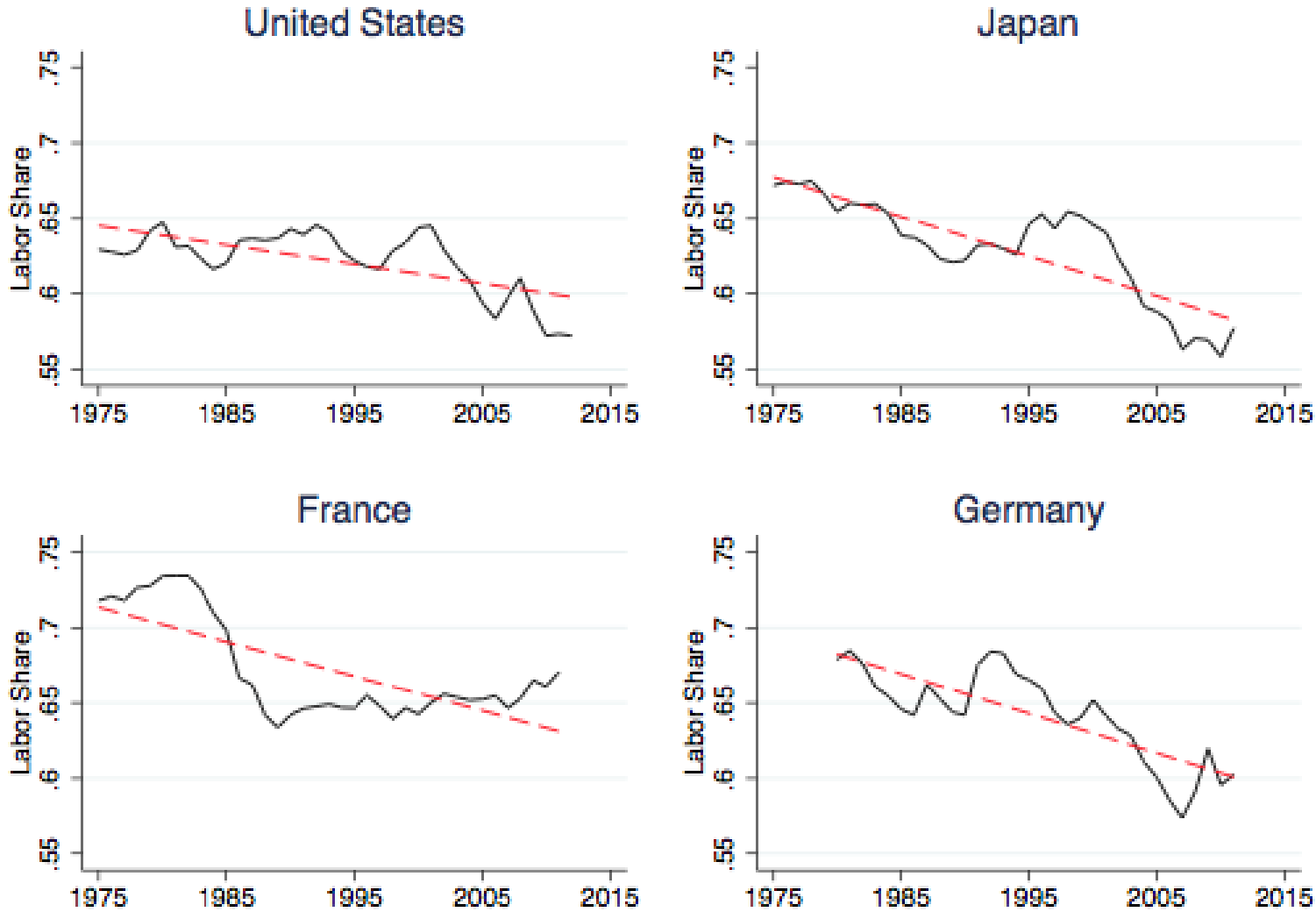
- Labor share: the fraction of total income that goes to labor
- Capital share: the fraction of total income that goes to capital

---

One way to measure labor and capital share:

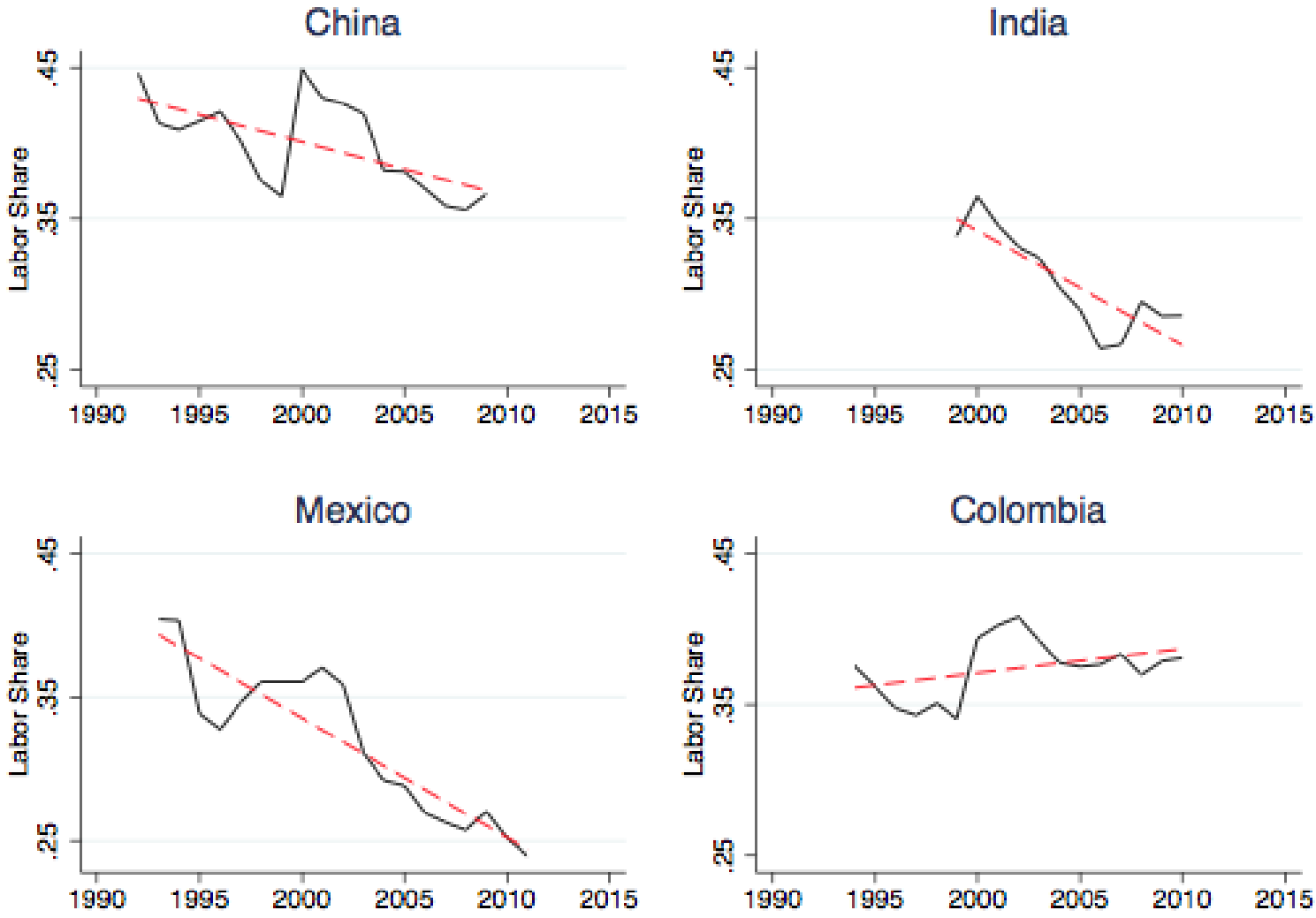
- Labor share $= \frac{\text{Labor Income}}{\text{National Income}}$
  - Labor income: compensation of employees + *imputed* labor share of proprietor's income
- Capital share $= \frac{\text{Capital Income}}{\text{National Income}}$
  - Capital income: corporate profits + interest + rent + *imputed*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

Labor Share in Selected Countries



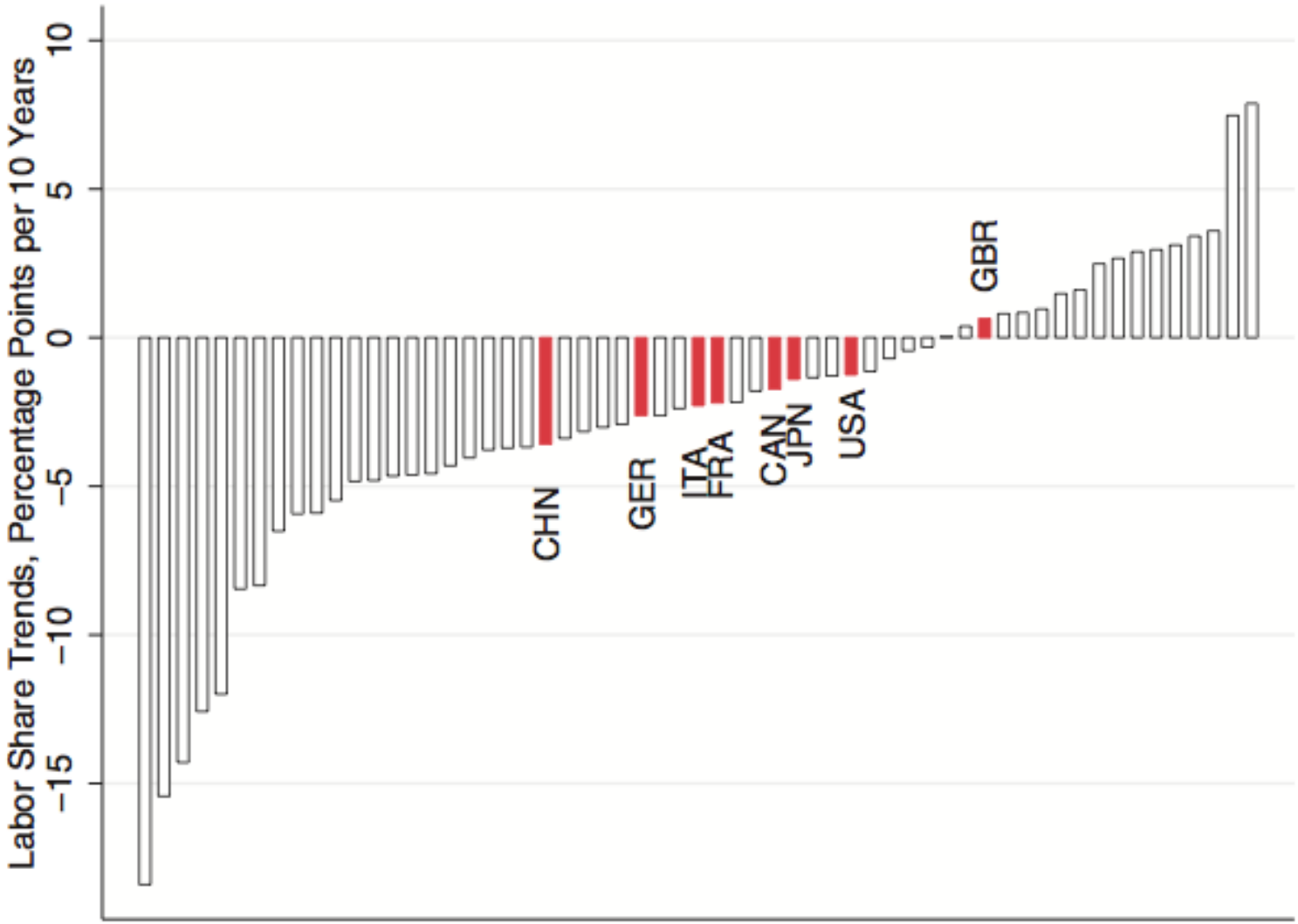
Labor share in the corporate sector.
Source: Karabarbounis and Neiman (2014)

