Chapter 2: The Data of Macroeconomics

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Chapter 2: The Data of Macroeconomics

- Learning goals

1. Gross Domestic Product
   - Four calculation methods of GDP
   - Real versus nominal GDP
2. Inflation
   - The GDP-deflator
   - Consumer Price Index
   - Comparison
   - Inflation Denmark
3. Measuring Joblessness: The Unemployment Rate
   - Household Survey

Learning Goals of chapter 2

After this chapter, you would be able to

a) name and apply alternative definitions of Gross Domestic Product (GDP),

b) explain why GDP is not a perfect measure of economic activity,

c) know differences between nominal and real variables as well as level and growth variables,

d) know what problems can arise in measuring inflation, and

e) know what problems can arise in measuring unemployment.

‘

2.1 Measuring production – GDP

- Gross Domestic Product (GDP): Measure of the aggregate economic production.

Production approach: 2 definitions!

1. GDP is the sum of the value of the *final* goods and services in the economy during a given period.
2. GDP is the sum of the value added on each layer of the economy.

Income approach

3. GDP is the sum of incomes in the economy during a given period.

Composition of GDP

4. Aggregated demand of goods from the different sectors of the economy.

Calculation of GDP: A numerical example

Steel (Firm 1)		**Automotive (Firm 2)**	
Sales	100	Sales	210
Expenditures (Wages)	−80	Expenditures (Wages)	−70
		Intermediates	−100
Profit	20	Profit	40

Cars are bought by

- Private consumers 150,
- Companies 20,
- Government 30,
- Foreign countries 10.

GDP: Production approach I

1. GDP is the sum of the value of the final goods and services in the economy during a given period.

- Only cars serve final consumption.
- Sales in automotive industry $= 210 \Rightarrow$ GDP $= 210$.

GDP: Production approach II

2. GDP is the sum of the value added on each layer of the economy.

- Sum of all added values $\Rightarrow$ Production value at each stage of the value chain must be determined.
- Value of production $-$ Value of intermediates $=$ Value added

	Value of production	Value of intermediates	Value added
Steel	100	0	100
Automotive	210	100	110
Sum			**210**

GDP: Income approach

3. GDP is the sum of incomes in the economy during a given period.

	Income (Steel)	Income (Automotive)	Sum
Wages	80	70	150
Profit	20	40	60
Sum	**100**	**110**	**210**

GDP: Composition approach

4. The GDP corresponds to the value of all expenditures, i.e. the aggregated demand of goods from the different sectors of the economy.

$$GDP = C + I + G + NX \tag{1}$$

$$GDP = 150 + 20 + 30 + 10 = 210$$

Nominal GDP

- P^A: Price of an apple
- A: Number of apples produced
- P^O: Price of an orange
- O: Number of oranges produced

	P^A	A	P^O	O	Nom. GDP
2017	1	10	2	20	50
2018	1.1	11	2.2	22	60.5

Nominal GDP increases, because

- the prices increase and
- the quantities increase.

Helpful hints for working with percentage changes

The percentage change of $P \cdot Q$ is *approximately* equal to

- the percentage change in prices
- PLUS
- the percentage change in quantities:

$$(P \cdot Q)\% \approx P\% + Q\% \tag{2}$$

$$20\% \approx 10\% + 10\% \tag{3}$$

Nominal GDP: Extending the numerical example to 2019

	P^A	A	P^O	O	Nom. GDP
2017	1	10	2	20	50
2018	1.1	11	2.2	22	60.5
2019	1.32	11	2.64	22	72.6

- Inflation causes an increase in nominal GDP!
- What if... one is interested in the *mountain of goods & services* produced?
- Calculate real GDP by using the *base-year-method* or by using the *chain-weighted-method*.

Real GDP: Base-year-method

- Choose a base year (2017) and
- keep prices constant.

	P^A	A	P^O	O	Real GDP
2017	1	10	2	20	50
2018	1	11	2	22	55
2019	1	11	2	22	55

Real GDP: Chain-weighted-method

- About every five years a new base year was chosen.
- Method changed in 1995.
- Switch to a *chain-weighted* measure.
- Average of 2017 and 2018 prices are used instead of the actual price of 2018.

