

# MACROECONOMICS

## 73-240

### LECTURE 2

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This version: August 28, 2019

# Last Class

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- We talked about what are the ingredients we would like to include in a model of the macro-economy
- We also looked at the Fed's FOMC statement to understand what measures it looks at to gauge the health of the economy.
- Today we want to study some of those measures and figure out how to compute them.

# Plan for this Lecture

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## Study GDP

- 1) Imputation of GDP
- 2) Three ways of computing GDP
- 3) What is missing from GDP?

# Underlying Question

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WHAT'S THE BEST WAY TO GAUGE THE HEALTH OF  
THE ECONOMY?

## Some History

A common measure used by economists: GDP

- Until the Great Depression: no standardized way to measure the strength of the entire economy just as GDP does now
- Prior to Great Depression, economists used industrial production data, stock numbers, and freight hauling data to assess health of economy
- Severe undercounting of economic activity
- Great Depression occurs: prompted urgent need for better data and a way to assess the ups and downs of the economy.

# History of GDP

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- Developed by **Simon Kuznets** and his team in 1934  
(once released, data was already 2 years old!)
- First estimate using IRS data and 1929 Census  
(he measured the **national income**)
- In 1940 government interested in measuring **national production**  
(estimated with: final sales, consumption spending, shipments...)
- In 1960s first **value added** estimates  
(estimated with the aid of input-output tables)

# Gross Domestic Product

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**Gross domestic product (GDP):** is the market value of all final goods and services produced in a country (or region) in a given period of time (for example one year)

- **Gross:** GDP includes production for replacing depreciated capital. It is **not** net of depreciation
- **Domestic:** GDP counts only production by factors located in the country
- **Product:** GDP is concerned with output!

# Some Notes about GDP

- GDP is measured in terms of **market value**
  - We value final goods and services using prices set by the market
  - This gives us a common unit of measurement (\$)
- GDP is measured in terms of **current production**
  - GDP is not a measure of sales
  - So if a car produced this period and gets sold twice at the same price (once in a secondary market), we count only the production value



# Who computes GDP today?

- The Bureau of economic analysis (**BEA**) periodically publishes the National Income and Product Accounts (**NIPA**). They contain:
  - 1) GDP and its components (more on these later)
  - 2) GDP by state, metropolitan area
  - 3) GDP by industry (I-O tables)
  - 4) International accounts (balance of payments)
- You can get all the data here: <http://www.bea.gov>
- BEA uses data from: Census, Bureau of labor statistics (surveys), Tax returns, Industry estimates...

### 3 Definitions of GDP

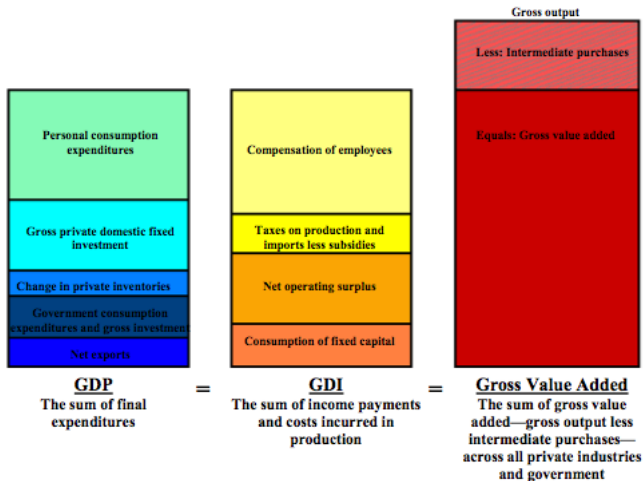
BEA uses 3 alternative definitions:

- **Product Approach (value added)**: Market value of final goods and services newly produced within a nation during a year.
- **Expenditure Approach**: Total spending on newly produced final goods and services produced within a nation during a year.
- **Income Approach (national income)**: Total Income generated by newly produced final production, profits and taxes paid by firms and depreciation within a nation during a year .

We will use the symbol  $Y$  to denote either total expenditure, income or value added!

### 3 Definitions of GDP (2005 data)

Chart 2.1—Three Ways to Measure GDP



How much **produced** → how much **income** earned → how much can be spent

### 3 Definitions of GDP and 3 Macroeconomic Questions

- **Product Approach (value added):** In the U.S. how much has manufacturing industry declined and service industry risen?
- **Expenditure Approach:** How much more are Americans spending on health care now than they did in 1950?
- **Income Approach (national income):** Have workers become poor at the expense of owners of firms/capital in the U.S. over the last 40 years?

# A KEY QUANTITY: GDP

Measurement with Product Approach

# GDP by Product Approach

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- Product Approach: we want to add up the value produced by every firm/production unit in the economy
- But how do we gauge a firm's contribution to output?
- Supply chain can involve many firms
- Look at value added by the firm

# GDP by Product Approach

A firm's **value added** is the value of its output minus the value of the intermediate goods the firm used to produce that output.