Labor Share in Selected Countries



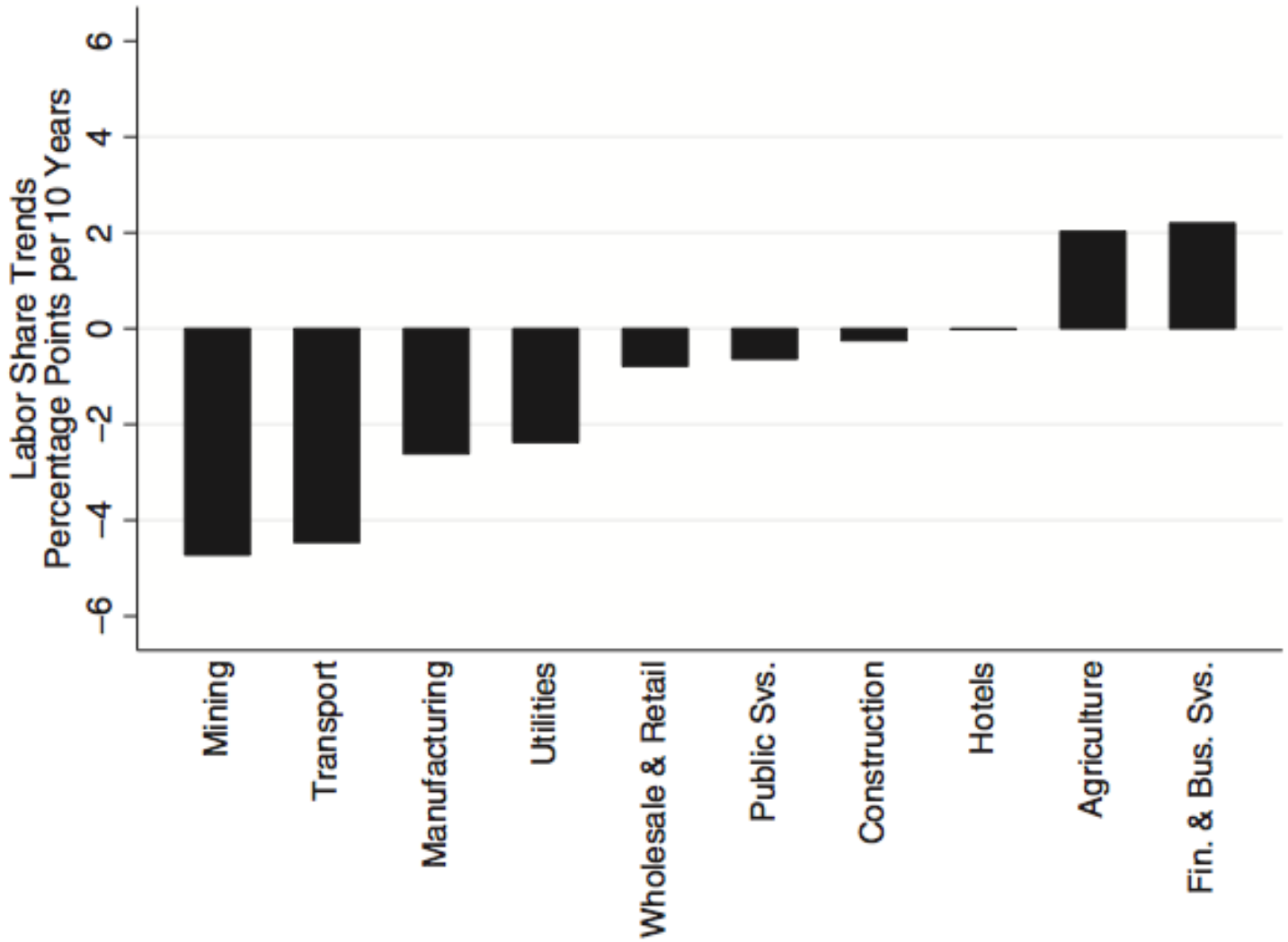
Labor share in the corporate sector.
Source: Karabarbounis and Neiman (2014)

Trends in Labor Share



Source: Karabarbounis and Neiman (2014)

Trends in Labor Share



U.S. labor share by sector. Source: Karabarbounis and Neiman (2014)

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)

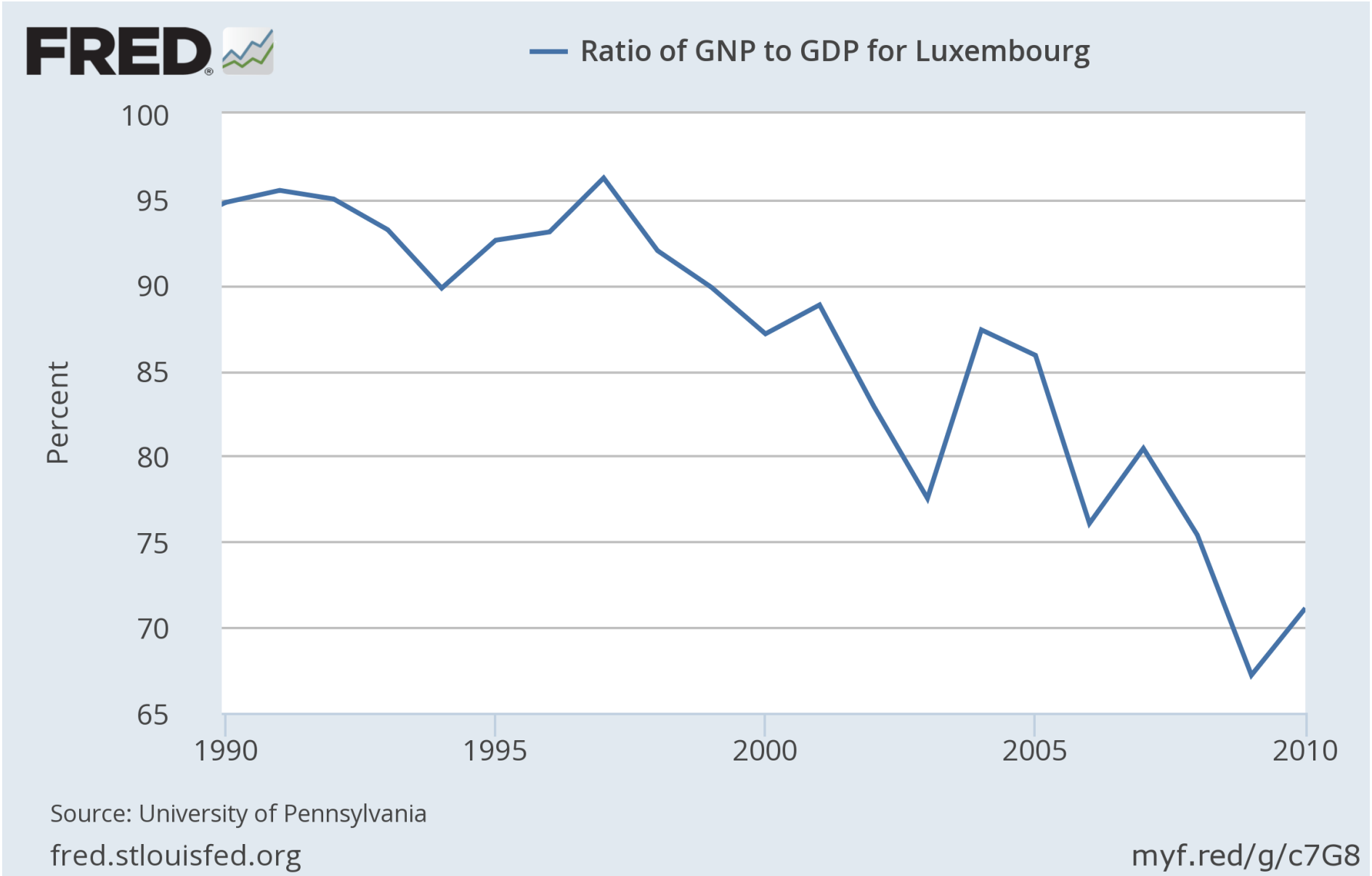
Definition (GNP)

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.

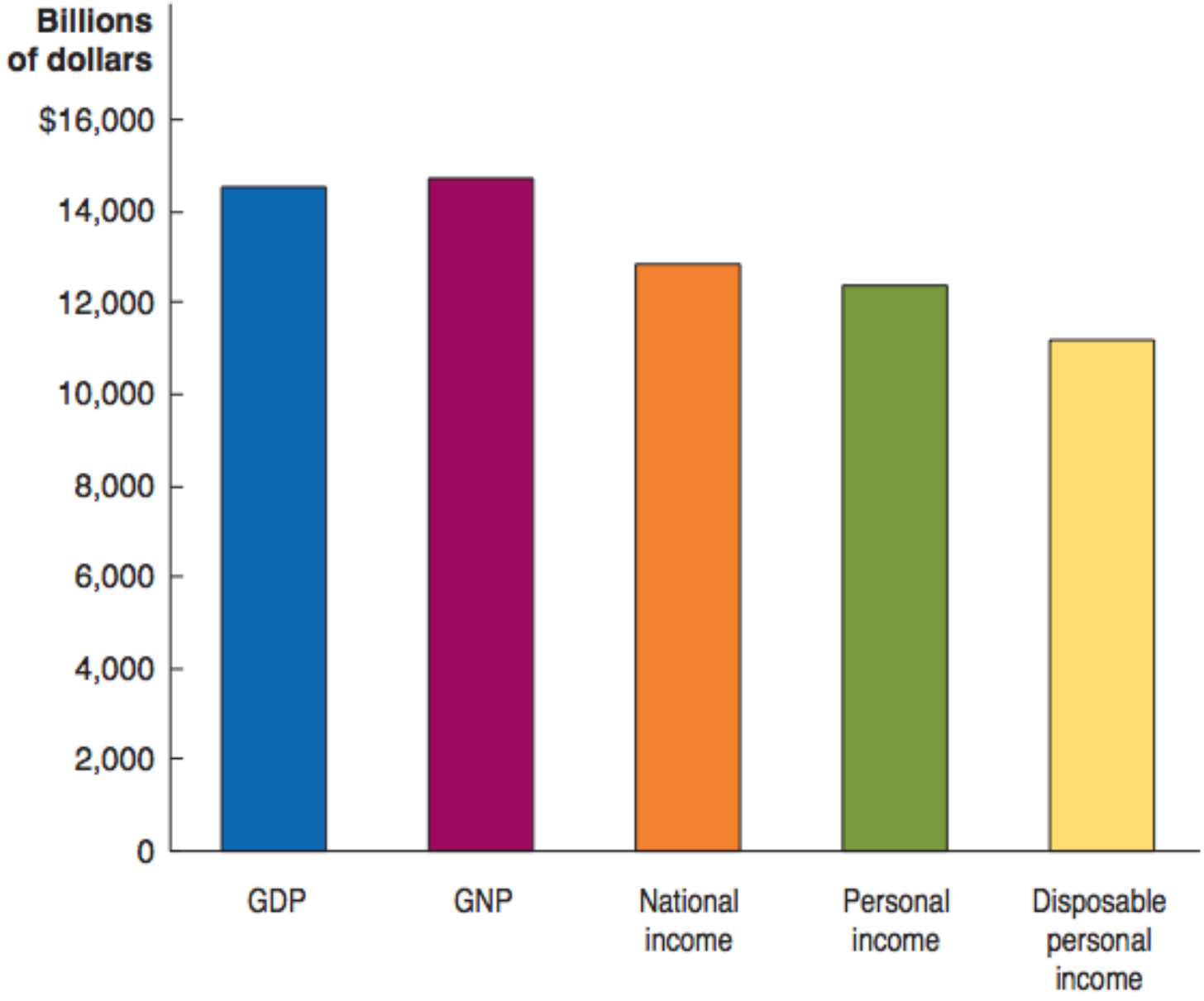
- If a county has similar inflows and outflows of income from assets, then GNP and GDP will be similar.
- If a country has, say, many companies owned by foreign shareholders, then GNP will be lower than GDP.


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[9]. 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.

[9] 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

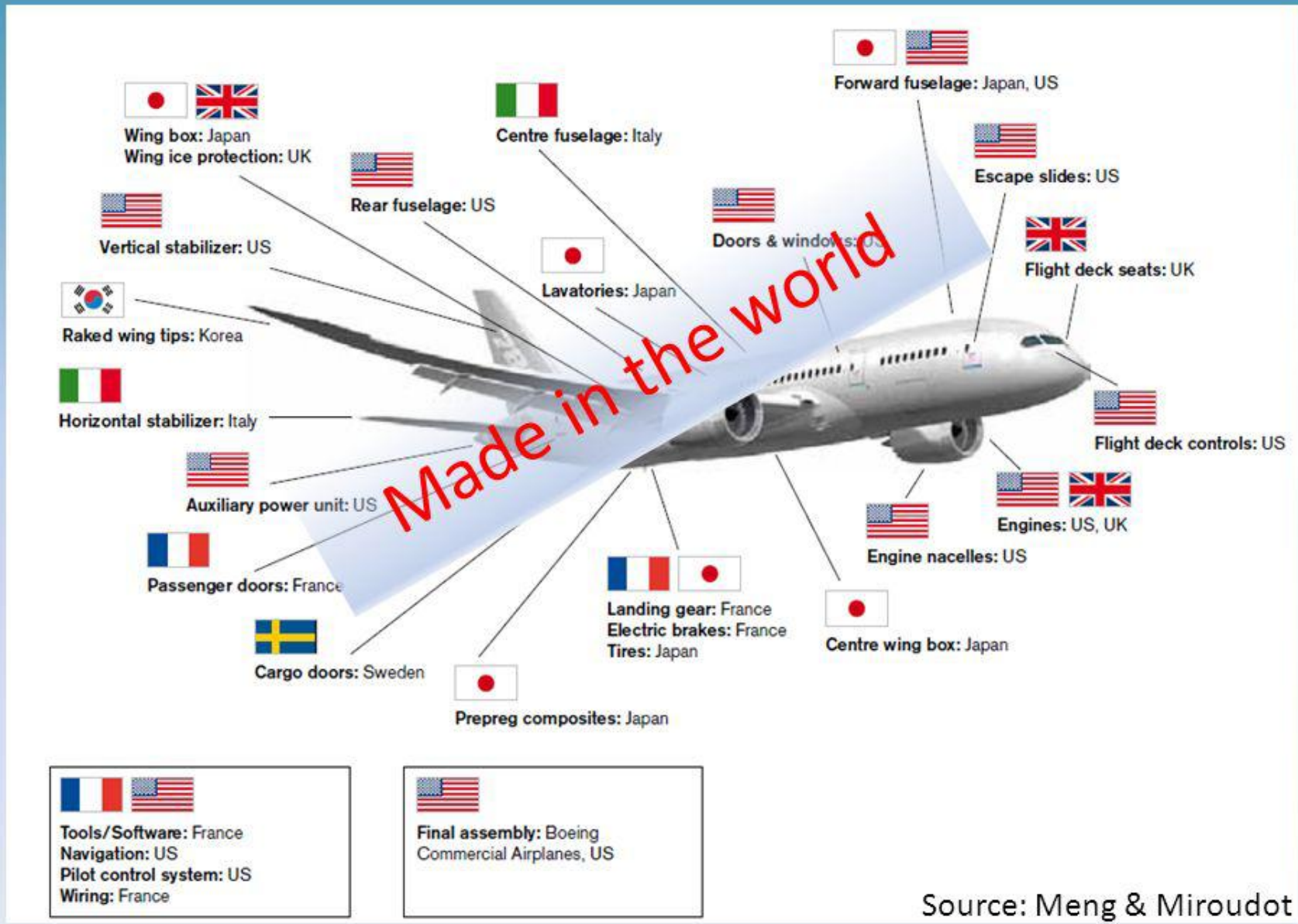
- home production
- underground economy
- accounting for quality and variety
- global value chains
- financial services
- zero-priced digital services
- intangible assets: IP products, digital assets (data, networks, etc.)