	P^A	A	P^O	O	Nom. GDP
2017	1	10	2	20	50
2018	1.1	11	2.2	22	60.5
2019	1.32	11	2.64	22	72.6

	P^A	A	P^O	O	Real GDP
2017	n.a.	10	n.a.	20	n.a.
2018	1.05	11	2.1	22	57.75
2019	1.21	11	2.42	22	66.55

GDP and the components of expenditure (USA, 2016)

	C	I	G	NX	Sum = GDP
in USD bill.	12,821	3,057	3,268	−521	18,625
in percent	69 %	16 %	18 %	−3 %	100 %

The inflation rate: The GDP-deflator

- If nominal GDP increase to a larger extend than real GDP, this is due to an increase of the price level
- Price increases can be measured by the change in the GDP deflator
- GDP deflator in year t is defined as the ratio of nominal GDP over real GDP:

$$\text{GDP Deflator} = D_t = \frac{\text{Nominal GDP}_t}{\text{Real GDP}_t} \tag{4}$$

The inflation rate: The GDP-deflator

$$\text{GDP Deflator} = D_t = \frac{\text{Nominal GDP}_t}{\text{Real GDP}_t}$$

- In the base year GDP deflator takes the value of 1 (or 100 %).
- GDP deflator is an index number $\Rightarrow$ The level has no economic meaning at all.
- Only changes of the deflator level can be interpreted as inflation:

$$\pi_t = \frac{D_t - D_{t-1}}{D_{t-1}} \quad \textit{for example} \quad \pi = \frac{122.4 - 120}{120} = 0.02 \tag{5}$$

Laspeyres Price Index

$$P_{La,t+1} = \frac{\sum_{i=1}^{n} p_{i,t+1} \cdot q_{i,t}}{\sum_{i=1}^{n} p_{i,t} \cdot q_{i,t}} \tag{6}$$

Let's go shopping

Shopping tour in period t

Item # i	1	2	3	4	n	
Item	Banana	Milk	Sausage	Beer	Choco	SUM
$q_{i,t}$	1	5	5	10	3	
$p_{i,t}$	2	5	3	4	6	
$p_{i,t} \cdot q_{i,t}$	2	25	15	40	18	100

$$P_{La,t+1} = \frac{}{\sum_{i=1}^{n} p_{i,t} \cdot q_{i,t}} \tag{7}$$

One year later: Shopping tour in period $t+1$

$$P_{La,t+1} = \frac{\sum_{i=1}^{n} p_{i,t+1} \cdot q_{i,t}}{} \tag{8}$$

Item # i	1	2	3	4	n	
Item	Banana	Milk	Sausage	Beer	Choco	SUM
$q_{i,t}$	1	5	5	10	3	
$p_{i,t+1}$	4	5	3	4	6	
$p_{i,t+1} \cdot q_{i,t}$	4	25	15	40	18	102

Comparison t and $t+1$: Official inflation

Item # i	1	2	3	4	n	
Item	Banana	Milk	Sausage	Beer	Choco	SUM
$q_{i,t}$	1	5	5	10	3	
$p_{i,t}$	2	5	3	4	6	
$p_{i,t} \cdot q_{i,t}$	2	25	15	40	18	100

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Actual behaviour & inflation of private household

Item # i	1	2	3	4	n	
Item	Banana	Milk	Sausage	Beer	Choco	SUM
$q_{i,t}$	1	5	5	10	3	
$p_{i,t+1}$	4	5	3	4	6	
$p_{i,t+1} \cdot q_{i,t}$	4	25	15	40	18	102