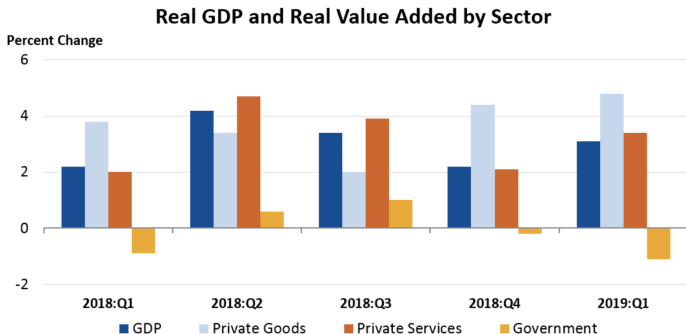
$$\begin{aligned}\text{GDP} &= \text{value of final goods produced} \\ &= \text{sum of value added at all stages of production}\end{aligned}$$

Why do we sum only value added?

Value added of government is equal to the wage of government employees. **Why?**

# GDP by Product Approach

- Using the product approach, we can identify which industries contributed to GDP growth



U.S. Bureau of Economic Analysis

Seasonally adjusted annual rates

Source: BEA



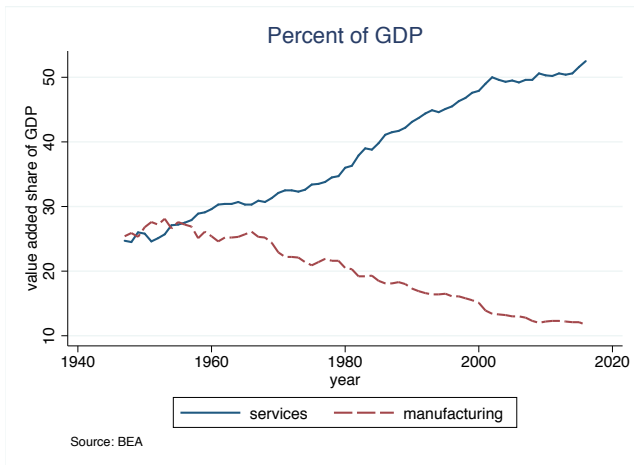
# VA as a % of GDP

We can ask which industries make up the biggest share of GDP

| Line | Name   | Q1 2019 | Q4 2018 | Q1 2018 |
|------|--|---------|---------|---------|
| 1    | ▼ Gross domestic product.....  | 100     | 100     | 100     |
| 2    | ▼ Private industries.....  | 87.9    | 87.9    | 87.6    |
| 3    | Agriculture, forestry, fishing, and hunting.....                         | 0.8     | 0.8     | 0.8     |
| 4    | Mining.....  | 1.4     | 1.6     | 1.5     |
| 5    | Utilities.....   | 1.6     | 1.6     | 1.6     |
| 6    | Construction.....  | 4.2     | 4.1     | 4.1     |
| 7    | ► Manufacturing.....   | 11.3    | 11.4    | 11.3    |
| 10   | Wholesale trade.....   | 6.1     | 6.1     | 6.0     |
| 11   | Retail trade.....  | 5.6     | 5.5     | 5.6     |
| 12   | Transportation and warehousing.....                                      | 3.2     | 3.2     | 3.2     |
| 13   | Information.....   | 5.6     | 5.5     | 5.4     |
| 14   | ► Finance, insurance, real estate, rental, and leasing.....              | 20.6    | 20.6    | 20.7    |
| 17   | ► Professional and business services.....                                | 12.6    | 12.6    | 12.5    |
| 21   | ► Educational services, health care, and social assistance.....          | 8.8     | 8.7     | 8.7     |
| 24   | ► Arts, entertainment, recreation, accommodation, and food services..... | 4.1     | 4.1     | 4.1     |
| 27   | Other services, except government.....                                   | 2.1     | 2.1     | 2.1     |
| 28   | ► Government.....  | 12.1    | 12.1    | 12.4    |

Source: BEA

# Industry Shares 1947–2017



- Dramatic rise in services and decline in manufacturing as share of GDP

# Sectoral changes in Employment

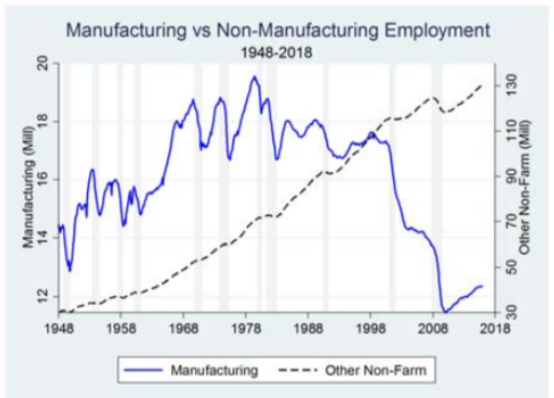
Declining importance of sector may be indicative of shrinking employment in that sector.