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

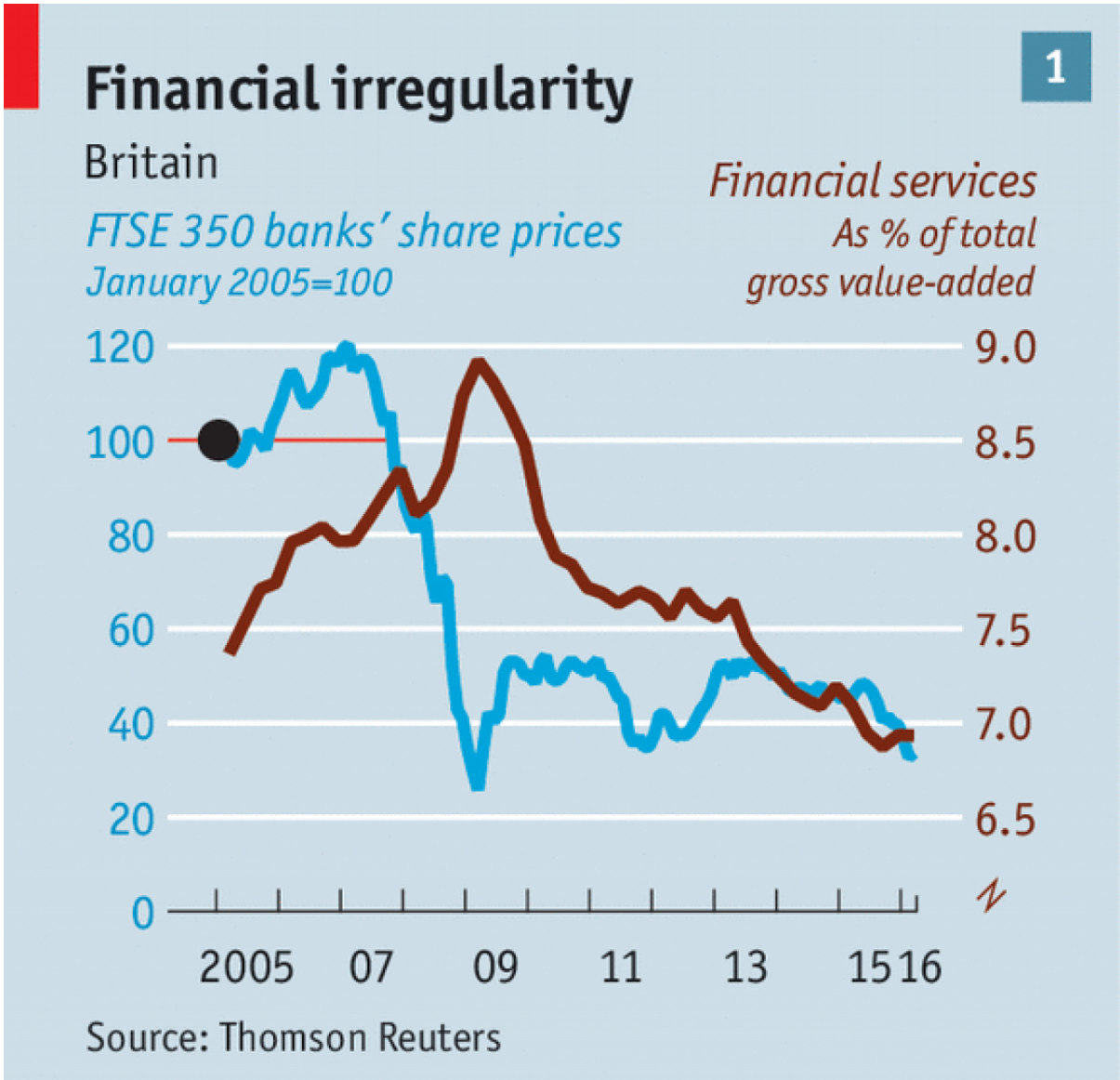
Source: Friedrich Schneider. Figures are for 2002.

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

Fragmentation of production: the example of the Boeing 787 Dreamliner



Source: Meng & Miroudot



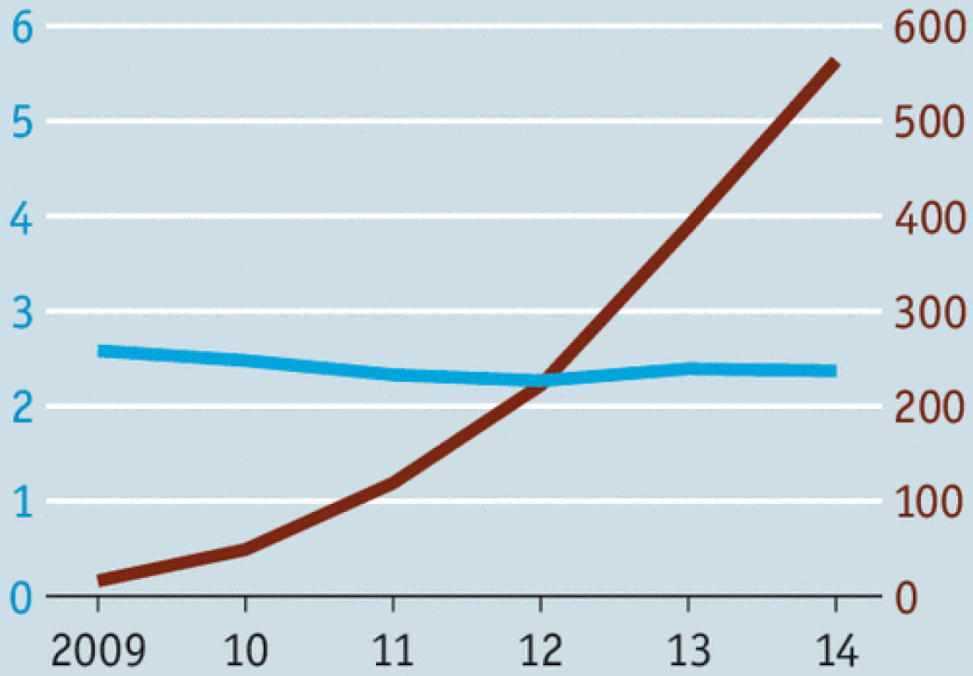
Economist.com

Digital dissonance

2

US broadcasting and telecommunications
As % of total gross value-added

North America monthly mobile data traffic
Petabytes



Sources: US Bureau of Economic Analysis; Cisco

Economist.com

The Rise of Data Capital

DATA CREATES VALUE

$78 trillion
Global gross domestic product 2014[1]

$4 trillion
Global information, communications, technology (ICT) spending 2014[2]

Some portion of the $74 trillion-dollar gap between these two numbers is attributable to the

4.4 zettabytes
of data in the digital universe. But how much?

$6 trillion
The accumulating global value of digital-capital investments, about 8.5% of nominal world GDP[4]

84% of the market value
of companies in the S&P 500 come from intangible assets[3]

j. mao

DATA CAPITAL *DEFINED*

Data capital is the recorded information necessary to produce a good or service. It encompasses any and all captured data, including:

Audio

Customer support calls, voice interactions from devices and automated systems

Video

Satellite imagery, X-rays, security footage

Sensor

Temperature, humidity, vibration, acceleration

Mobile

App interactions, device configuration, GPS

Social

Posts, shares, network links

Enterprise

Transactions, customer records, support history

Limitations of GDP Accounting

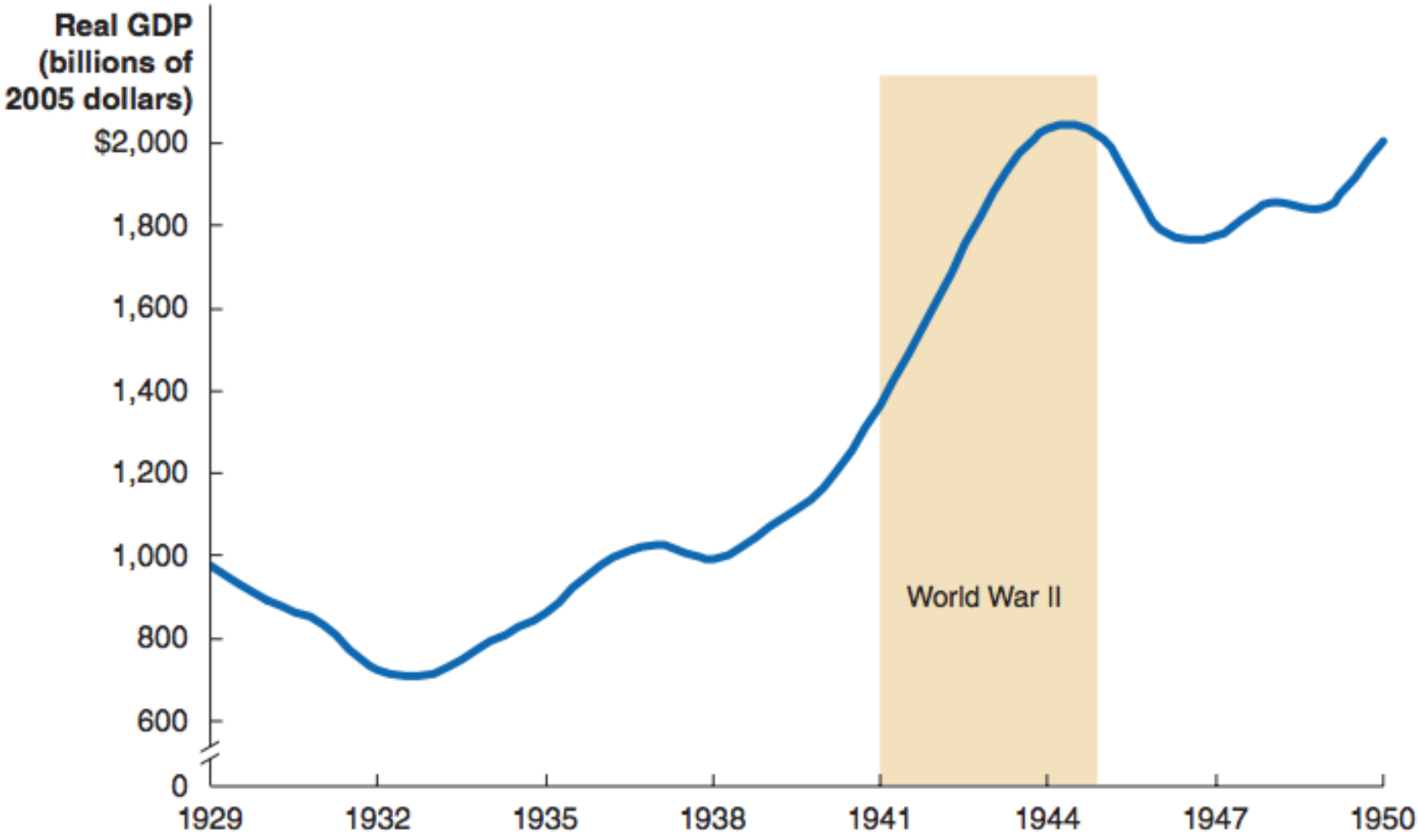
Shortcomings of GDP as a Measure of Well-Being

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

U.S. vs. France

- GDP per capita: French GDP/capita is 67% of U.S.'s (2005)
- Consumption per person: France is 60% of U.S.'s (2005)
- Life expectancy: France – 80; U.S. – 77
- Leisure: France – 535 annual working hours per person; U.S. – 877 hours
- Inequality: France – 0.294; U.S. – 0.394 (2014 Gini coefficient)


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

	2000		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

	2000		2010	
	P	Q	P	Q
Haircut	\$10	100	\$15	500
TV	\$1000	1	\$1200	2

Measuring Change in Price

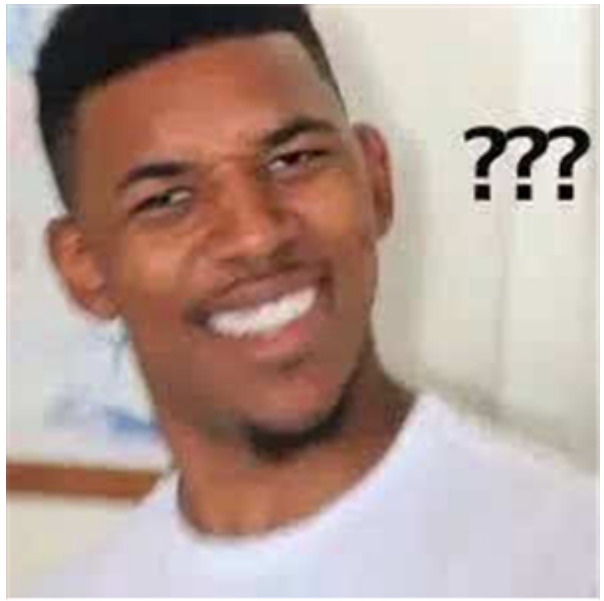
An Economy with Many Goods

	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

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 the **base period**[10].

[10] Here we make the index = 1 at the base period. If we would like to make the index = 100 at the base period, then

$$\mathcal{P}_{t_0,t} = \frac{\overline{p}_t}{\overline{p}_{t_0}} \times 100$$

Price Index

Price Indices

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

- Laspeyres price index

$$\mathcal{P}_{1,t}^{L} = \frac{p_t^A q_1^A + p_t^B q_1^B}{p_1^A q_1^A + p_1^B q_1^B}$$

  - Use base period quantities as weight.