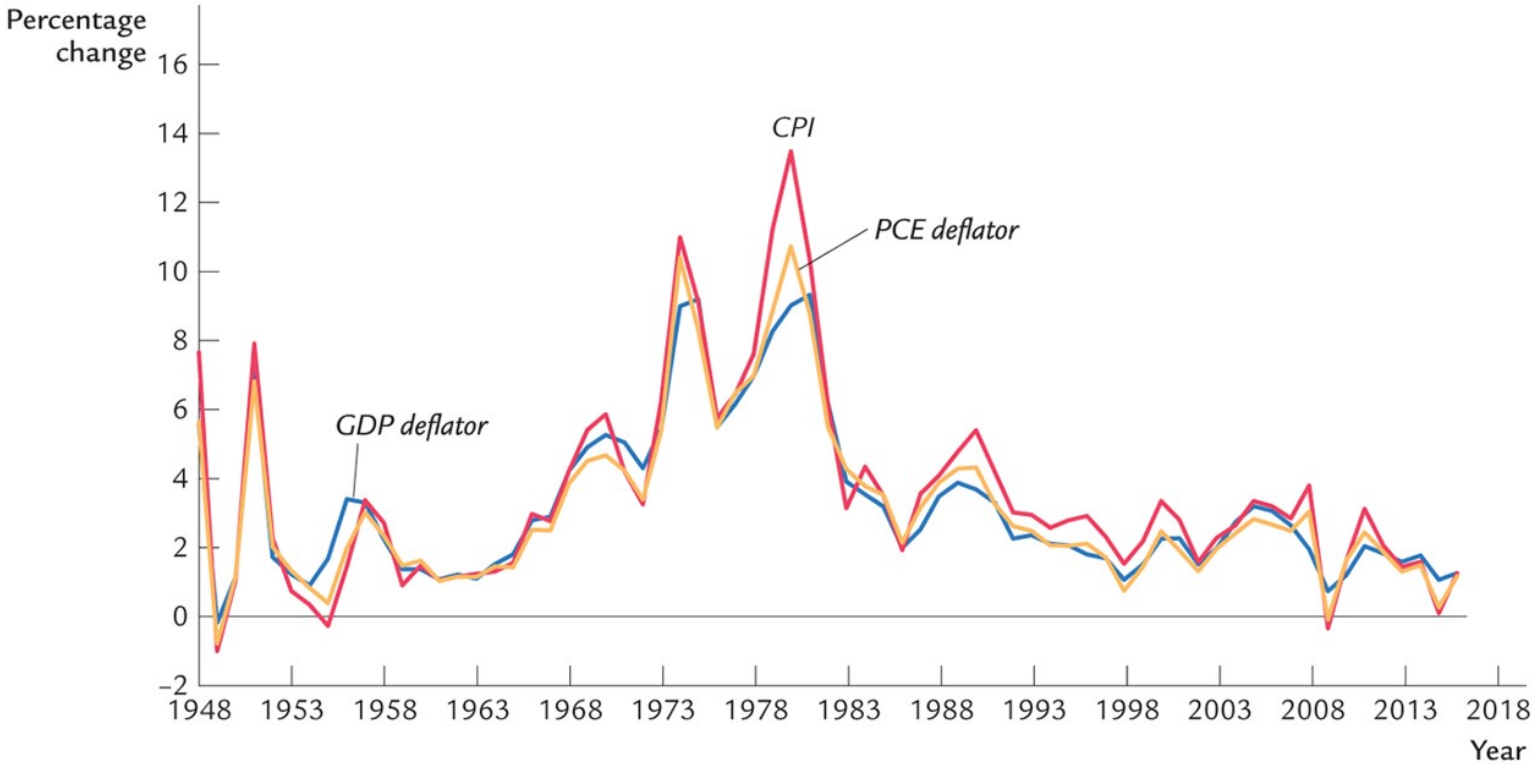
Item # i	1	2	3	4	n	
Item	Apples	Milk	Sausage	Beer	Choco	SUM
$q_{i,t}$	1	5	5	10	3	
$p_{i,t+1}$	2	5	3	4	6	
$p_{i,t+1} \cdot q_{i,t}$	2	25	15	40	18	100

When the price hammer hits...

- Private households are *directly* substituting expensive goods by cheaper goods.

Problems of keeping the quantity structure constant

- Substitution effect.
- Discounters.
- Innovations of goods and services.
- Quality changes.



