Measuring the Cost of Living: GDP Deflator & CPI

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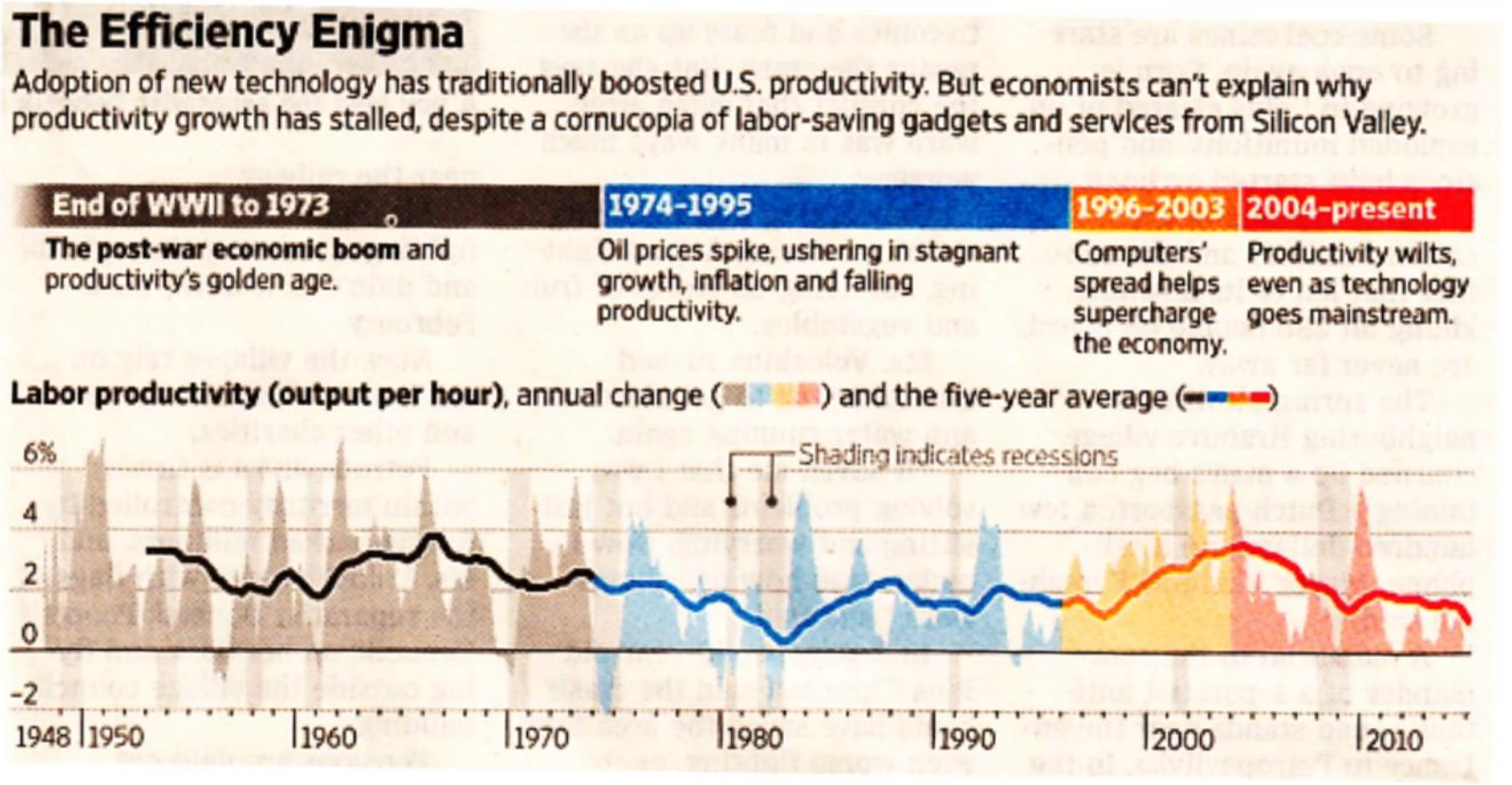
Outline: Unit I, Section INT 3

I. Price level: GDP Deflator
II. Price level: CPI
III. Inflation Rate

Current event

US productivity slump?



"US Productivity: Missing or in Hiding?" WSJ, 07-17-15

Is GDP Just Mis-measured?