- Paasche price index

$$\mathcal{P}_{1,t}^{P} = \frac{p_t^A q_t^A + p_t^B q_t^B}{p_1^A q_t^A + p_1^B q_t^B}$$

  - Use current period 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[11] and thus tends to *overstate* increases[12] in the cost of living.
- Paasche price index takes into account substitution behavior but not utility change as a result of substitution[13] and thus tends to *understate* increases[14] 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.

[11] i.e. Laspeyres price index *does not correct for* substitution bias.
[12] and understate decreases
[13] i.e. Paasche price index *over-corrects* substitution bias.
[14] 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

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

- Chained Fisher price index

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

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[15] 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.

[15] 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

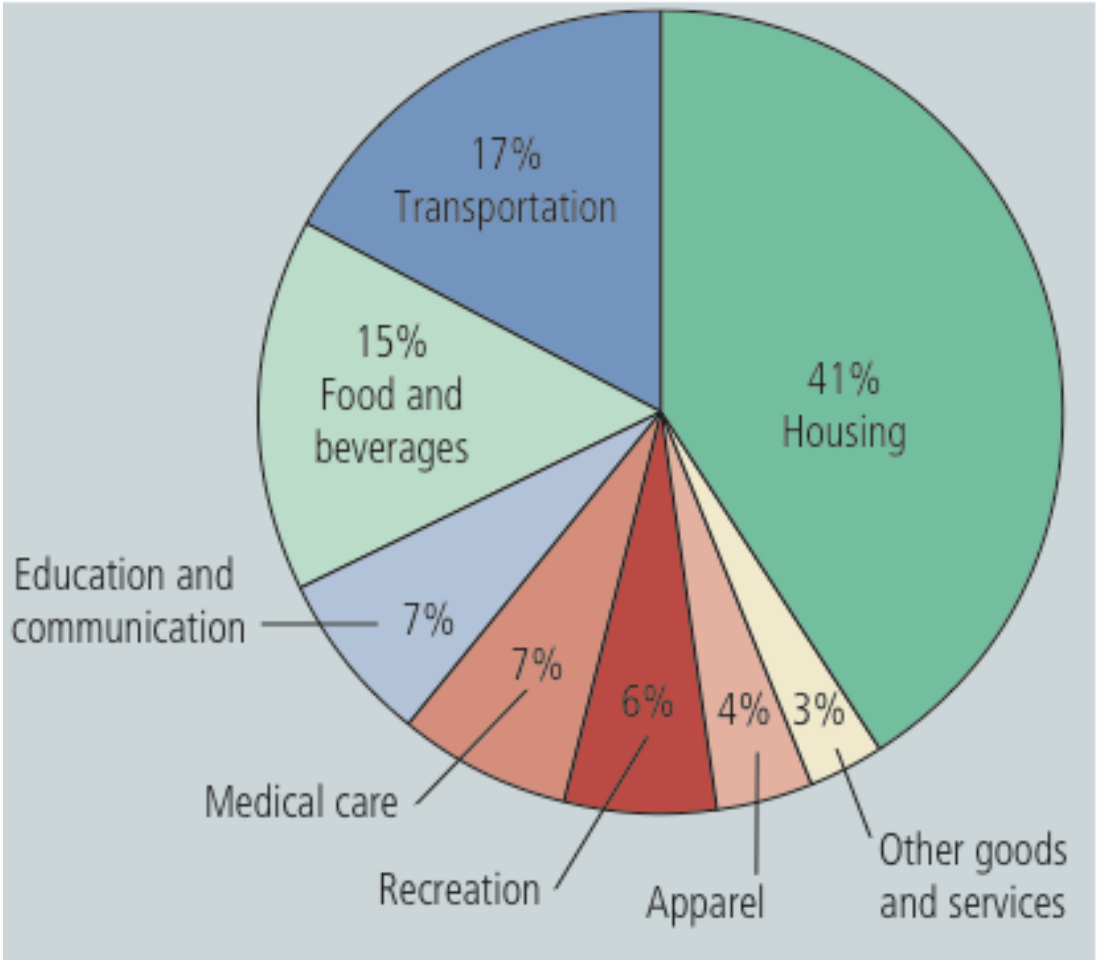
- The **consumer price index** (**CPI**) is a measure of the overall cost of the goods and services bought by a typical consumer.
  - The CPI is intended to monitor changes in the cost of living over time.
- How the CPI is produced:
  1. Fix the basket
     - ⋆ In the U.S., CPI is produced by the Bureau 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

- The main CPI produced by the BLS is a Laspeyres-type price index that measures how much it costs to buy a fixed basket of goods and services over time.
  - The Consumer Price Index for All Urban Consumers (CPI-U)
- The BLS also publishes a chained CPI:
  - The Chained Consumer Price Index for All Urban Consumers (C-CPI-U)[16]
- Both are on a 100-scale (= 100 in the base period).

[16] 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.

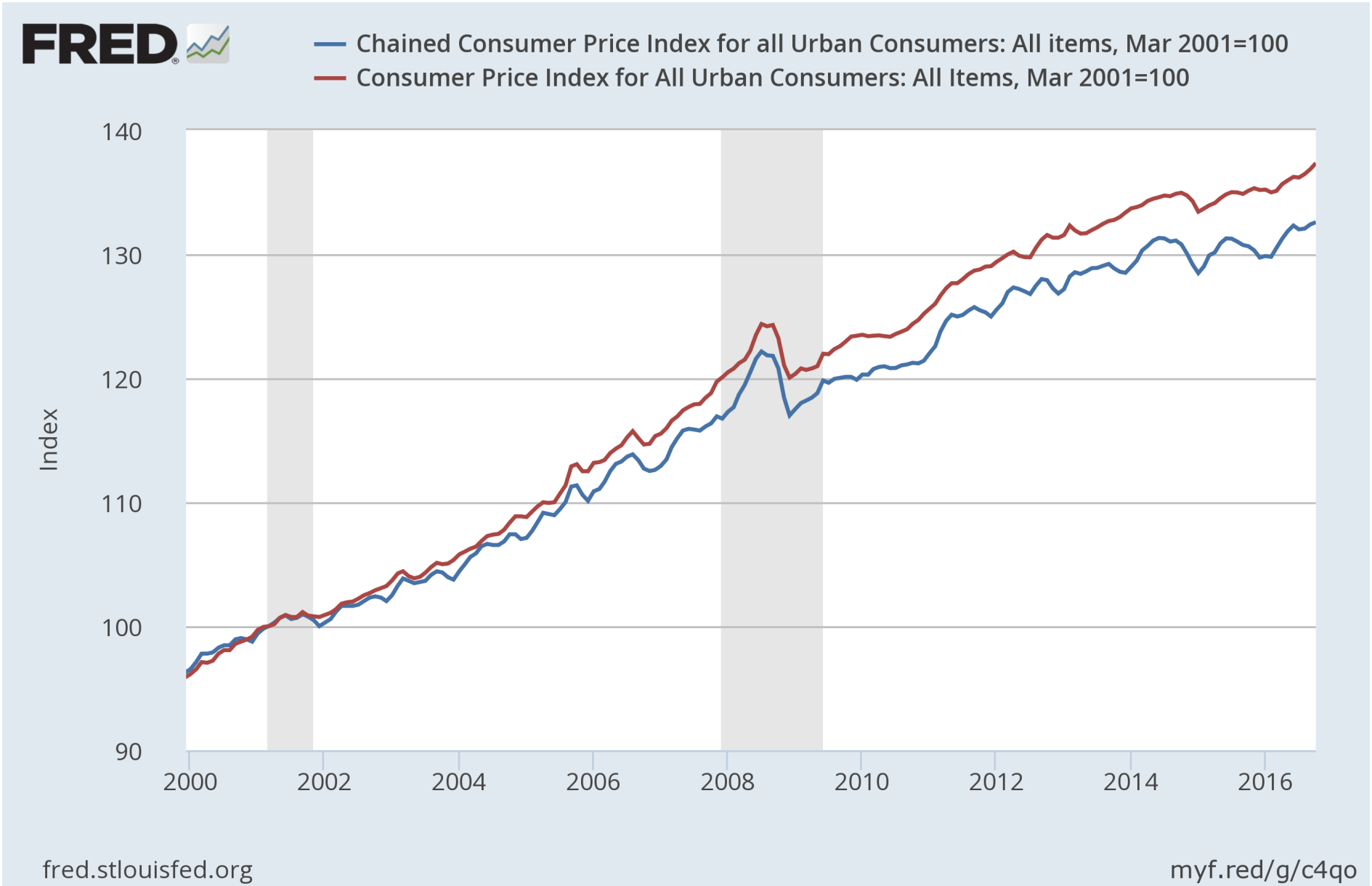
	beef		chicken	
	price	quantity	price	quantity
$t = 1$	\$4	10 lbs	\$4	20 lbs
$t = 2$	\$5	10 lbs	\$5	20 lbs
$t = 3$	\$9	5 lbs	\$6	25 lbs

- CPI: 100, 125, 175
- Chained CPI[a]: 100, 125, 168.63

[a] Using chained Fisher formula:

- $\mathcal{P}^L_{1,2} = 1.25, \mathcal{P}^L_{2,3} = 1.40, \mathcal{P}^P_{1,2} = 1.25, \mathcal{P}^P_{2,3} = 1.30$
- $\mathcal{P}^F_{1,2} = 1.25, \mathcal{P}^F_{2,3} = 1.3491, \mathcal{P}^C_{1,2} = 1.25, \mathcal{P}^C_{1,3} = 1.6863$

CPI



j. mao

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

2012: $11 x 500 + $2.50 x 1100 = $8,250 — 37.5%

2013: $12 x 600 + $3 x 1200 = $10,800 — 30.9%

	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

2012: $10 x 500 + $2 x 1100 = $7,200 — 20.0%

2013: $10 x 600 + $2 x 1200 = $8,400 — 16.7%

j. mao

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	14.6%
2012	$8250	$7200	114.6	12.2%
2013	$10,800	$8400	128.6	

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 = $46,200

B. Compute real GDP in 2012.

$30 x 1000 + $100 x 200 = $50,000

	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 = $58,300

Real GDP = $30 x 1050 + $100 x 205 = $52,000

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

= 100 x ($58,300)/($52,000) = 112.1

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.

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 base period 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 current period 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

- Since 1996, the BEA has been calculating **chain-weighted real GDP**.
- Fixed-weight real GDP = Nominal GDP of base year $\times$ Laspeyres quantity index
  - i.e., $RGDP_t^{fixed} = GDP_{t_0} \times \mathcal{Q}^L_{t_0,t}$
- Chain-weighted real GDP = Nominal GDP of base year $\times$ Chained Fisher quantity index
  - i.e., $RGDP_t^{chain} = GDP_{t_0} \times \mathcal{Q}^C_{t_0,t}$

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

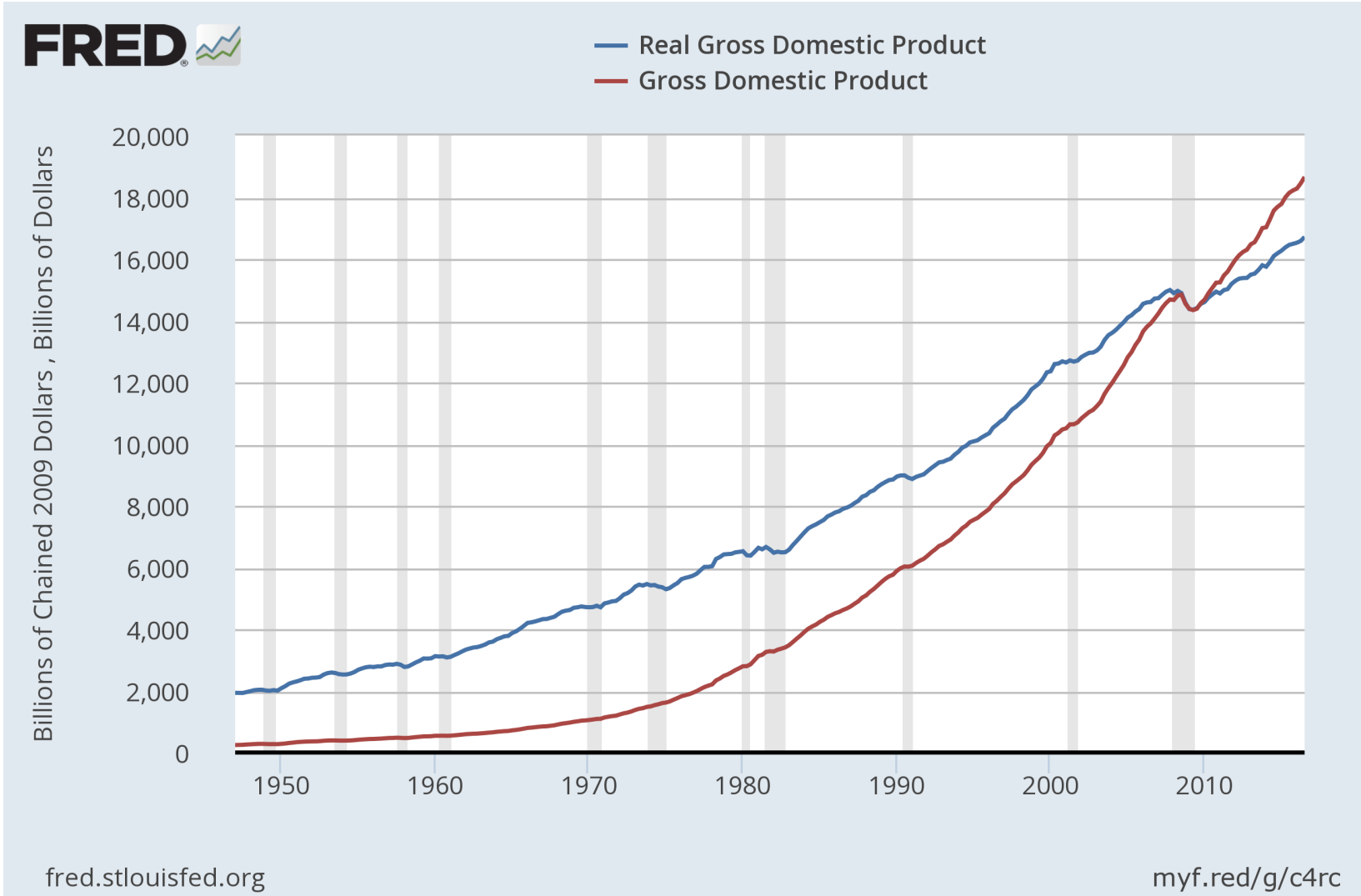
- Nominal GDP – yr 1: \$30,000, yr 2: \$50,700
- Real GDP (fixed-weight, yr 1 base) – yr 1: \$30,000, yr 2: \$37,000
- Real GDP (fixed-weight, yr 2 base) – yr 1: \$41,000, yr 2: \$50,700
- GDP deflator (fixed-weight, yr 1 base) – yr 1: 100, yr 2: 137.03
- GDP deflator (fixed-weight, yr 2 base) – yr 1: 73.17, yr 2: 100