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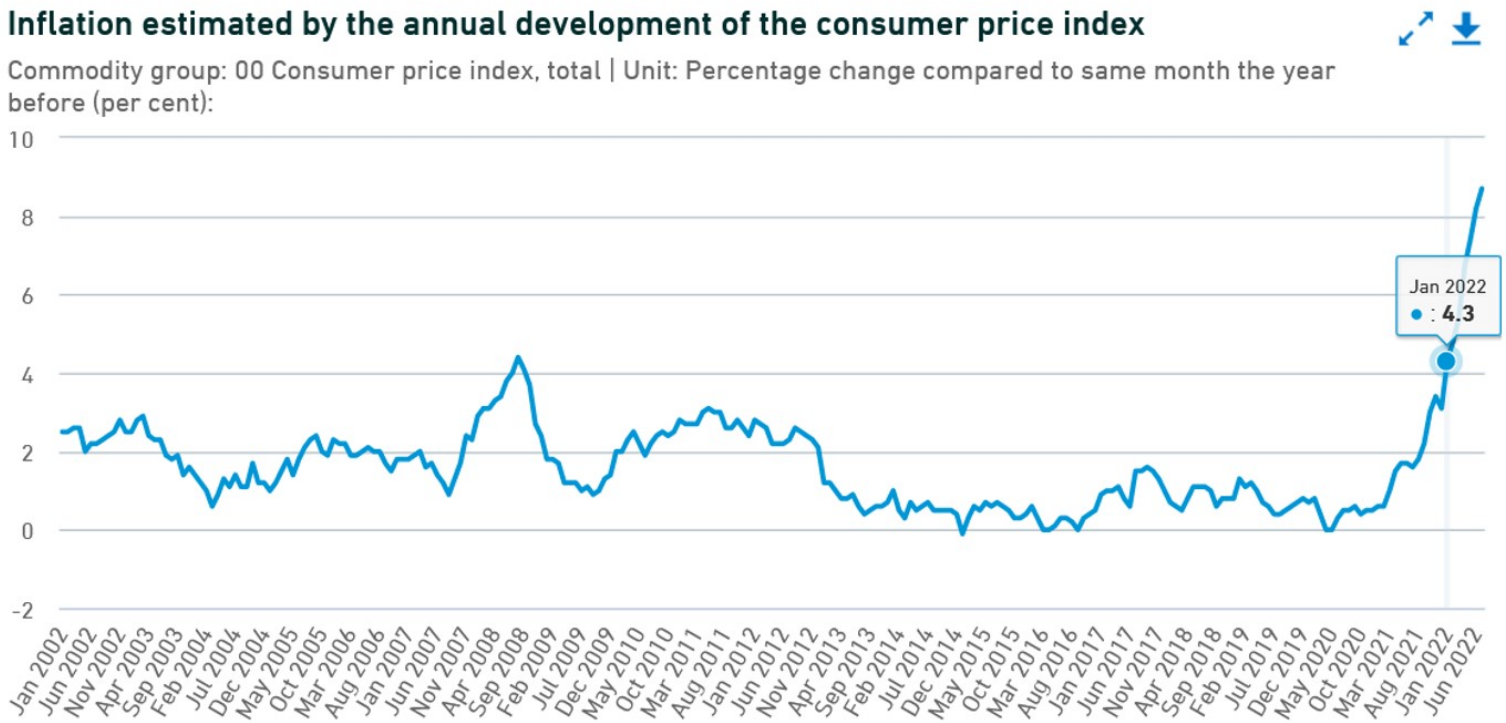
Why is CPI inflation different from GDP deflator?

- Prices of investment goods or goods used for government consumption:
  - included in GDP deflator (if produced domestically)
  - excluded from CPI
- Prices of imported consumer goods:
  - included in CPI
  - excluded from GDP deflator
- The basket of goods:
  - CPI: fixed
  - GDP deflator: changes every year

Inflation Denmark Jul. 2022: 8.7 %



Source: Danmarks Statistik (Sep. 2022).