- New technological improvements are free
  - E.g. Google search/maps, Skype, other apps
  - Provide productivity improvements
    - Free up time for leisure & media
    - Free up time for additional work
  - GDP measures the market value of all final…
    - Productivity (GDP/L or Y/L) is measured using GDP
  - Ideal GDP?

Alternative View

- Technological Progress takes time to become reflected in official GDP
  - 1980s: Computers eventually increase productivity
- Wages have not increased
- What alternative measure would you use?
  - BEA: Make adjustments to current measure
    - Include intellectual property into investment
      - E.g. Lady Gaga invests in writing and recording music (Sichel)

I. GDP Deflator

Real GDP versus Nominal GDP

- Assume your parents made $30,000 in 1990. Is that the same as making $30,000 in 2015?

- Nominal GDP = Value of goods and services measured at current prices

- Real GDP = Value of goods and services measured at constant prices

  => Real purchasing power

GDP Deflator

- GDP Deflator = Measure of the price level = A factor used for converting nominal GDP to real GDP

- Question: How can I compare today's nominal GDP in 2015 with the (nominal) GDP in say 2000?

- Answer: Fix prices in the year 2000, and value 2015 output using constant 2000 prices

Calculating GDP Deflator

Steps:

1. Specify the base year
2. Fix prices in the base year
3. Holding prices fixed, compute real GDP for every year
4. Compute $GDP\ Deflator_t = \frac{nom\ GDP_t}{real\ GDP_t} * 100$ for every year
5. Compute inflation rate for every year

GDP Deflator: Apples and Bananas

Year	Apples		Bananas		Nom GDP	Real GDP	GDP deflator
	P_A	Q_A	P_B	Q_B	-	-	-
2011 (base)	2	50	0.50	100			
2012	3	100	1	200			

Calculate nominal GDP and real GDP using the table above.

Notes

Compute the GDP deflator for each year

$$P_{11} = GDP\ Deflator_{11} = \frac{nom\ GDP_{11}}{real\ GDP_{11}} * 100 = \frac{150}{150} * 100 = 100$$

$$P_{12} = GDP\ Deflator_{12} = \frac{nom\ GDP_{12}}{real\ GDP_{12}} * 100 = \frac{500}{300} * 100 = 167$$

How much did the price level increase by?

π: Inflation rate

- π_t = Inflation rate in year t = Percent change in the price level in year t $= \%\Delta P_t$