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

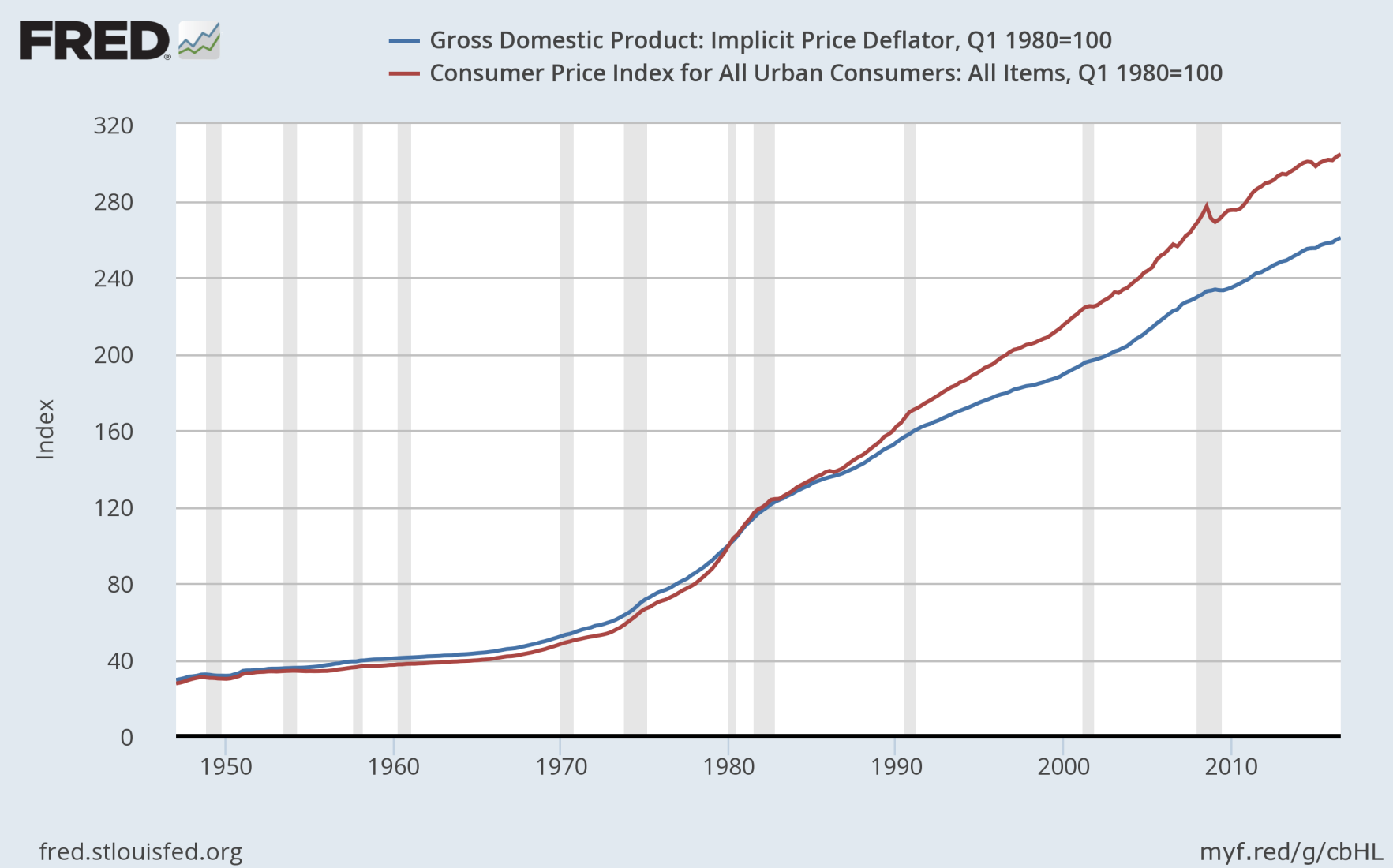
- $\mathcal{Q}^L_{1,2} = 1.2333$, $\mathcal{Q}^P_{1,2} = 1.2367$, $\mathcal{Q}^C_{1,2} = \mathcal{Q}^F_{1,2} = 1.23496$
- Real GDP (chain-weight, yr 1 base) – yr 1: \$30,000, yr 2: \$37,048.80
- Real GDP (chain-weight, yr 2 base) – yr 1: \$41,053.96, yr 2: \$50,700
- GDP deflator (chain-weight, yr 1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

BEA GDP Release

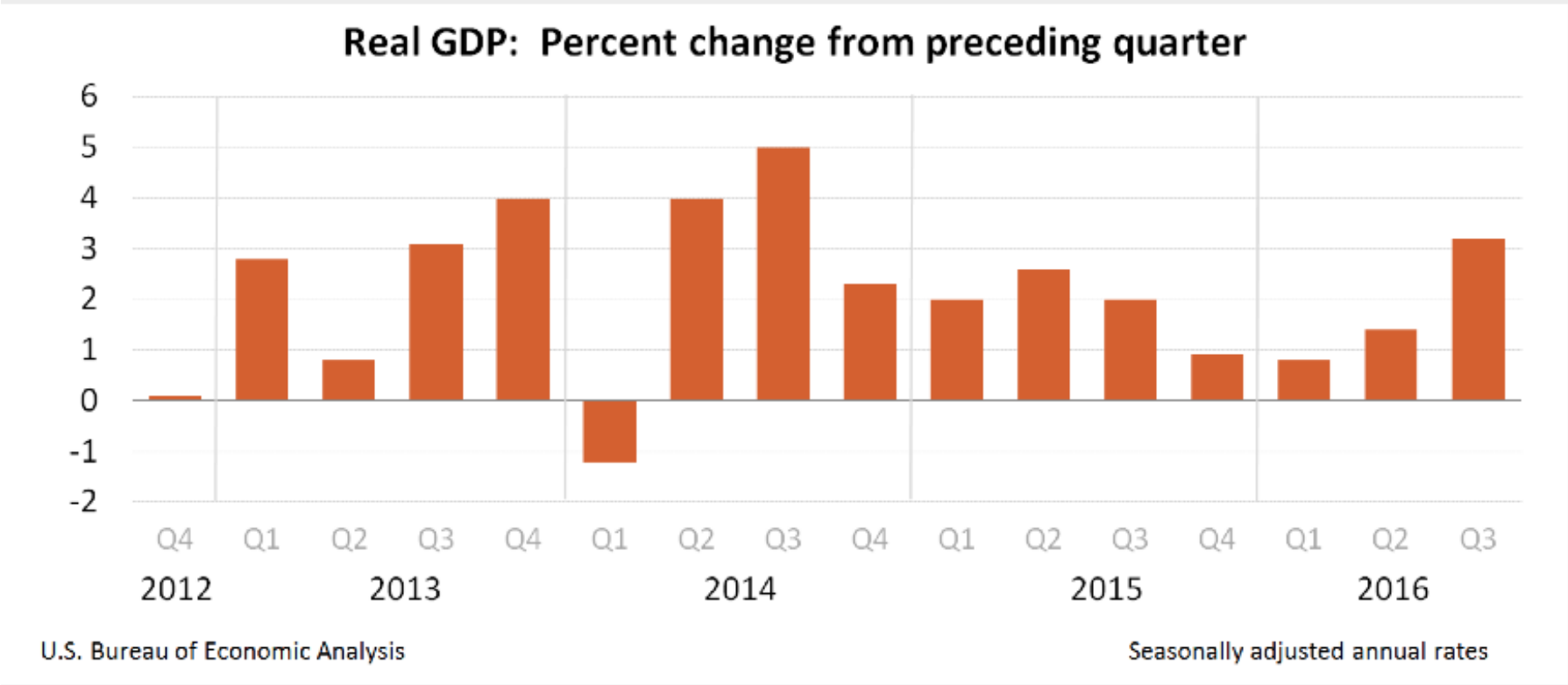
Schedule

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)

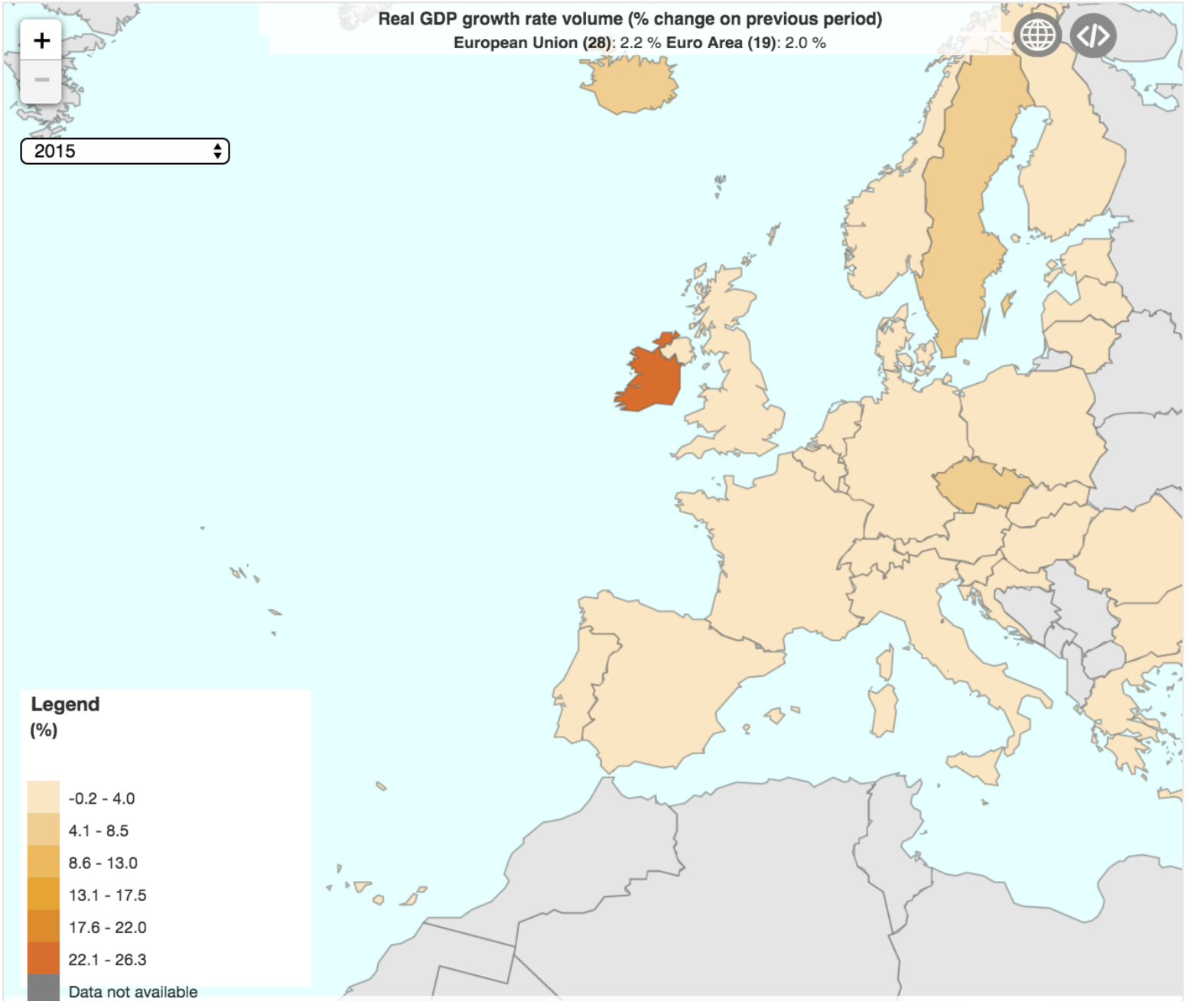
BEA GDP Release

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.