`https://www.dst.dk/en/Statistik/emner/oekonomi/prisindeks/forbrugerprisindeks`

Household Survey

- U.S. Bureau of Labor Statistics (BLS)
- Current Population Survey
- 60,000 households (110,000 individuals)
- There is also something called *"Establishment Survey"*

Three categories

- Employed
- Unemployed
  - not employed
  - available for work
  - tried to find employment during the previous four weeks
- Not in the labor force
  - full-time student
  - homemaker
  - retiree
  - discouraged worker: wants a job, but has given up looking

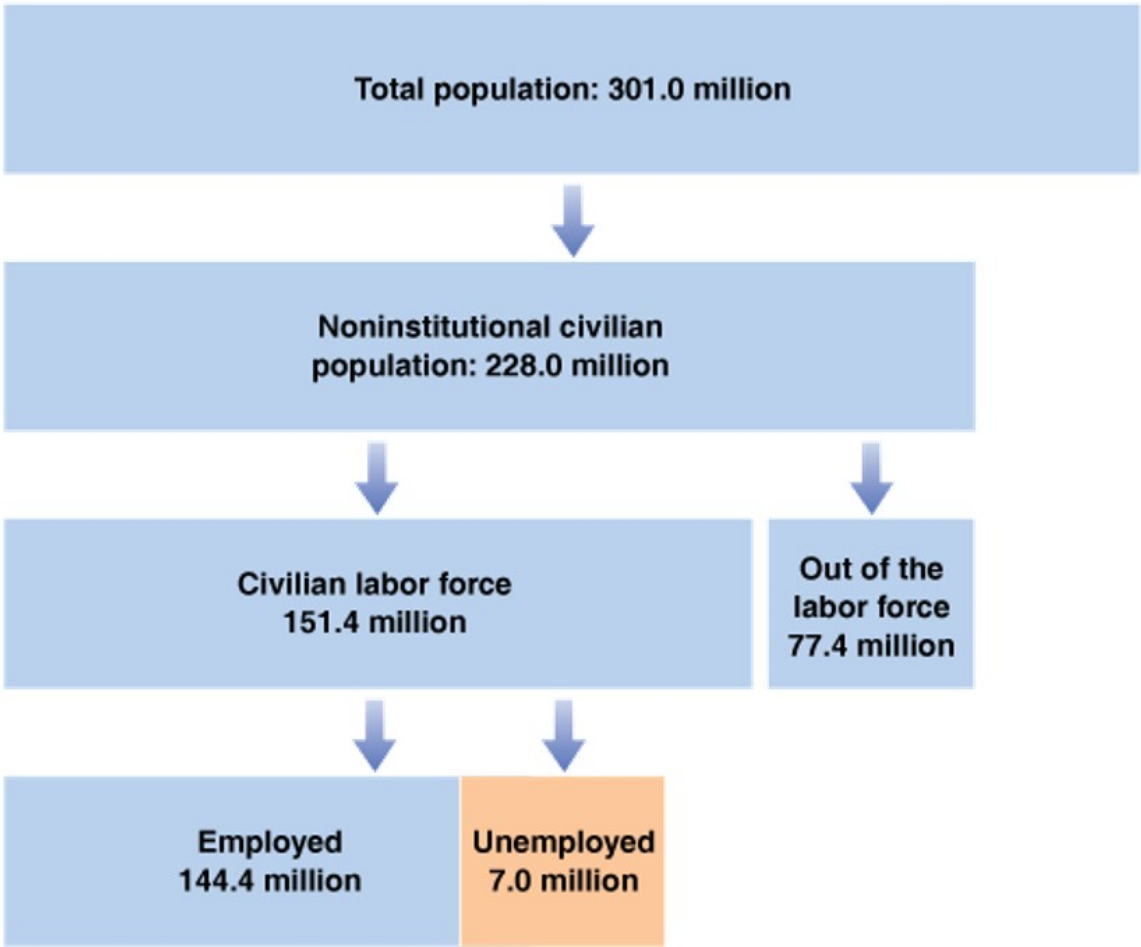
Three categories

- Labor force = Number of Employed + Number of Unemployed

$$\text{Unemployment rate} = \frac{\text{Number of Unemployed}}{\text{Labor Force}} \tag{9}$$

$$\text{Labor force participation rate} = \frac{\text{Labor Force}}{\text{Adult Population}} \tag{10}$$

