Econ 352 - Measurement

(See Williamson Ch. 2)

Trevor S. Gallen

What is Macro?

- Let's think about how we measure GDP
- Recall GDP is the dollar value of final output produced during a given period of time within the borders of the United States
- There are three ways to measure this!
  - Expenditure approach: cost of all final goods sold
  - Income approach: all income received by agents contributing to production
  - Value-added approach: sum up all value added
- Let's dig down in how we measure things!

Coconut Production

- Coconut producer owns coconut trees: makes 10 million coconuts sold for \$2 each, earns \$20 million
- Pays inputs: \$5 million to workers, \$0.5 million on loan, \$1.5 million to government in taxes

Coconut Producer	
Total Revenue	\$20 million
Wages	\$5 million
Interest on Loan	\$0.5 million
Taxes	\$1.5 million

Coconut Use

- 6 million of the 20 million coconuts are used by a restaurant (intermediate good), and 4 million are used by by consumers directly (final good)

- So need to keep track of restaurant as well!

- Restaurant sells \$30 million in meals, pays \$12 million for coconuts, pays workers \$4 million in wages and \$3 million in taxes

Restaurant	
Total Revenue	\$30 million
Cost of Coconuts	\$12 million
Wages	\$4 million
Taxes	\$3 million

Government

Government takes in \$5.5 million in taxes and pays \$5.5. million for soldiers to defend the coconuts

Government	
Tax Revenue	\$5.5 million
Wages	\$5.5 million

Product Approach to Measuring GDP

- Let's look at the "value added" approach: add up the sum of value added
- Coconuts sold+restaurant profits after inputs+government expenditure
- \$20 million for coconuts+ (\$30 million in revenue-\$12 million for coconuts)+\$5.5 million for government

Product Approach	
Value added - coconuts	\$20 million
Value added - restaurant food	\$18 million
Value added - government	\$5.5 million
GDP	\$43.5 million

Expenditure Approach to Measuring GDP

- $$Y = C + I + G + X$$
- ($30 million at restaurants +$8 million directly)+0+5.5+0

Product Approach	
Consumption	$38 million
Investment	$0 million
Government expenditures	$5.5 million
Net exports	$0 million
GDP	$43.5 million

Clearing up a common misconception

- It is sometimes claimed that imports reduce GDP because:

$$Y = C + I + G + Ex - Im$$

  Where Ex is exports and Im is imports
- If I buy an iPhone from China, this is a final good sold in the U.S. and is in C. But it wasn't produced in the U.S.! To avoid double counting, we take it out in Im.
- The iPhone didn't take away from GDP, it was just completely excluded

Income Approach to Measuring GDP

- Wage income+profits+interest income+taxes

Product Approach	
Wage income	\$14.5 million
After-tax profits	\$24 million
Interest income	\$0.5 million
Taxes	\$4.5 million
GDP	\$43.5 million

Income Approach to Measuring GDP

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Flaws in GDP

- What are some flaws in GDP?
  - Doesn't account for distribution
  - Leaves out nonmarket activity
  - Environmental degradation
  - Government production
  - Underground economy

Price and Quantity Indicies

- We want to compare GDP over time, e.g. if all prices double but quantity stays same, want real GDP not to change!
- Multiply by constant prices

Example: Calculating Nominal GDP

- Take a set of N goods

$$\text{NomGDP}_t = \sum_{i=1}^{N} P_{i,t} Q_{i,t}$$

Year	$P_{a,t}$	$P_{b,t}$	$Q_{a,t}$	$Q_{b,t}$	$GDP_{a,t}$	$GDP_{b,t}$	GDP_t
2010	\$1	\$1	1	1	\$1	\$1	\$2
2011	\$1	\$2	1	0.4	\$1	\$0.8	\$1.8
2012	\$2	\$1	0.8	1	\$1.6	\$1	\$2.6
2013	\$2	\$2	1	1	\$2	\$2	\$4
2014	\$2	\$2	0.5	0.5	\$1	\$1	\$2
Eq.	·	·	·	·	$P_{a,t}Q_{a,t}$	$P_{b,t}Q_{b,t}$	$GDP_{a,t}$ $+GDP_{b,t}$

- Why is this troubling?
  - Does 2010 $\rightarrow$ 2012 make sense?
  - Does 2010 $\rightarrow$ 2013 make sense?
  - Does 2010 $\rightarrow$ 2014 make sense?
- How do we fix it?