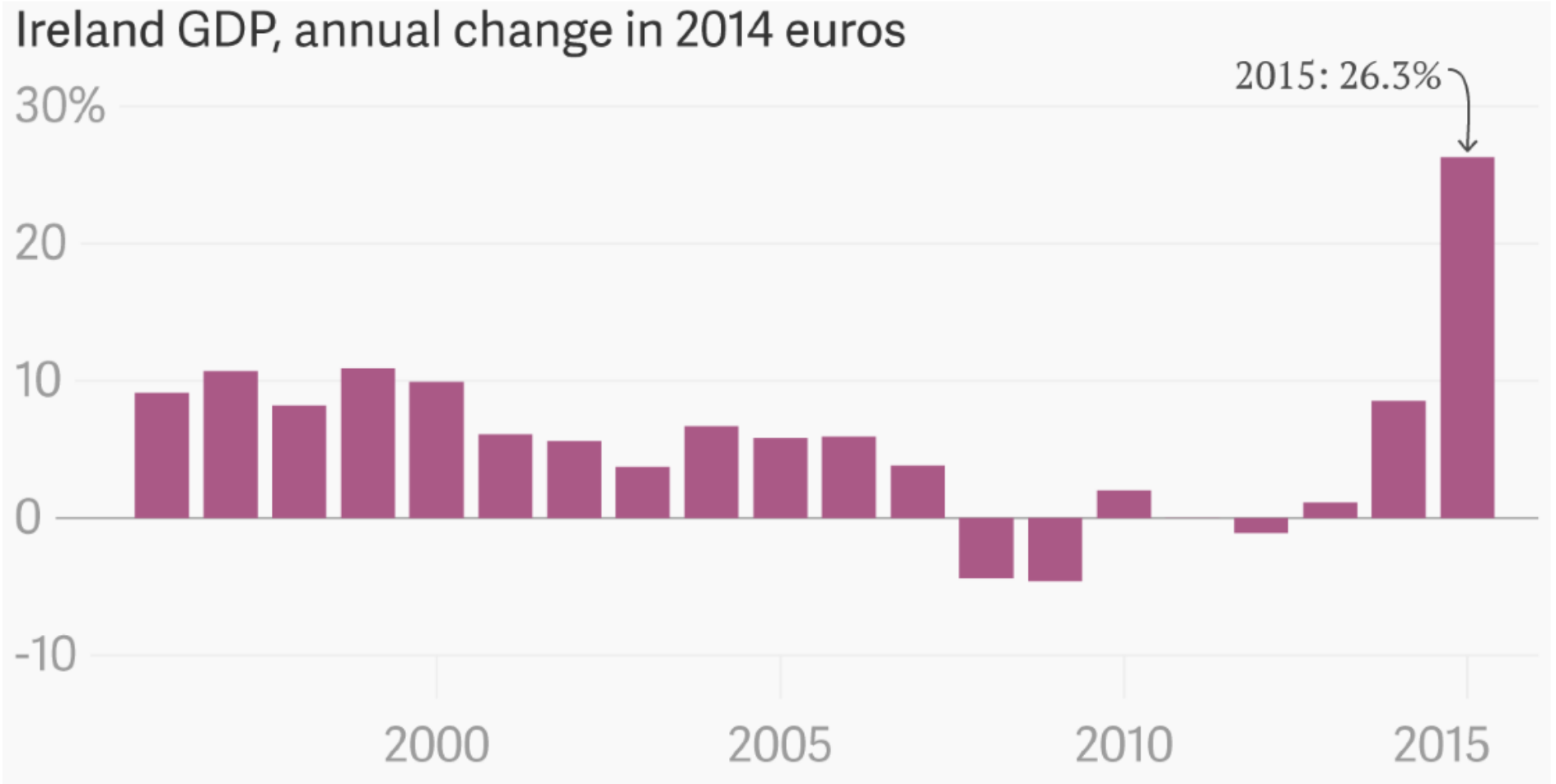
The GDP estimate released today is based on more complete source data than were available for the "advance" estimate issued last month. In the advance estimate, the increase in real GDP was 2.9 percent. With the second estimate for the third quarter, the general picture of economic growth remains the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



(/new


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

Ireland and its 26 Percent Growth



Ireland and its 26 Percent Growth

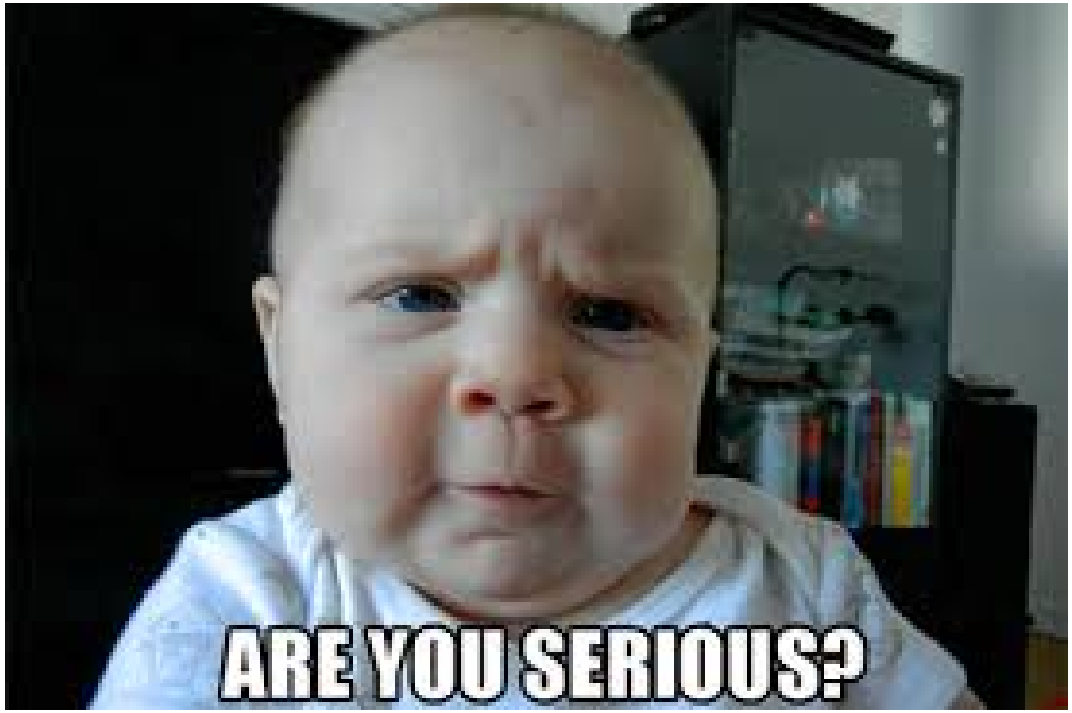
National Income (Constant market prices, chain linked annually and referenced to 2014) €m

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



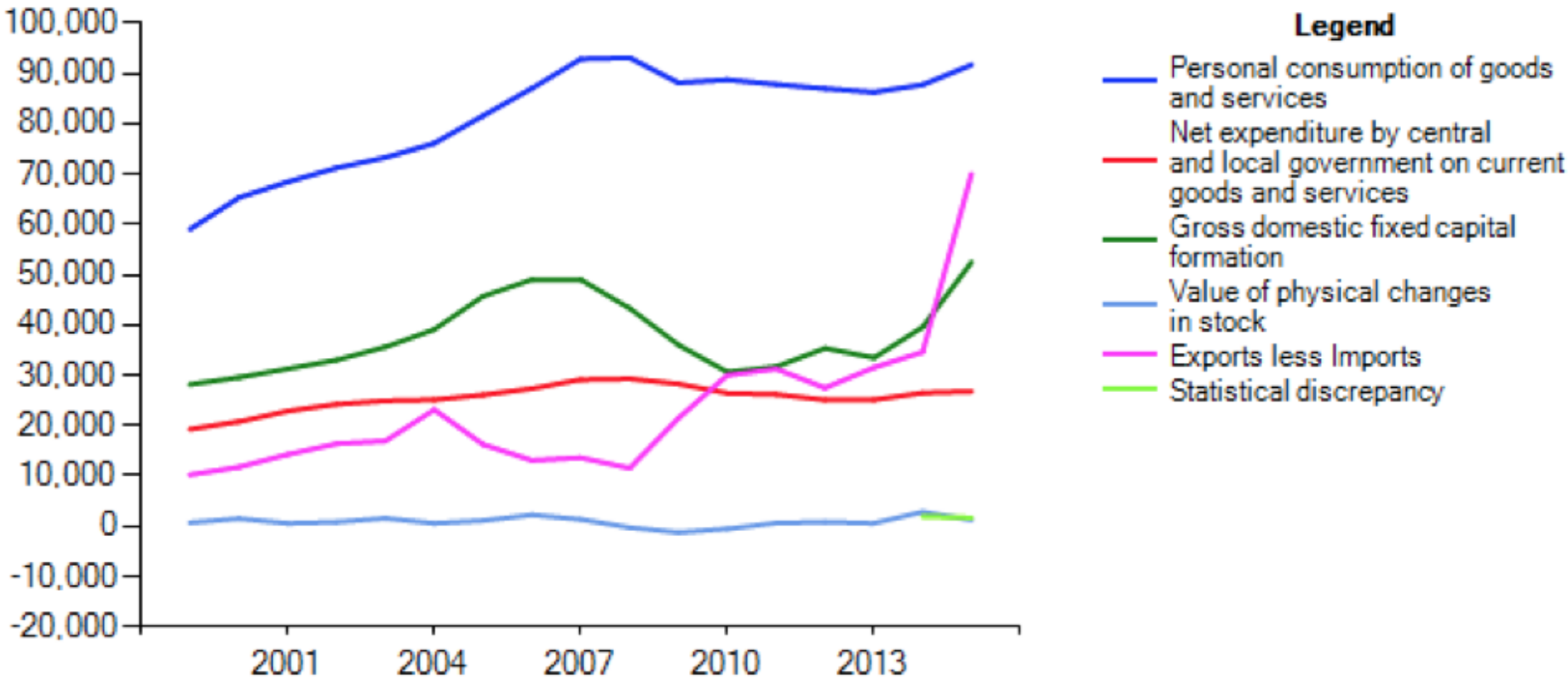
Ireland and its 26 Percent Growth

- 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)

Ireland and its 26 Percent Growth



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.

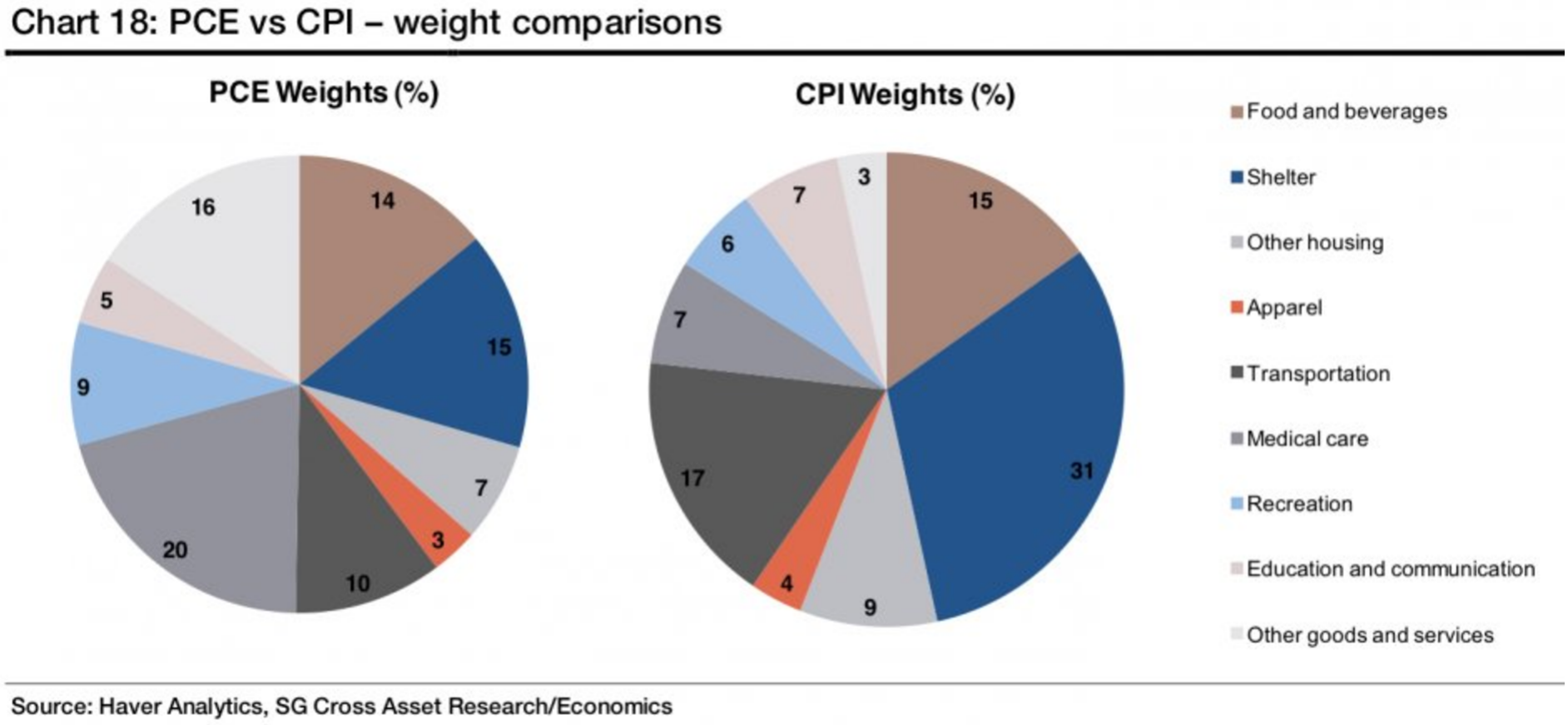
PCEPI

- 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.