$$\pi_t = \%\Delta P_t = \frac{P_t - P_{t-1}}{P_{t-1}} * 100$$

$$= \frac{GDP\ Deflator_{12} - GDP\ Deflator_{11}}{GDP\ Deflator_{11}} * 100$$

$$\pi_{12} = \%\Delta P_{12} = \frac{167-100}{100} * 100 = 67\%$$

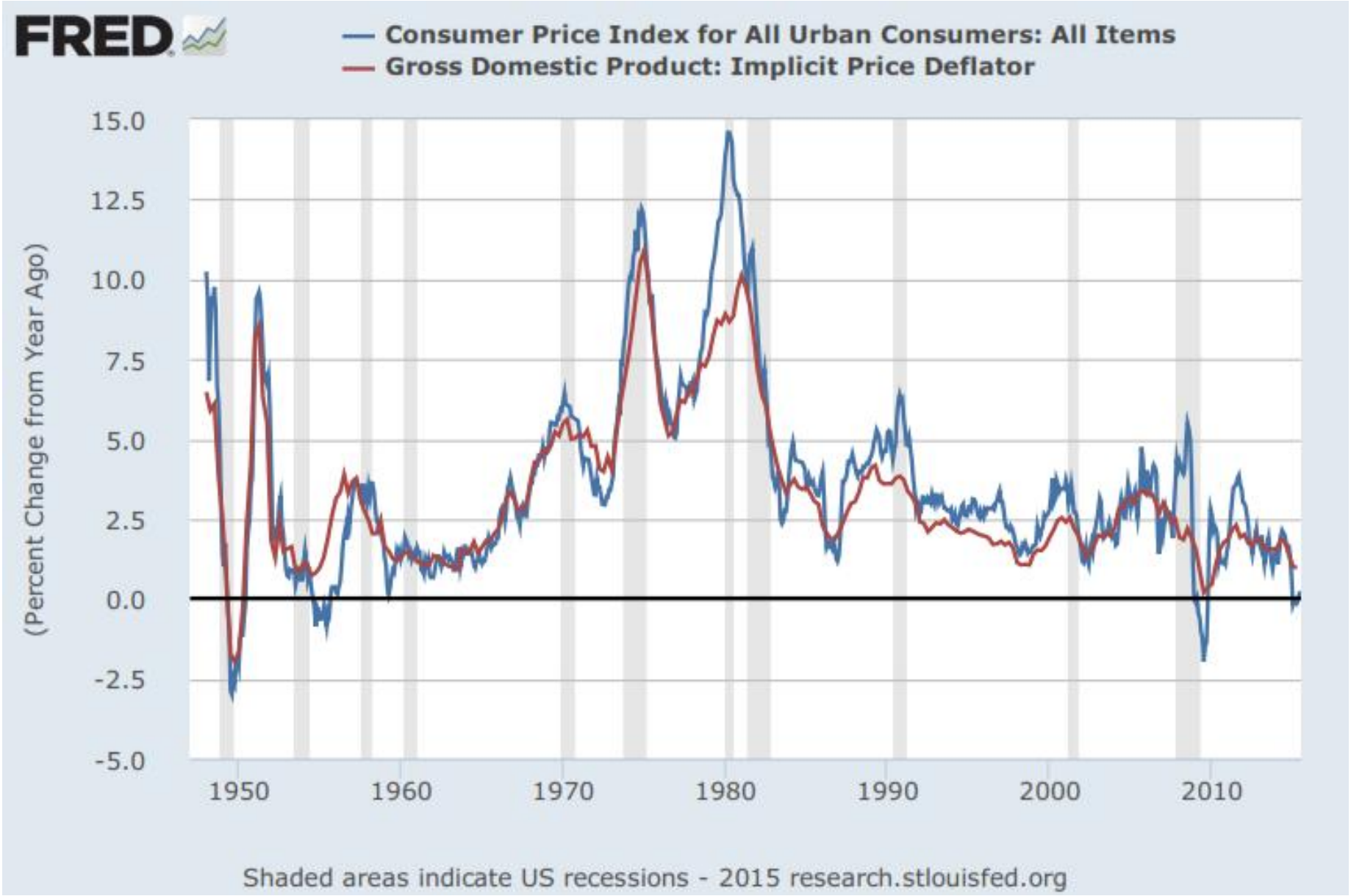
Converting nominal GDP to real GDP

$$real\ GDP_t = \frac{nom\ GDP_t}{GDP\ Deflator_t} * 100$$

Year	GDP deflator	Nominal GDP	Real GDP
2000(base)	100	2000	(2000/100)*100 = 2000
2005	112	4000	(4000/112)*100 = 3571
2010	130	8600	(8600/130)*100 = 6615
2015	158	12400	(1240/158)*100 = 7848

In 2000 US$

Inflation rates: CPI and GDP deflator



CPI

CPI = Measure of the overall cost of a typical basket of goods and services bought by the average consumer

Steps:

1. Specify the base year
2. Fix the basket in base year [4 Chips, 2 Donuts]
3. Holding the basket (quantities) fixed, compute the basket cost for every year
4. Compute $CPI_t = \frac{Cost\ of\ basket\ in\ year\ t}{Cost\ of\ basket\ in\ base\ year} * 100$ for every year
5. Compute inflation rate for every year

Given P and Q, calculate CPI

Fix the basket: 4 Chips, 2 Donuts

Year	P_C	P_D	Cost	CPI
2010 (base)	1	2		
2011	2	3		
2012	3	4		

Notes

π: Inflation rate

$$\pi_t = \%\Delta P_t = \frac{P_t - P_{t-1}}{P_{t-1}} * 100$$

$$\pi_t = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} * 100$$

- $\pi_{11} = \frac{CPI_{11} - CPI_{10}}{CPI_{10}} * 100 = \frac{175-100}{100} * 100 = 75\%$
- $\pi_{12} = \frac{CPI_{12} - CPI_{11}}{CPI_{11}} * 100 = \frac{250-175}{175} * 100 = 43\%$