| Industry Description          | Sector                | $g^*$ (2016-2026) |
|-------------------------------|-----------------------|-------------------|
| <u>Fastest Growing</u>        |                       |                   |
| Home health care svcs         | Healthcare            | 4.4               |
| Mgmt & tech. consulting svcs  | Prof. & Bus. Services | 2.1               |
| Software publishers           | Information           | 1.8               |
| <u>Most Rapidly Declining</u> |                       |                   |
| Tobacco manufacturing         | Manufacturing         | -4.7              |
| Federal electric utilities    | Government            | -3.5              |
| Apparel manufacturing         | Manufacturing         | -3.5              |

Source: BLS, Employment Projections  
 $g^*$  = Compounded Annual Rate of Change

# Changes in Manufacturing Employment

Decline in manufacturing has also been accompanied by decline in manufacturing employment

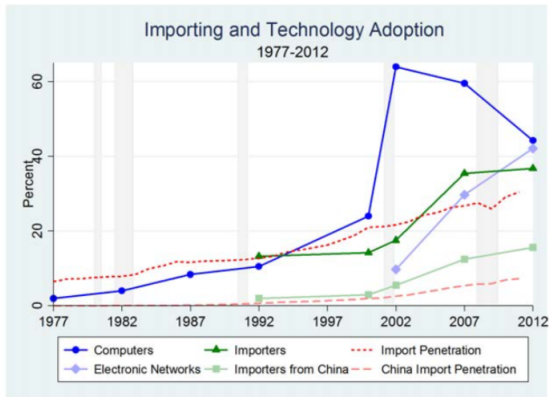


Source: Fort et al (2018)

What has led to the decline in manufacturing employment?

# Changes in Manufacturing Employment

Both adoption of technology and import penetration rose with Chinese import penetration pick up in the 2000s.

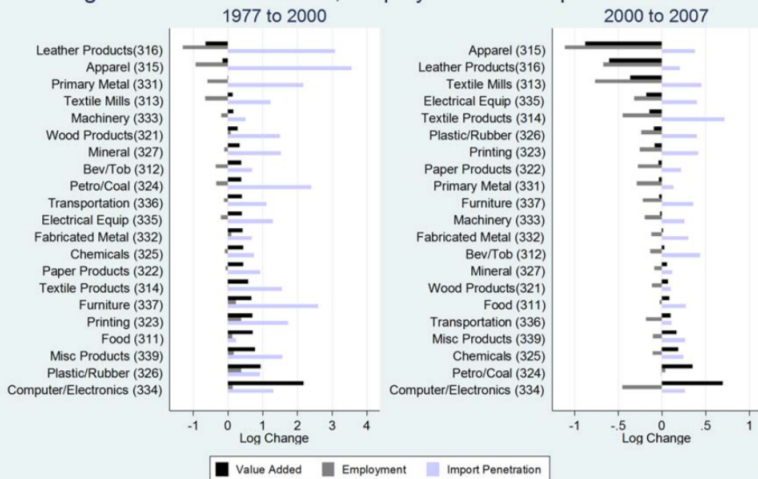


Source: Fort et al (2018)

Notes: Import penetration is calculated as manufacturing imports divided by the sum of domestic manufacturing shipments plus imports less exports. Importers is the percent of US manufacturing firms importing from any country.

# Changes in Manufacturing Employment

## Change in Real Value Added, Employment and Import Penetration



Source: Fort et al (2018)

# Changes in Manufacturing Employment

- Sectors like apparel, textiles: decline in employment coincides with declining VA
- Large exit (shutdown) of labor intensive firms in sectors whose products overlap with that produced by manufacturers in China
- Some sectors: employment declines despite positive VA growth
- Experience of these sectors more suggestive of adoption of labor-saving technological change

## Calculate GDP via Product Approach

- Firm 1 makes computer chips. It sells the computer chips to Firm 2 for \$1000. It hires workers for \$800.
- Firm 2 buys the \$1000 worth of computer chips from Firm 1. It imports rare metals worth \$1000 from country Y. Firm 2 use the computer chips and rare metals to produce phones and sells phones to domestic households for \$3000
- .
- What is the GDP for this economy via the Product Approach?



# A KEY QUANTITY: GDP

Measurement with Expenditure Approach

# GDP by Expenditure Approach

Output that is produced is used by one of the following

- **Consumption expenditures (C):** consumer goods and services
- **Investment (I):** investment spending on new capital goods and change in inventories
- **Government expenditures (G):** government spending on goods and services
- **Net exports (NX):** goods and services exported minus goods and services imported

Therefore, GDP (expenditure approach) is comprised by:

$$GDP = C + I + G + NX$$

# Consumption

- **Definition:** The value of all newly produced goods and services bought by households.
- Includes
  - Durable Goods: last a long time (cars, home appliances)
  - Nondurable Goods: last a short time (food, clothing)
  - Services: work done for consumers (dry cleaning, air travel)
- also includes items like: Health expenditure, education, etc.