Labour market: USA (2006)

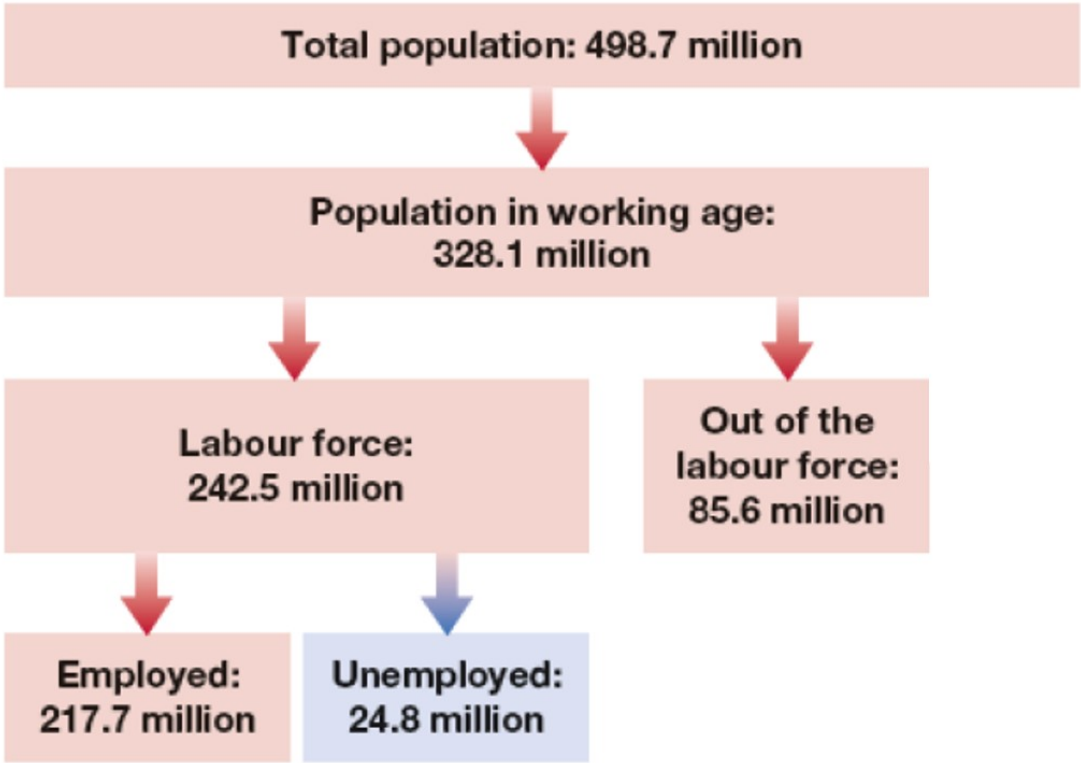


Labour market: USA (2006)

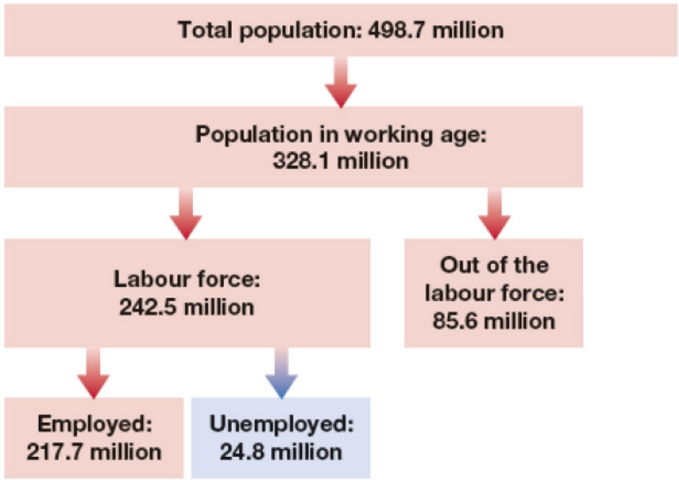
$$\text{Unemployment rate} = \frac{\textit{Unemployed}}{\text{Employed} + \text{Unemployed}} = \frac{\textit{Unemployed}}{\text{Labour force}} = \frac{7.0}{144.4 + 7.0} = 4.6\%$$

$$\text{Labor force participation rate} = \frac{151.4}{228.0} = 66.4\%$$

Labour market: EU (2014) (Blanchard et al. p. 135)