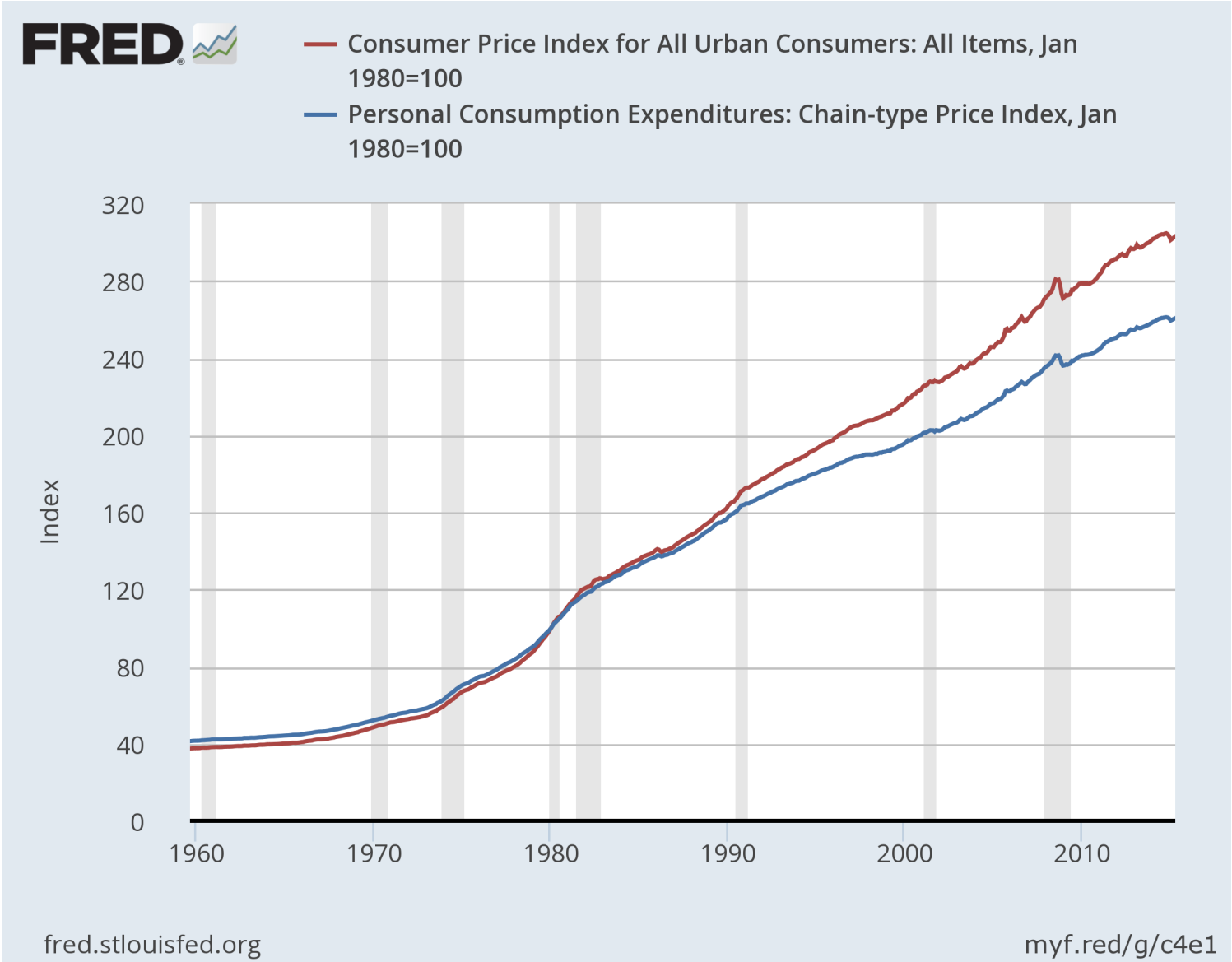
PCEPI vs. CPI

- 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



PCEPI vs. CPI



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[17].
  - U.S. PPI is produced by the BLS and is a Laspeyres index[18].

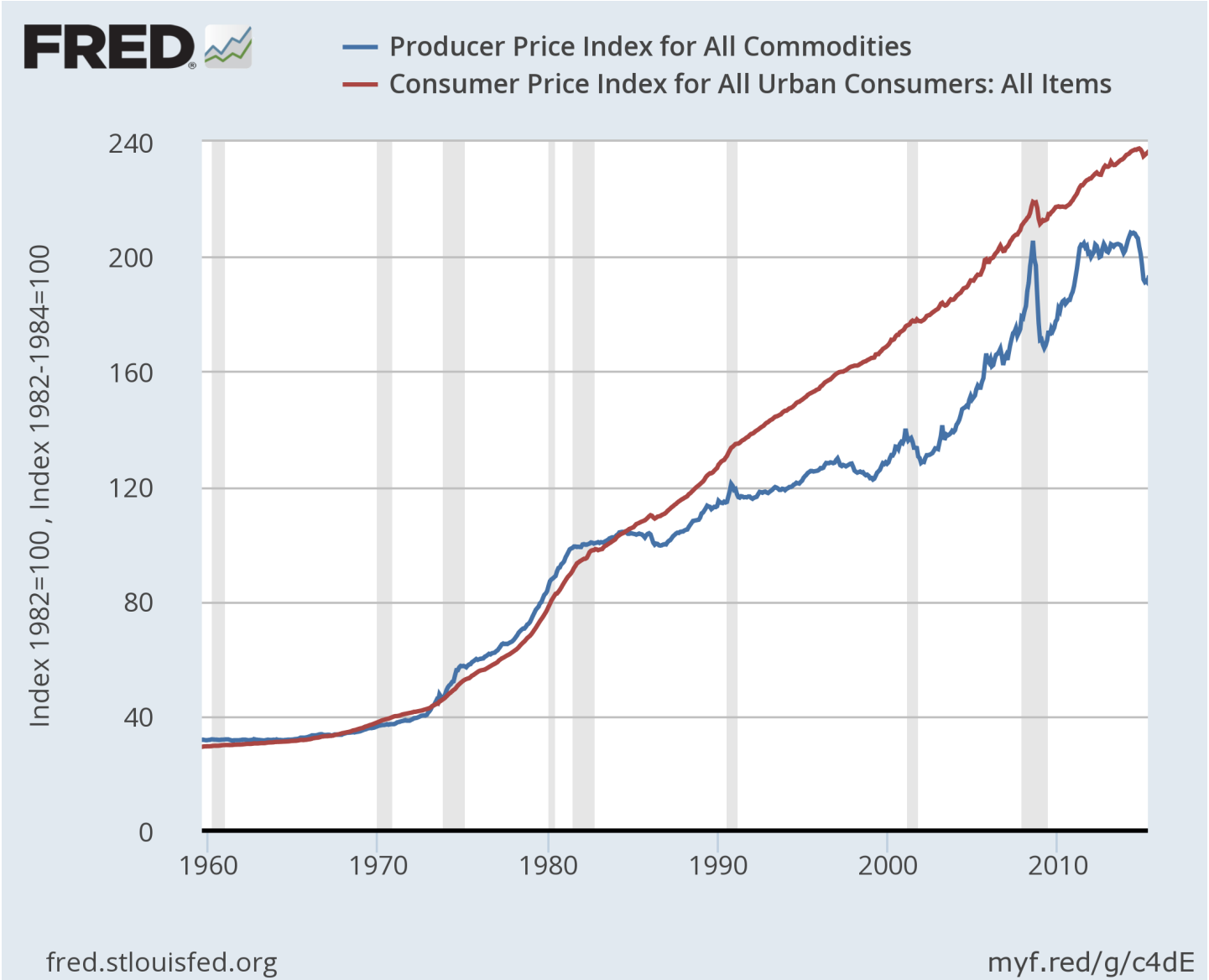
[17] Capital goods are final goods used as investment.

[18] 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



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

$$\pi_t = \left(\frac{\mathcal{P}_t}{\mathcal{P}_{t-1}} - 1 \right) \times 100\%$$

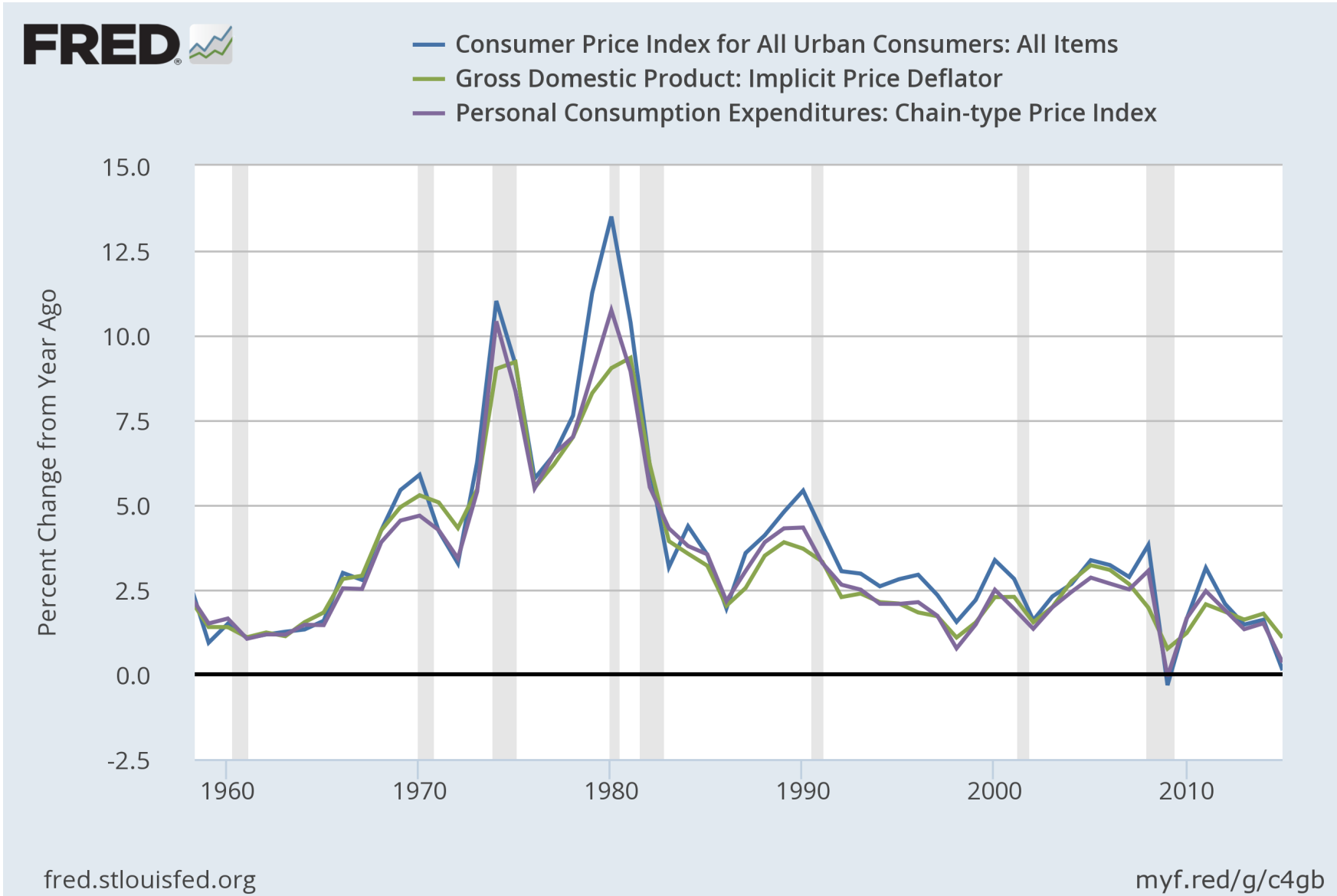
, where $\mathcal{P}_t$ is a price index.