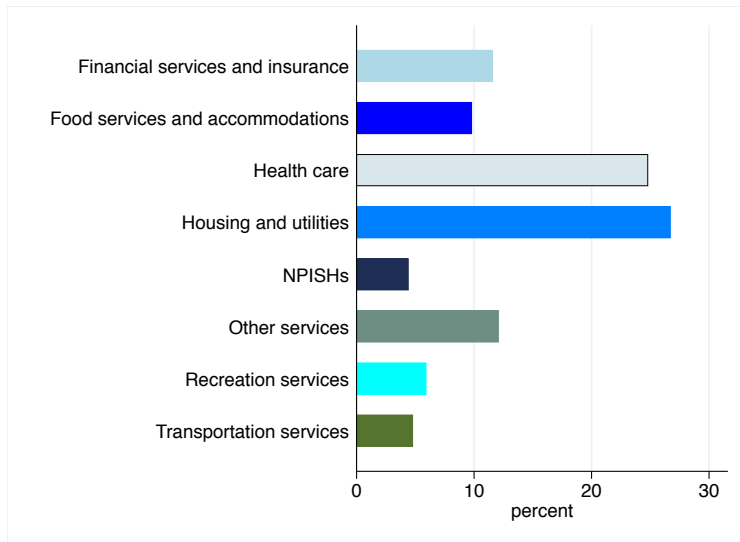
## U.S. consumption, 2018

|             | \$ billions | % of GDP |
|-------------|-------------|----------|
| Consumption | 13,998.7    | 68.0     |
| Durables    | 1475.6      | 7.2      |
| Nondurables | 2889.1      | 14.0     |
| Services    | 9633.9      | 46.8     |

Source: Bureau of Economic Analysis (BEA)  
<https://www.bea.gov/data/consumer-spending/main>

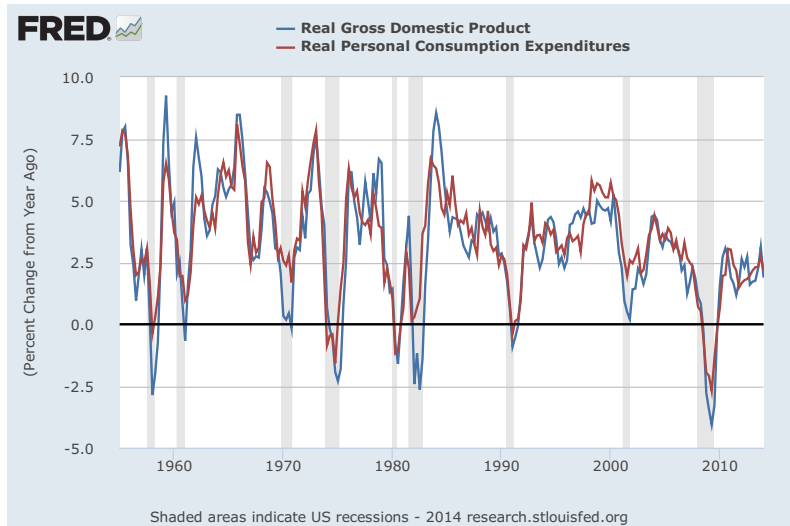
Why is Services the largest component of consumption expenditure?  
What does a big portion of our income get spent on?