Labour market: EU (2014) (Blanchard et al. p. 135)

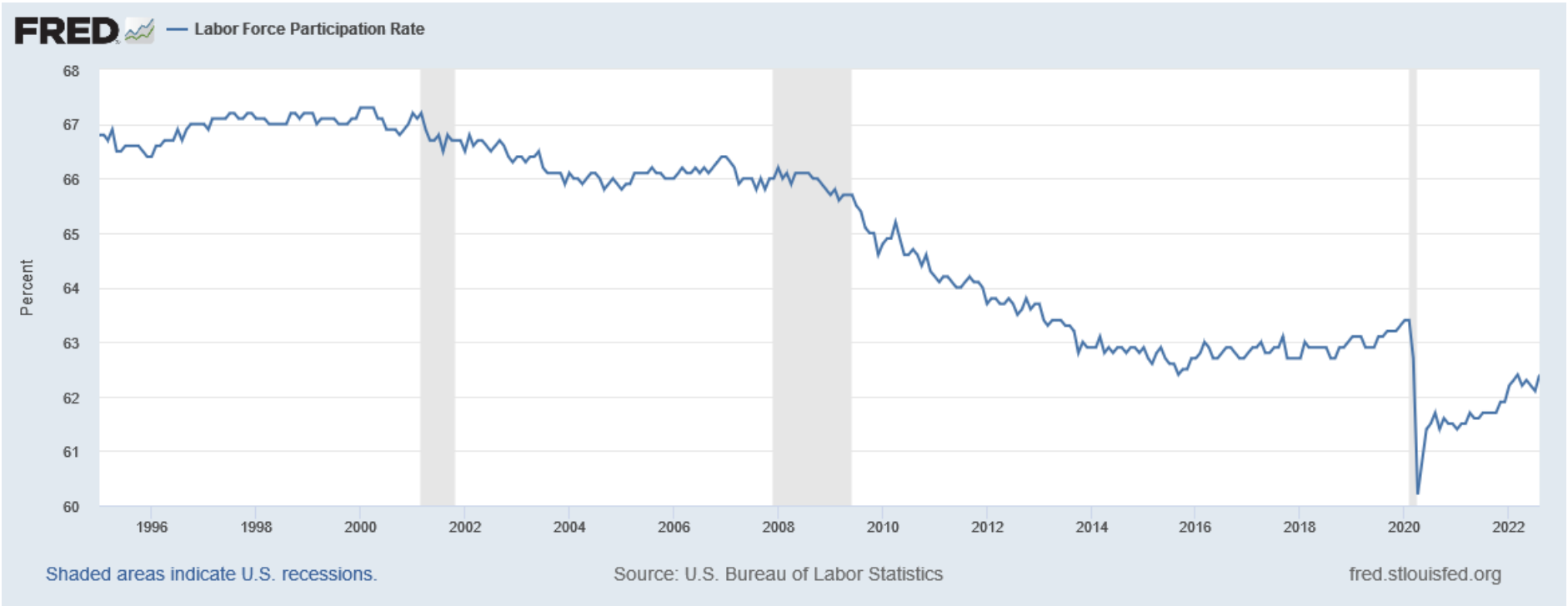


$$\text{Unemployment rate} = \frac{\textit{Unemployed}}{\text{Employed} + \text{Unemployed}} = \frac{\textit{Unemployed}}{\text{Labour force}} = \frac{24.8}{217.7 + 24.8} = 10.2\%$$