Example: Calculating GDP in Constant Dollars-I

We'll use 2010 prices (denoted by a bar):

$$\text{RealGDP}_t = \sum_{i=1}^{N} \bar{P}_i Q_{i,t}$$

Year	$P_{a,t}$	$P_{b,t}$	$Q_{a,t}$	$Q_{b,t}$	$GDP_{a,t}$	$GDP_{b,t}$	GDP_t
2010	\$1	\$1	1	1	\$1	\$1	\$2
2011	·	·	1	0.4	\$1	\$0.4	\$1.4
2012	·	·	0.8	1	\$0.8	\$1	\$1.8
2013	·	·	1	1	\$1	\$1	\$2
2014	·	·	0.5	0.5	\$0.5	\$0.5	\$1
Eq.	·	·	·	·	$P_{a,2010} Q_{a,t}$	$P_{b,2010} Q_{b,t}$	$GDP_{a,t} + GDP_{b,t}$

- Does 2010 $\rightarrow$ 2012 make sense now?
- Does 2010 $\rightarrow$ 2013 make sense now?
- Does 2010 $\rightarrow$ 2014 make sense now?

Example: Calculating GDP in Constant Dollars-II

Or use 2014 prices:

Year	$P_{a,t}$	$P_{b,t}$	$Q_{a,t}$	$Q_{b,t}$	$GDP_{a,t}$	$GDP_{b,t}$	GDP_t
2010	·	·	1	1	\$2	\$2	\$4
2011	·	·	1	0.4	\$2	\$0.8	\$2.4
2012	·	·	0.8	1	\$1.6	\$2	\$3.6
2013	·	·	1	1	\$2	\$2	\$4
2014	\$2	\$2	0.5	0.5	\$1	\$1	\$2
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    1. Get average price between two years for each good:
    $\bar{P}_a = \frac{P_{a,t}+P_{a,t+1}}{2}$, $\bar{P}_b = \frac{P_{b,t}+P_{b,t+1}}{2}$

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2. Find the new GDP component for each good: $Q_{a,t}\bar{P}_a + Q_{b,t}\bar{P}_b$ and $Q_{a,t+1}\bar{P}_a + Q_{b,t+1}\bar{P}_b$

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3. Find the percentage difference between the two: $\frac{Q_{a,t+1}\bar{P}_a+Q_{b,t+1}\bar{P}_b}{Q_{a,t}\bar{P}_a+Q_{b,t}\bar{P}_b}$

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  5. Choose an arbitrary level

- Note: this is slightly simpler than what we actually do. See online notes for details.

Example: Chain-Weighted GDP

Year	$P_{a,t}$	$P_{b,t}$	$Q_{a,t}$	$Q_{b,t}$	$\frac{GDP_t}{GDP_{t-1}}$	GDP_t
2010	\$1	\$1	1	1	·	100
2011	\$1	\$2	1	0.4	0.64	64
2012	\$2	\$1	0.8	1	1.29	82.6
2013	\$2	\$2	1	1	1.13	93.3
2014	\$2	\$2	0.5	0.5	0.5	46

- We now have the relative change in GDP between each period.
- Chain them together and choose an arbitrary starting point

Price Level

- Real GDP growth tells us how many goods we have (valued at base year)