# U.S. consumption, 2018

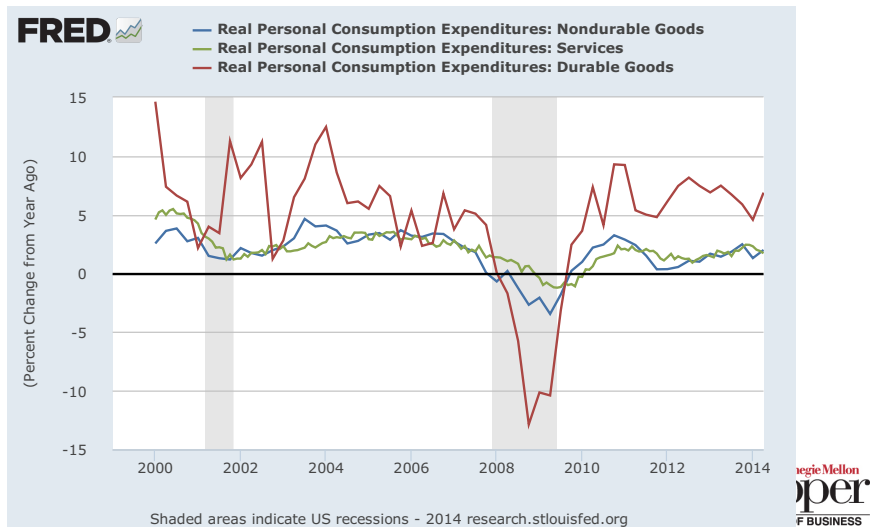


Source: BEA

# U.S. Real Consumption Growth vs. GDP Growth



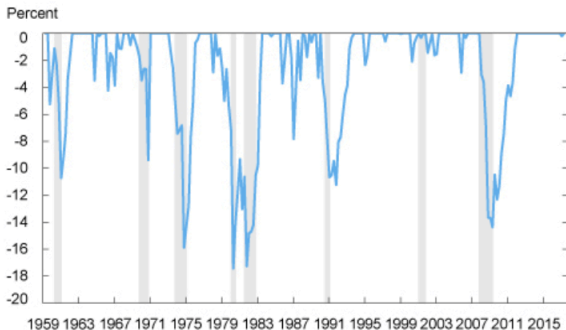
# U.S. Real Consumption Growth: Individual Components



# Was Durable Spending Decline Different during the Great Recession?

- Depth of decline in durables spending not different from other severe recessions
- Length of decline (number of periods) also not substantially different from other recessions

Cumulative Declines in Real Durable Goods Expenditures



Source: U.S. Bureau of Economic Analysis.

Notes: The shaded areas indicate periods designated recessions by the National Bureau of Economic



# Investment Expenditures

- Two definitions:
  - ① Spending on capital [the factor of production]
  - ② Spending on goods bought for future use
- Includes
  - Business fixed investment: Spending on plant and equipment that firms will use to produce other goods & services.
  - Residential investment: Spending on construction of new houses and apartments.
  - Inventory investment: The change in the value of all firms' inventories.

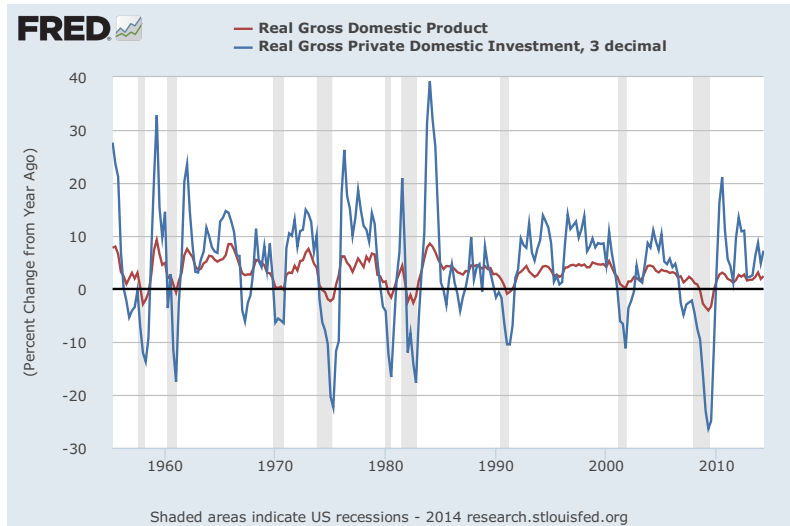
# Investment Expenditures

- $I$  in GDP is gross investment
  - ① Net investment = gross investment - depreciation.
  - ② Net investment = addition to capital stock

$$K_{t+1} = K_t + \underbrace{I_t - Depreciation_t}_{\text{net investment}}$$

- Notice that capital,  $K_t$ , is the stock
- $I_t$  is a flow (additions)

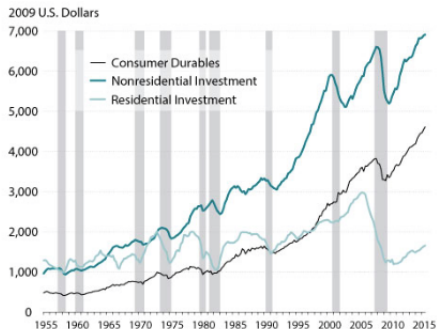
# U.S. Real Investment Growth vs. GDP Growth



# Investment Over Time

- Non-residential fixed investment: larger component of private investment
- Consumer Durables are not part of investment (part of  $C$  not  $I$ !) but its behavior is like that of investment

**Real Private Investment Per Capita by Major Component**



NOTE: The shaded bars indicate recessions as determined by the National Bureau of Economic Research.

SOURCE: Haver Analytics and authors' calculations.

# Government Expenditure

- Government Consumption of Goods and Services (about 85% of G)
  - non-market output such as education, healthcare, policing, defense, judicial, etc.
  - goods and services produced by government
- Government Invest (about 15%)
  - e.g. acquiring buildings/machines
- excludes transfer payments (e.g., unemployment insurance payments). Why?