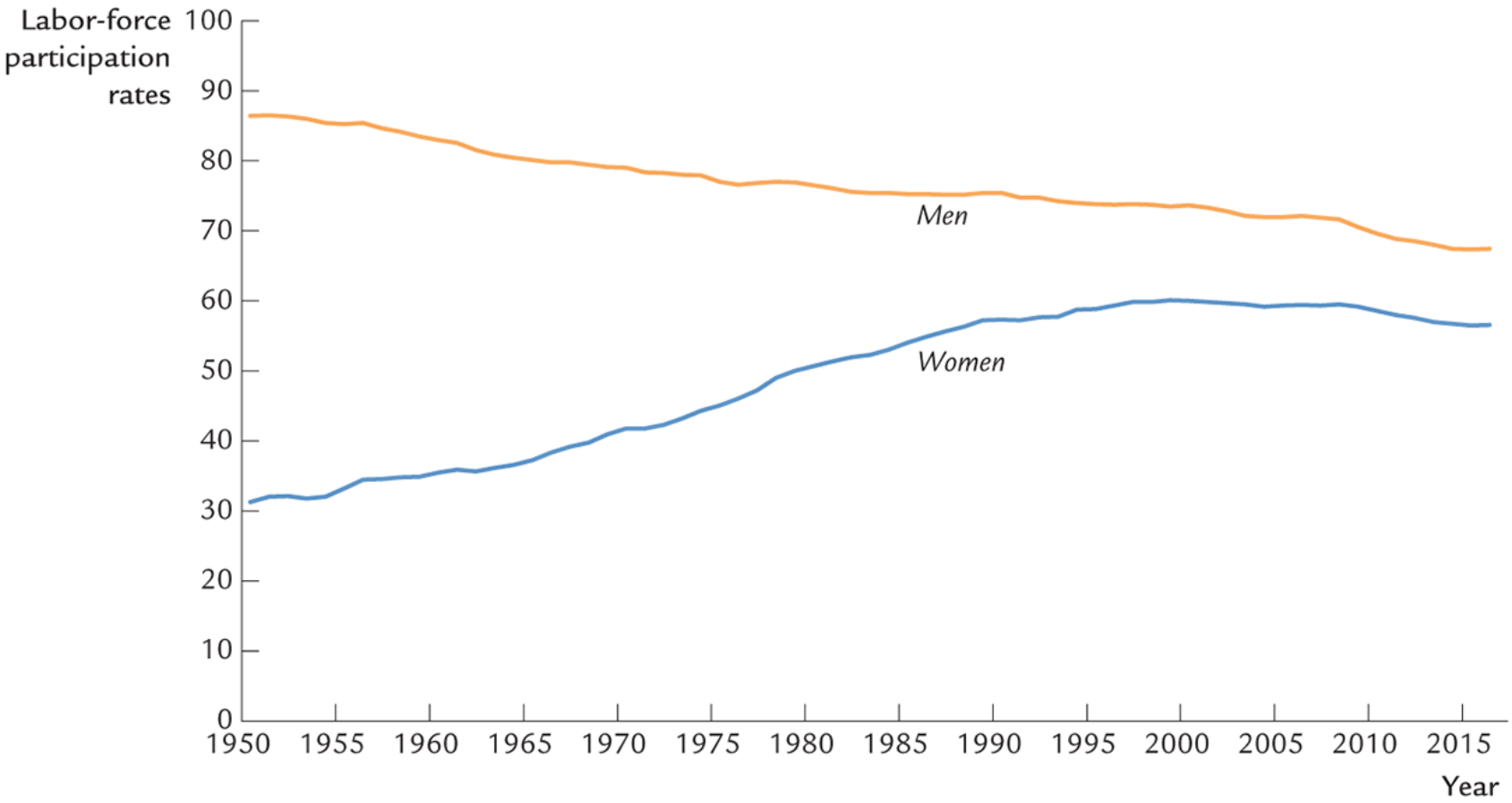
Mistake in the book! 11.4 % wrong = fake news

$$\text{Labor force participation rate} = \frac{242.5}{328.1} = 73.9\%$$

Labor force participation rates USA FRED database



Gender: Labor force participation rates USA



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