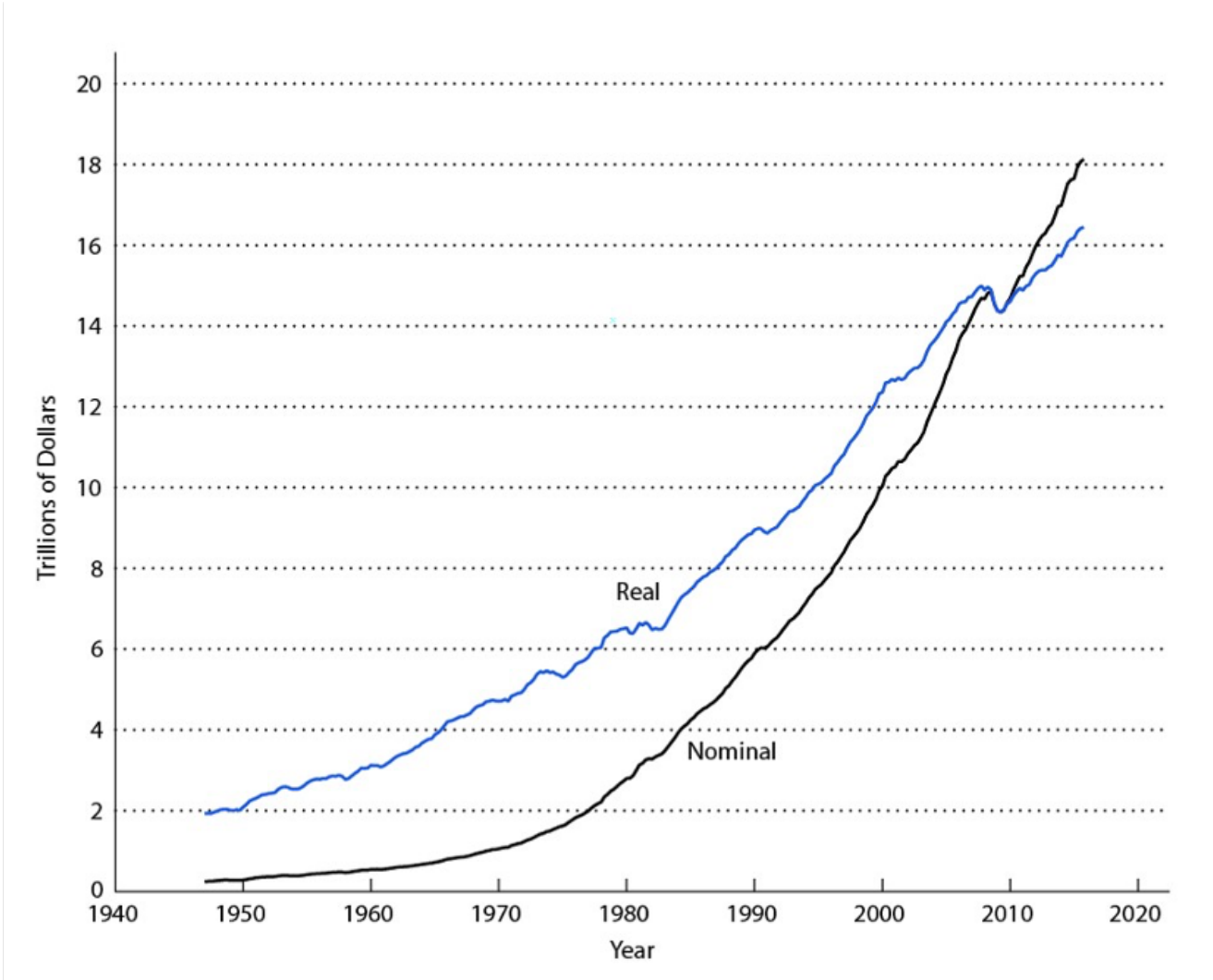
$$RealGrowth = \frac{\sum_g^N Q_{g,t} P_{g,base}}{\sum_g^N Q_{g,base} P_{g,base}}$$