## U.S. Government Expenditure, 2006

|                        | \$ billions | % of GDP |
|------------------------|-------------|----------|
| Government Expenditure | 2527.7      | 19.1     |
| Federal                | 926.6       | 7.0      |
| Non-defense            | 305.6       | 2.3      |
| Defense                | 621.0       | 4.7      |
| State and local        | 1601.1      | 12.1     |

Source: Economic Report of the President

<http://www.bea.gov/national/nipaweb/Index.asp>

# Net Export

- Net export is the difference between what an economy exports and imports

$$NX = \text{exports} - \text{imports}$$

- If positive, it captures the net expenditure by the rest of the world on our products
  - If negative, it captures our net expenditure on what the rest of the world produces
- Net exports (trade balance) for the United States is negative.
- The recent trade deficit indicates that the United States is borrowing goods from the rest of the world.
- As the trade balance has turned negative, consumption has increased as a share of GDP recently.

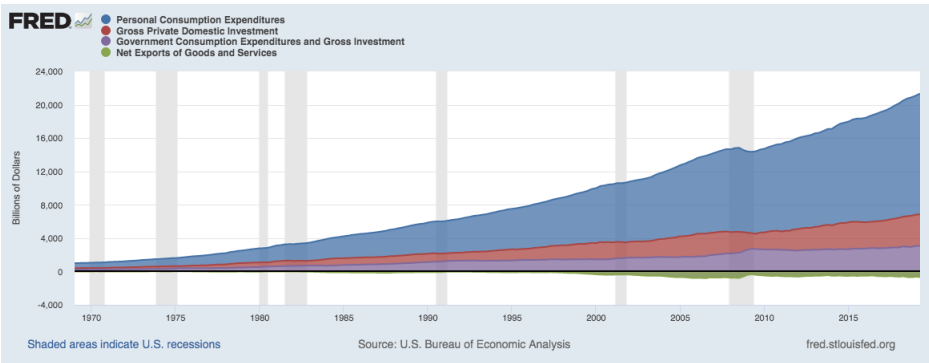
# A Note on Net Exports

Suppose we want to measure net exports of country X

- Note: the export of country X's good that is used in country Y's production of another good would still be counted in country X's GDP.
- Why?
  - Recall we look at final goods and services produced in a country to avoid double counting.
  - For country X, the export of its good *even if* its used as an intermediate good in another country is only counted once in country X's production.



# Expenditures in the US over time



# Calculate GDP via Expenditure Approach

- Firm 1 makes computer chips. It sells the computer chips to Firm 2 for \$1000. It hires workers for \$800.
- Firm 2 buys the \$1000 worth of computer chips from Firm 1. It imports rare metals worth \$1000 from country Y. Firm 2 use the computer chips and rare metals to produce phones and sells phones to domestic households for \$3000
- .
- What is the GDP for this economy via the Expenditure Approach?

# A KEY QUANTITY: GDP

Measurement with Income Approach

# GDP vs. GNP

- **Gross National Product (GNP):** Total income earned by the nation's factor of production, regardless of where located
- **Gross Domestic Product (GDP):** Total income earned by the domestically located factor of production, regardless of nationality

$$\begin{aligned}\text{GNP-GDP} &= \text{factor payments from abroad} \\ &\quad - \text{factor payments to abroad} = NFP\end{aligned}$$

# Measuring GDP by income approach

- Producing goods and services generates income
  - Wages and Salaries to workers
  - Profit to owners of business
- Total income of all Americans (regardless of location) is called **National Income**
- National Income is related to GNP

$$\underbrace{\text{National Income} + \text{Sales Taxes}}_{\text{Net NP}} + \text{depreciation} = \text{GNP}$$

# National Income

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National Income is the sum of

- **Compensation of Employees:** wages, salaries and fringe benefits earned by workers (incl. self-employed income)
- **Proprietors Income:** income of non-corporate business, such as small farms, self-employed
- **Rental Income:** income that landlords receive from renting, including the imputed rent that homeowners pay themselves
- **Corporate Profits:** income of corporations after payments to their workers and creditors
- **Net interest/ Dividend income:** interest paid by domestic businesses plus interest earned from foreigners

# National Income in year 1999

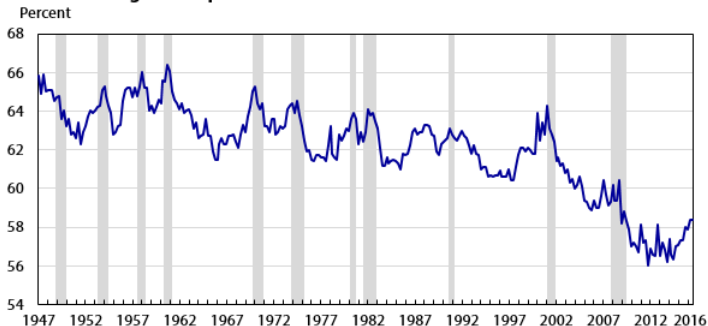
| <b>in year 1999</b>       | <b>Billions of US<br/>\$</b> | <b>% of National<br/>Income</b> |
|---------------------------|------------------------------|---------------------------------|
| National Income           | 7469.7                       | 100%                            |
| Compensation of Employees | 5299.8                       | 71.00%                          |
| Proprietors' Income       | 663.5                        | 8.90%                           |
| Rental Income             | 143.4                        | 1.90%                           |
| Corporate profits         | 856                          | 11.50%                          |
| Net interest              | 507.1                        | 6.80%                           |