  - $\pi > 0$: inflation
  - $\pi < 0$: deflation

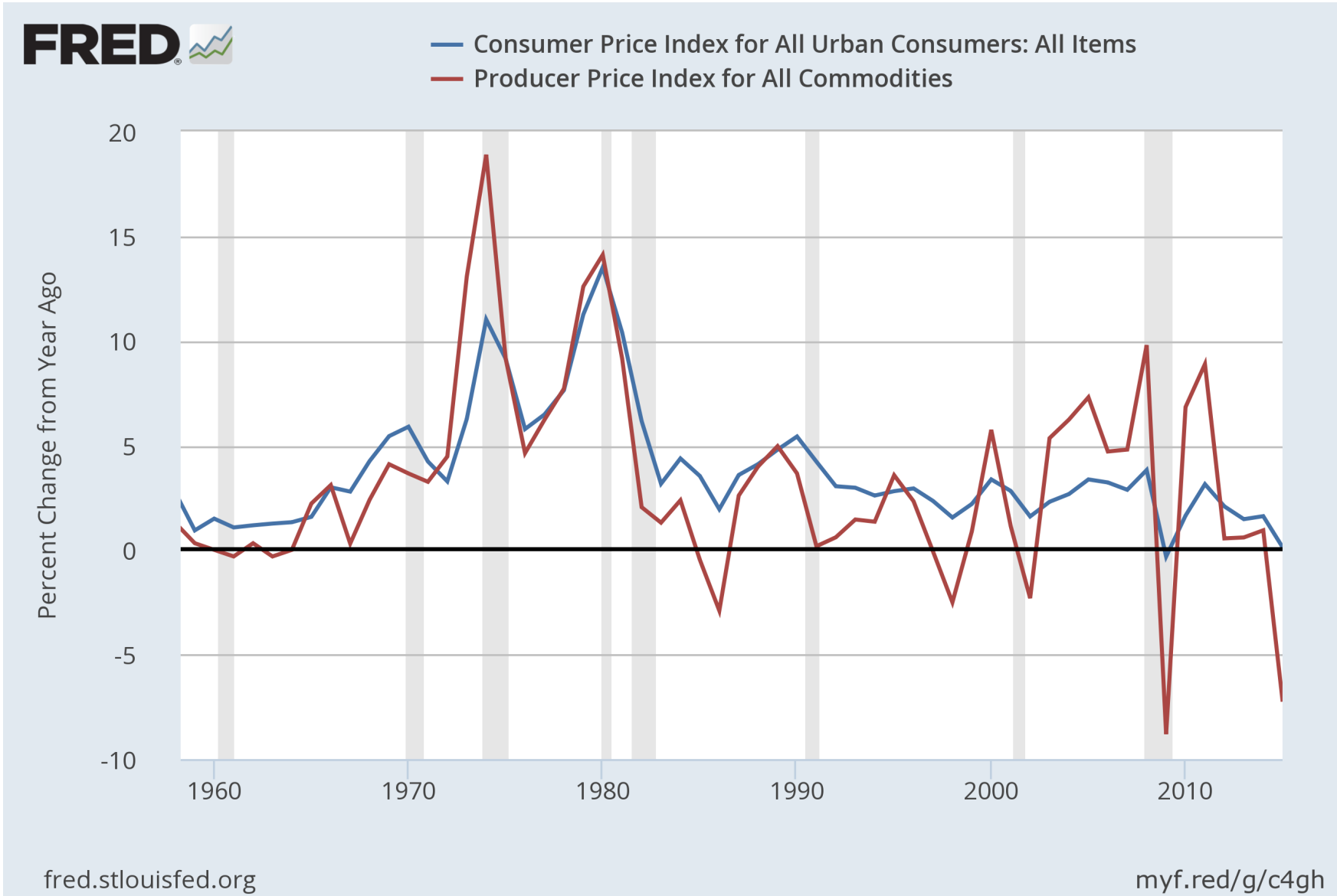
Inflation

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

Inflation



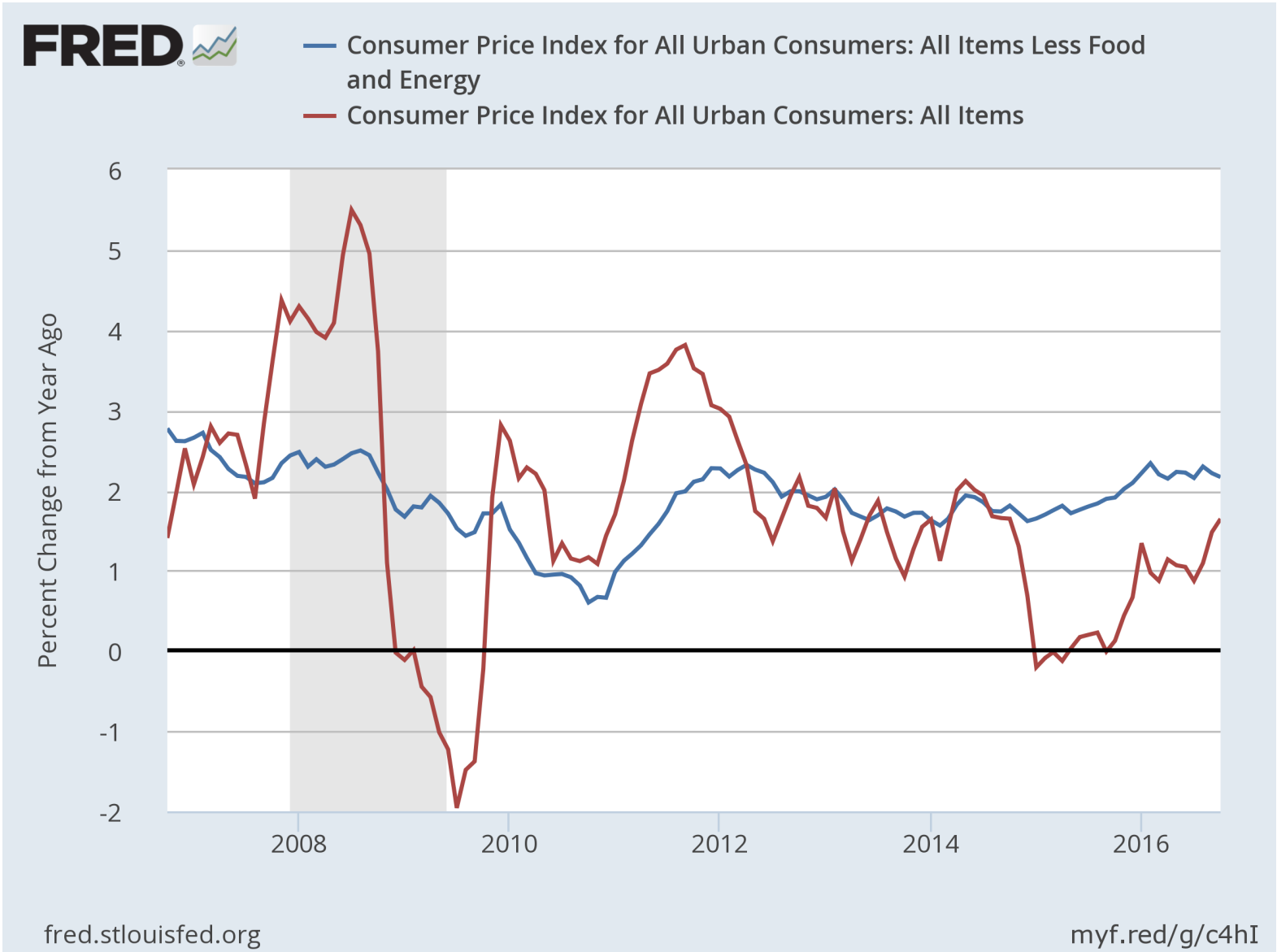
Inflation



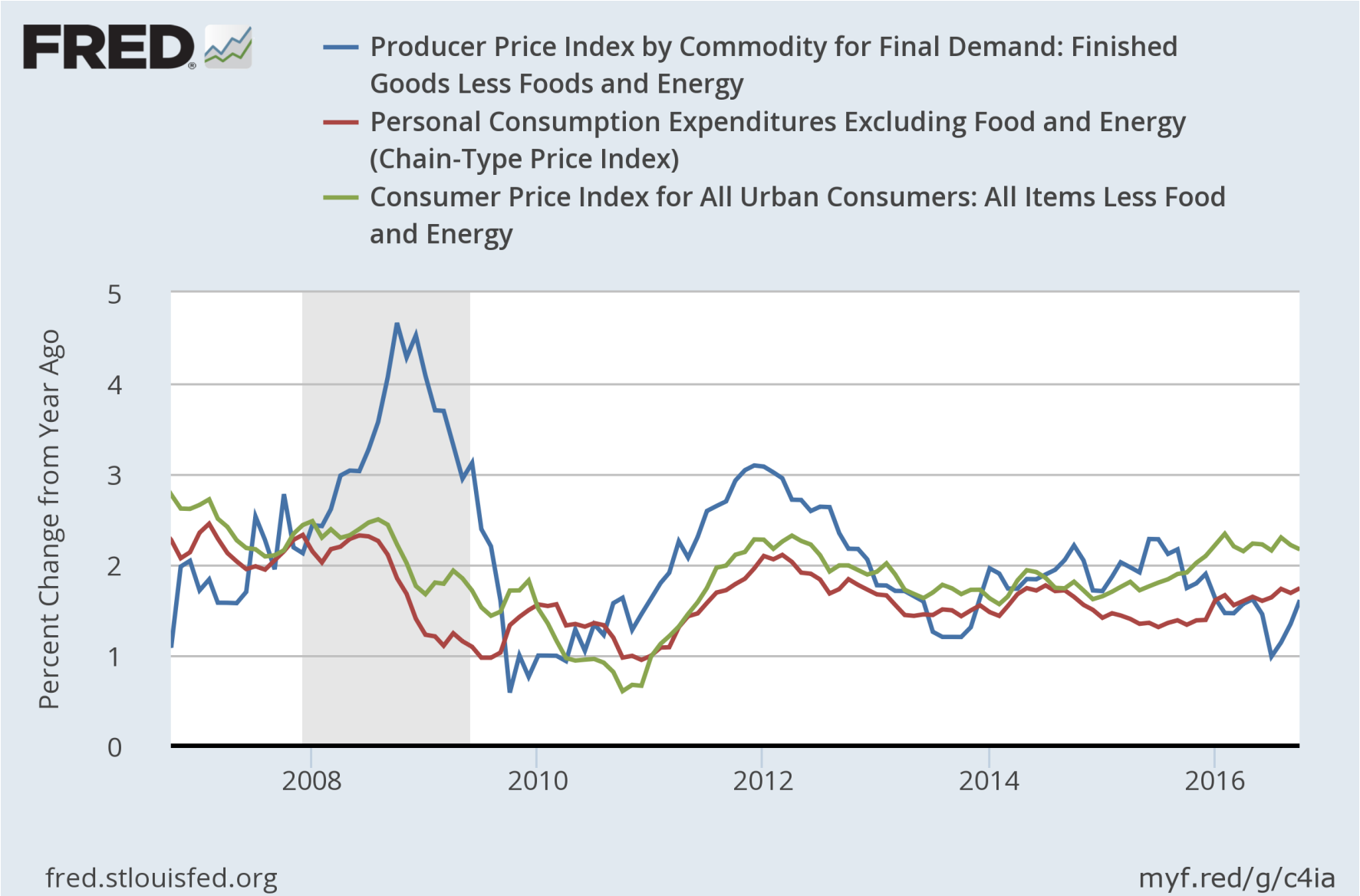
Core Inflation

- 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"…

j. mao

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.

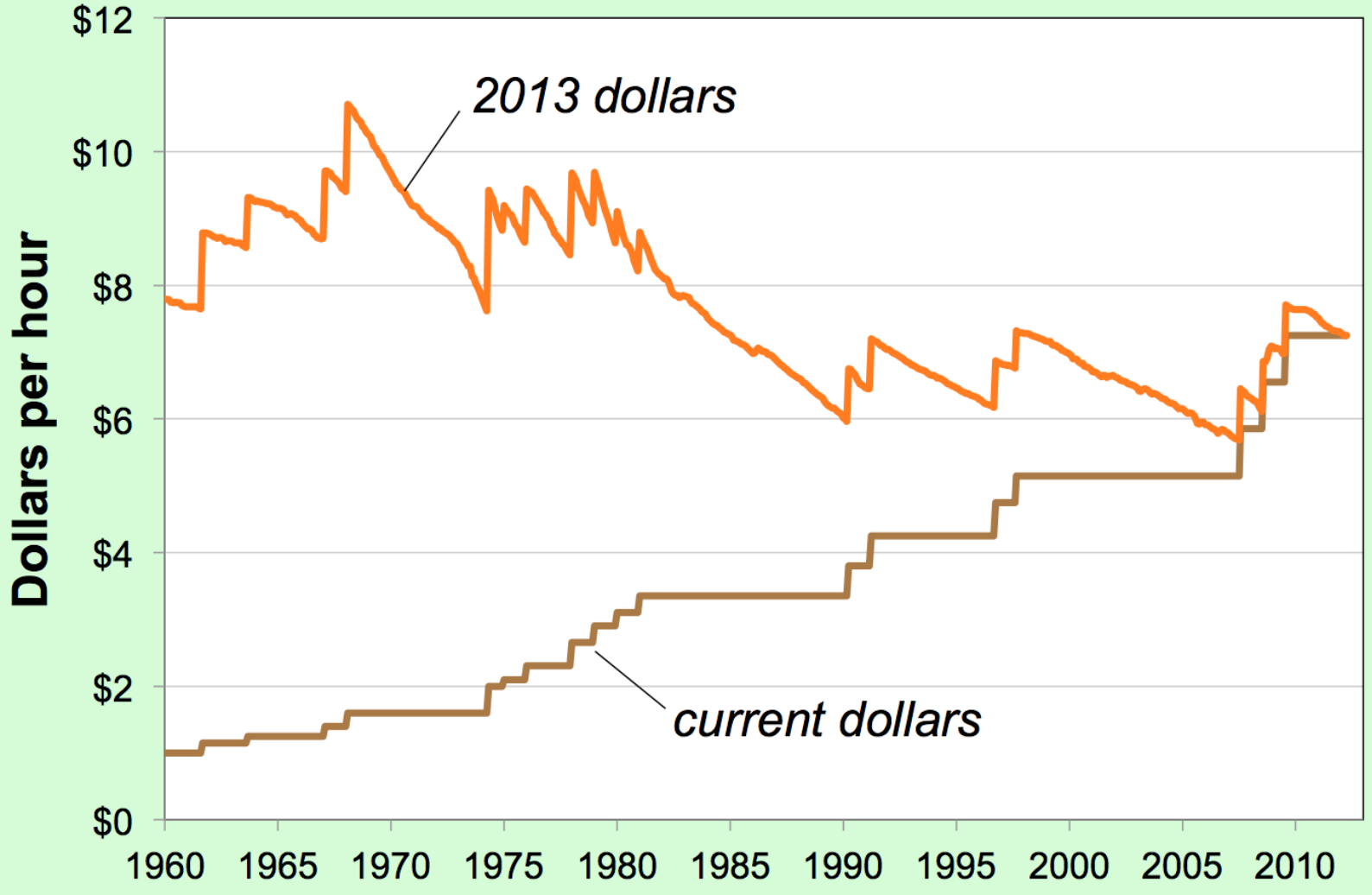
$$\$9.49 = \$1.25 \times \frac{234.6}{30.9}$$

j. mao

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



j. mao

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?

j. mao

	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.

j. mao

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^

j. mao

Acknowledgement

Part of this lecture is adapted from the following sources:

- Hubbard,R. G. and A. P. O'Brien. (2016). *Economics* (6th ed.). Pearson.
- Krugman, P. and R. Wells. (2015). *Economics* (4th ed.). Worth Publishers.
- Mankiw, N. G. (2017). *Principles of Economics* (8th ed.). Cengage Learning.
- Mandel, M. (2018). *Economics: The Basics* (3rd ed.). McGraw-Hill Education.
- Zivot, E. (2000). *Intermediate Macroeconomics*. Lecture at the University of Washington, retrieved on 2016.01.01. [link]

Reference

Karabarbounis, L. and B. Neiman. 2014. "The Global Decline of the Labor Share," *Quarterly Journal of Economics*, 129(1).