- Price index tells us how many dollars we need to buy same basket of goods

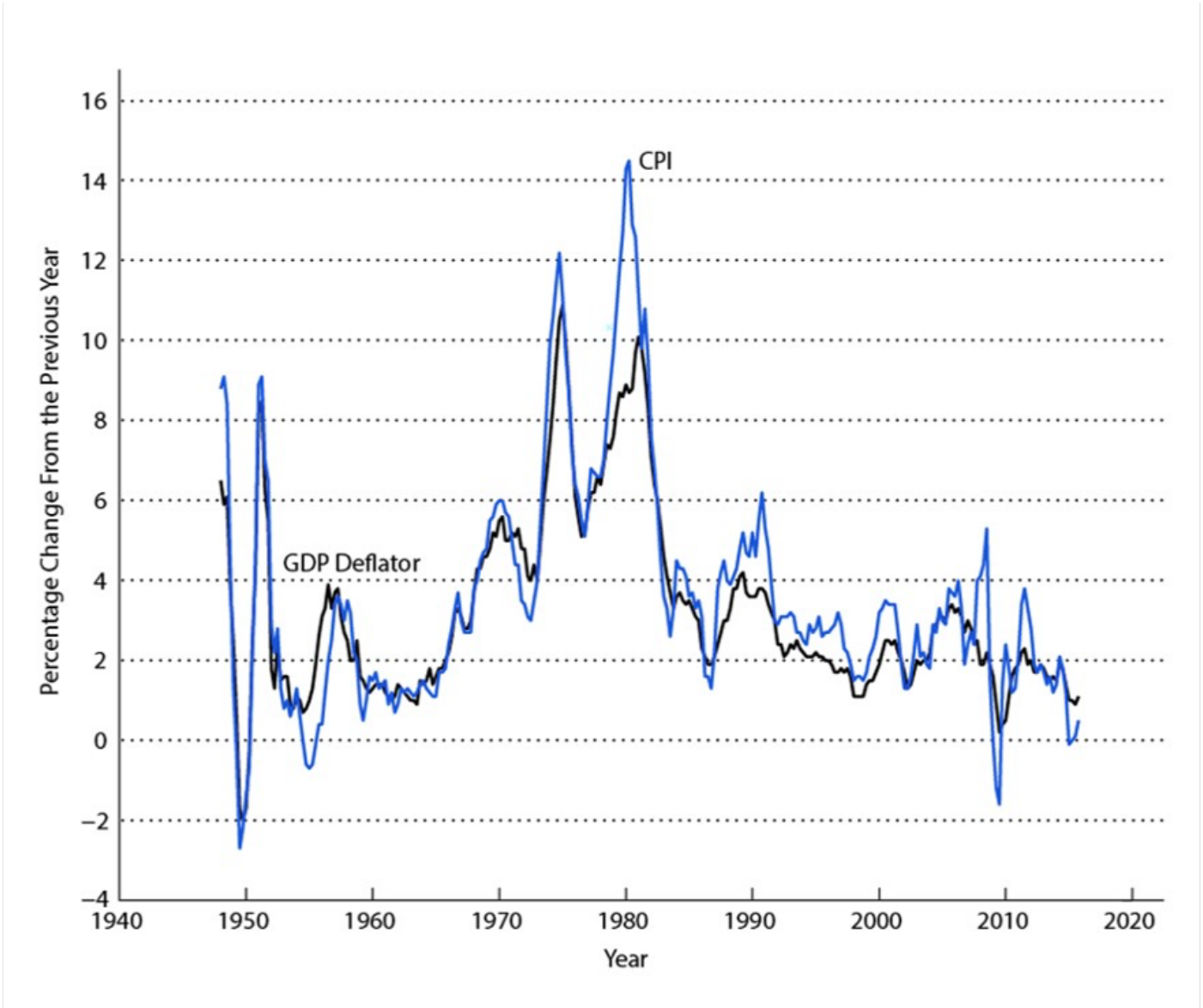
$$RealGrowth = \frac{\sum_g^N Q_{g,base} P_{g,base}}{\sum_g^N Q_{g,base} P_{g,t}}$$

- Same idea: in one you fix prices in the other you fix quantities
- Can pick different baskets of Q! What consumers buy (CPI) vs GDP (implicit price deflator)