Source: Economic Report of the President

<http://www.gpoaccess.gov/eop/download.html>

# Income Shares 1929–2014

**Figure 1. Labor's share of output in the nonfarm business sector, first quarter 1947 through third quarter 2016**



Note: Shaded areas indicate recessions, as determined by the National Bureau of Economic Research.

Source: U.S. Bureau of Labor Statistics.

- labor share =  $\frac{\text{labor income}}{\text{national income}}$
- labor share close to 70%, some decline recently
- Some versions of this calculation include proprietor's labor compensation



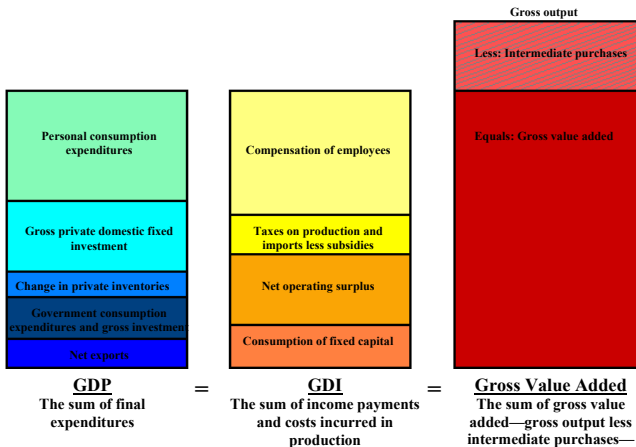
## Calculate GDP via Income Approach

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- .
- What is the GDP for this economy via the Income Approach?

# In summary

In theory the three definitions give the same values...

Chart 2.1—Three Ways to Measure GDP



## The Limits of GDP

# Problems with GDP as a measure of...

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We want GDP to be reflective of the productive capacity of the economy.

- But what does GDP not count?

# Problems with GDP

GDP doesn't count

- non-market production



# Problems with GDP

What is GDP not counting in measuring the *size* of the economy?

1) Non-market production:

- Home production (think about housework, childcare, DIY)
- In developing countries: subsistence farmers (living with 1\$ a day means that most of the crops are for own consumption, few sold for cash)

# GDP doesn't count non-market production

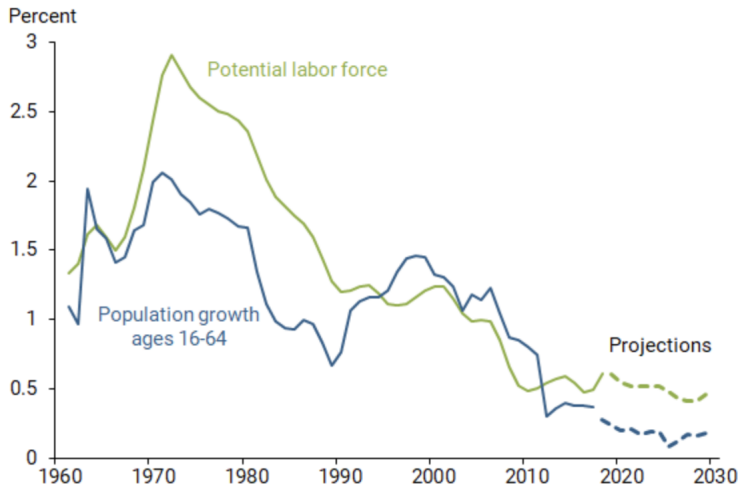
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*"In the United States, if there was equal participation of women in the labor market, GDP would be up by 5 percent."*

-Christine Lagarde (Dec 9th 2018)

# GDP doesn't count non-market production

- Slowing labor supply growth



Source: FRBSF, CBO, Census



# Problems with GDP

GDP doesn't count

- informal/underground economic activities



# Underground Economy Across Countries

Data: World Bank (1998).

| Country     | Fraction of GDP |
|-------------|-----------------|
| Nigeria     | 77%             |
| Thailand    | 70%             |
| Bolivia     | 67%             |
| Italy       | 27%             |
| US          | 10%             |
| Switzerland | 9%              |

# Problems with GDP

What is GDP not counting in measuring the *size* of the economy?