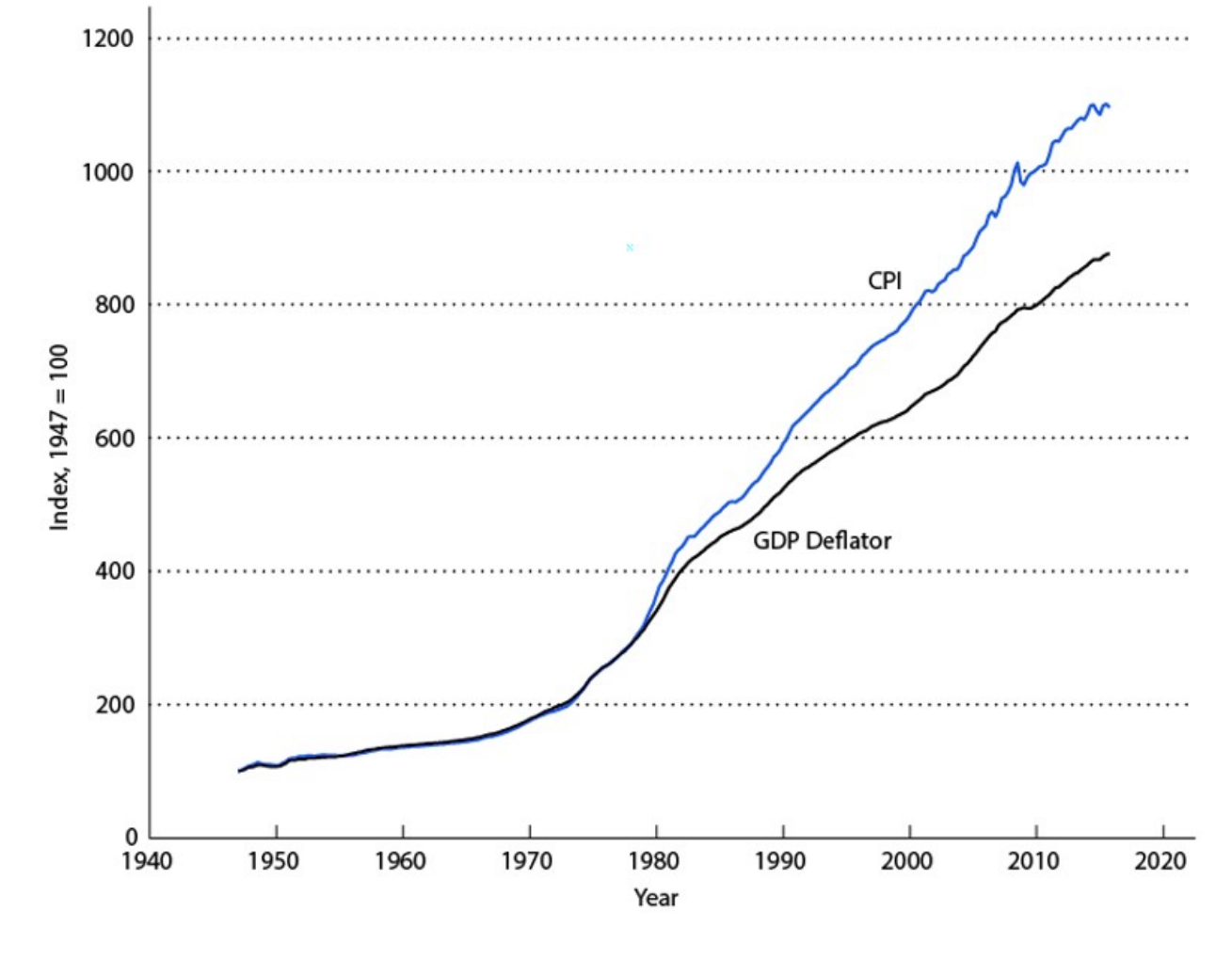
Nominal and Real GDP over Time



CPI Inflation Rate over Time



CPI vs GDP Deflator



Issues in Measurement

- The relative prices of goods change over time ? a problem for CPI measurement.
- The quality of goods and services changes over time.
- New goods and services are introduced, and some goods and services become obsolete.

Savings, Wealth, and Capital

- The most common issue people have when thinking about GDP is confusing it with wealth
- GDP is a flow, like income, while wealth is a stock (earned interest would be its income)
- Similarly, savings (or investment) are flows that contribute to wealth
- There are many forms savings take, depending on who does it!
- Private Sector Saving:

$$S^P = Y^D - C = Y + NFP + TR + INT - T - C$$

- Where:
  - Y^D is disposable income
  - C is consumption
  - NFP is net payments from abroad
  - TR are transfers from govt to households
  - INT is interest paid from govt
- Govt savings is:

$$S^g = T - TR - INT - G$$

National Savings

- In english: private savings is all production (Y) and income from abroad (NFP, minus what we eat (C), minus the net the government takes away ($TR + INT - T$)
- In english: government savings is all taxation T minus what it "eats" ($INT + TR + G$)
- Note that some private savings is government dissaving. National saving is:

$$S = S^P + S^g = Y + NFP + TR + INT - T - C + T - TR - INT - G = Y +$$

- In english: What the economy makes (Y), plus what is sent to it (NFP) minus what it "eats" ($C + G$)
- Can use $Y = C + I + G + X$ to get:

$$S = I + NX + NFP$$

- Where:
  - I is investment
  - NX is net exports
  - NFP is net factor payments from abroad
- $CA = NX + NFP$ is the current account surplus, so:

National Savings

- $CA = NX + NFP$ is the current account surplus, so:

$$S = I + CA$$

- In english: if you produce more than you consume, you either export it, or invest it
- Alternatively: you accumulate wealth by creating a capital stock (built by I) or having people owe you goods in the future

Measuring the labor market

- We have a few measurements that tell us how the labor market is doing:

$$Laborforce = Numberofemployed + numberofunemployed$$

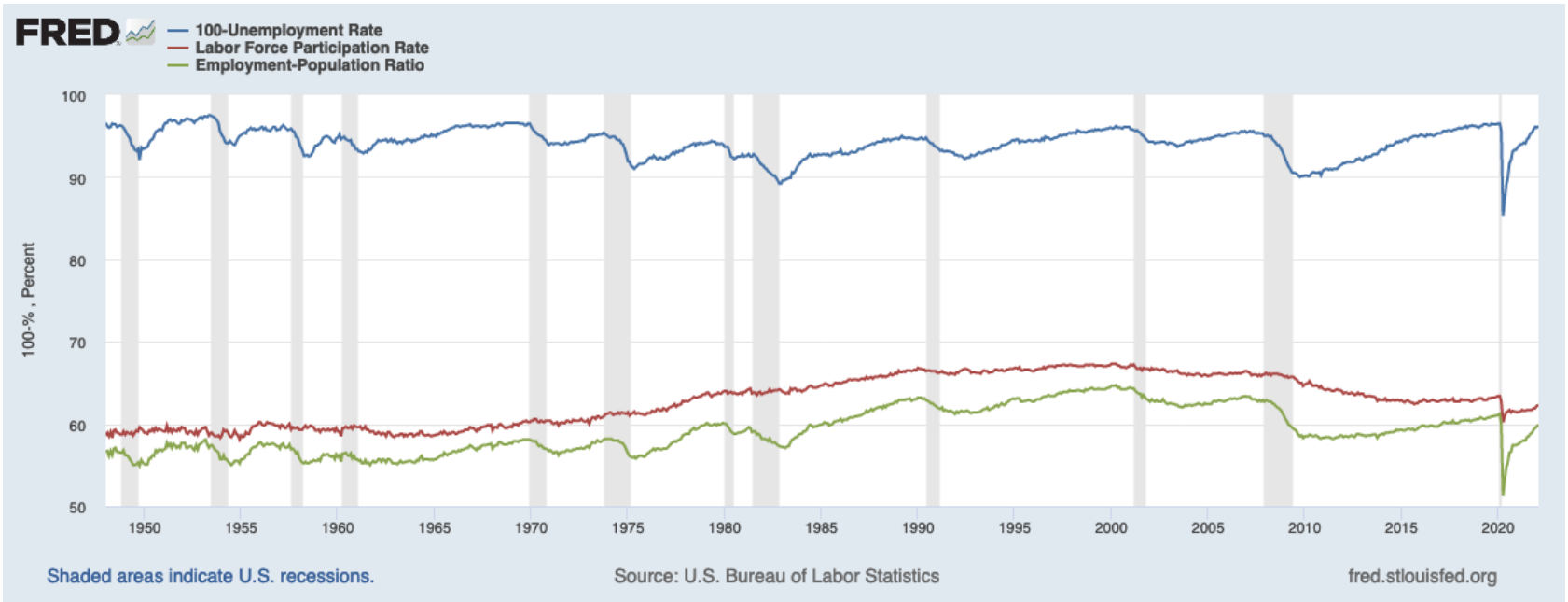
$$UnemploymentRate = \frac{Numberofunemployed}{Laborforce}$$

$$ParticipationRate = \frac{Laborforce}{Totalworkingagepopulation}$$

$$Employment/PopulationRatio = \frac{TotalEmployment}{Totalworkingagepopulation}$$

- Each one measures something different.
- Unemployment rate: "labor market tightness," difficulty in finding a worker for firms, in finding a job for workers
- Participation rate: how engaged your overall population is in labor force (how many aren't even looking!)
- Employment/population ratio: how much of your potential labor force you're using
- My own preference for the last is hours/working age