1) Non-market production:

- Home production (think about housework, childcare, DIY)
- In developing countries: subsistence farmers (living with 1\$ a day means that most of the crops are for own consumption, few sold for cash)

2) Underground economy

3) Returns to intangible capital (Brand names)

# Problems of GDP as a measure of...

We sometimes use GDP per capita to be an indicator of average well-being

- GDP measures market value of current production of final goods and services... doesn't actually measure welfare.
- If market doesn't exist, even if people receive benefit from e.g. clean air, doesn't get picked up in GDP.
  - Pollution
  - Depletion of natural resources

# Interpreting GDP: Hours

Is GDP measuring *welfare* ?

- Leisure, health care, education, inequality...

| Rank | Countries                       | Amount ▼    |
|------|---------------------------------|-------------|
| # 1  | <a href="#">Australia:</a>      | 1,814 hours |
| # 2  | <a href="#">Japan:</a>          | 1,801 hours |
| # 3  | <a href="#">United States:</a>  | 1,792 hours |
| # 4  | <a href="#">Canada:</a>         | 1,718 hours |
| # 5  | <a href="#">United Kingdom:</a> | 1,673 hours |
| # 6  | <a href="#">Italy:</a>          | 1,591 hours |
| # 7  | <a href="#">Sweden:</a>         | 1,564 hours |
| # 8  | <a href="#">France:</a>         | 1,453 hours |
| # 9  | <a href="#">Norway:</a>         | 1,337 hours |

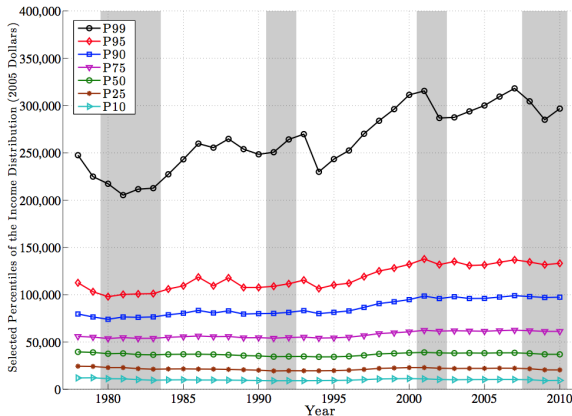
Source: OECD

# Interpreting GDP: Inequality

Is GDP measuring *welfare* ?

- How about inequality?

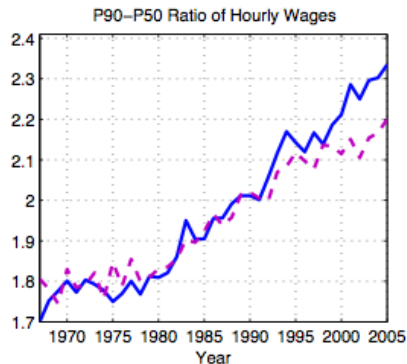
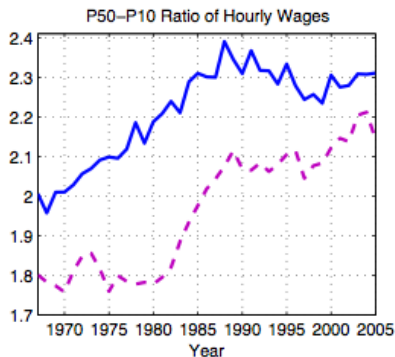
⇒ GDP is a sum, contains no information on distribution of consumption/income



Source: Guvenen et al (2014)

# Interpreting GDP: Inequality

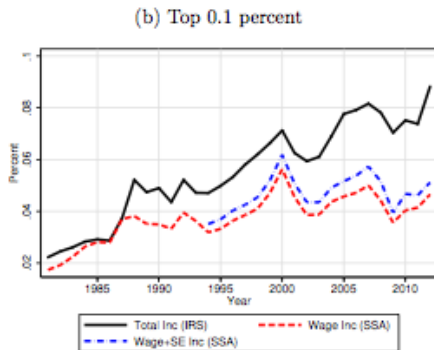
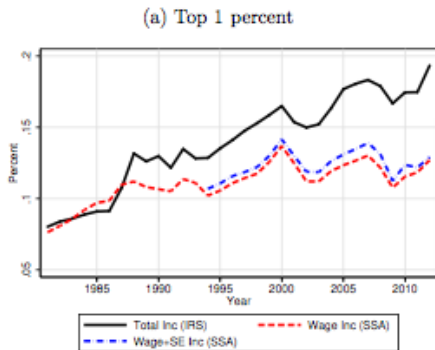
- Since mid-1980s, rising inequality more due to greater fanning out of incomes at top end of distribution



blue - Men purple - Women  
Source: Heathcote et al (2010)

# Interpreting GDP: Inequality

- 20% of aggregate HH income (capital and labor income) is held by top 1% of households in the US



Source: Guvenen and Kaplan (2017)



# Roadmap

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- Today  $\Rightarrow$  Studied GDP and its components
- Next Wednesday...  $\Rightarrow$  Study nominal vs real quantities, prices
- After that...  $\Rightarrow$  A First Macroeconomic Model