CPI vs GDP Deflator

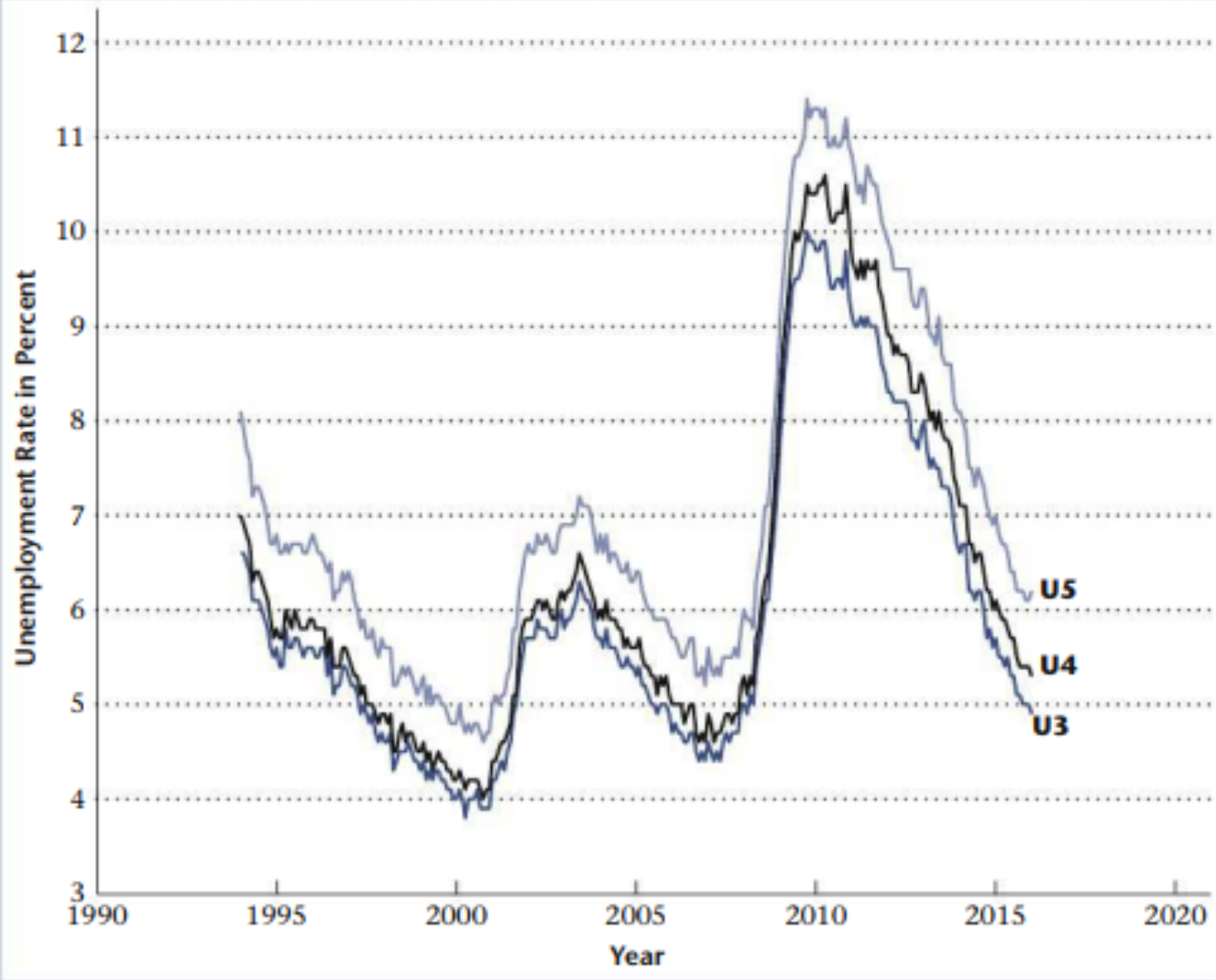


Note I graphed 100-UR

Unemployment Rate: Alternative Definitions

Figure 2.5 Alternative Measures of the Unemployment Rate

In the figure, U3 denotes the conventional unemployment rate, U4 includes discouraged workers, and U5 includes all marginally attached workers. The differences between U4 and U3, and between U5 and U3, increase during the last recession, which began at the end of 2007.



Takeaways

- Many ways to measure GDP
- GDP has flaws!
- We care about real GDP (how calculate)
- Ways of measuring price index
- Flows vs stocks: savings
- Ways. of measuring the health of the labor market