CPI Bias

- COLA = Cost of living adjustment
- Overestimates COLA
  - Substitution bias
    - E.g. coffee and tea substitutes
  - New goods bias
    - E.g. TurboTax
  - Unmeasured quality change bias
    - E.g. Better computers and cars
  - Boskin commission (1995): Bias = 1.1%
    - Overcompensating: Soc Sec/Medicare/Retirement payments, private sector wages

GDP Deflator versus CPI

GDP Deflator

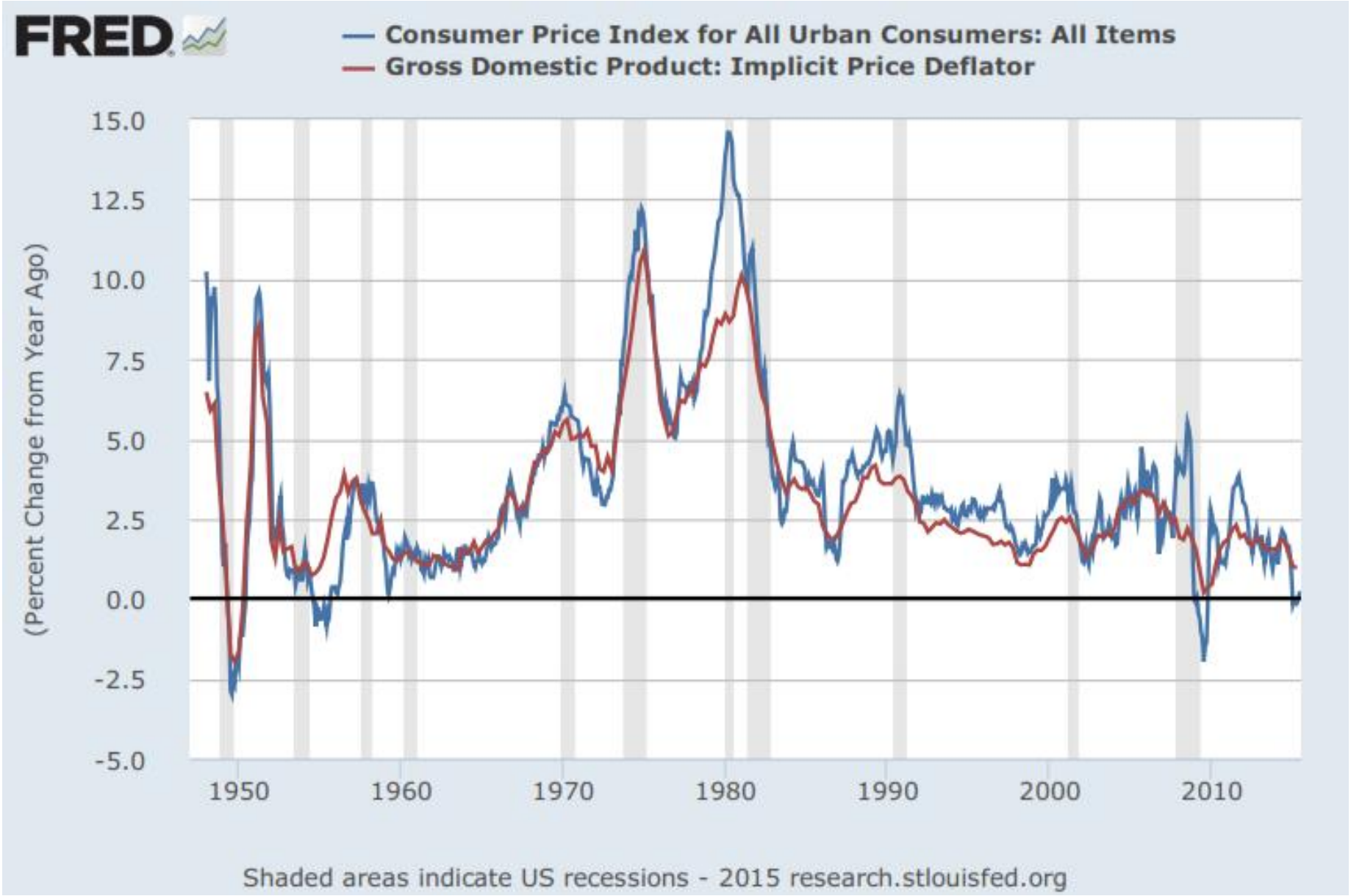
- Fixed prices
- Produced domestically
- Any component of GDP

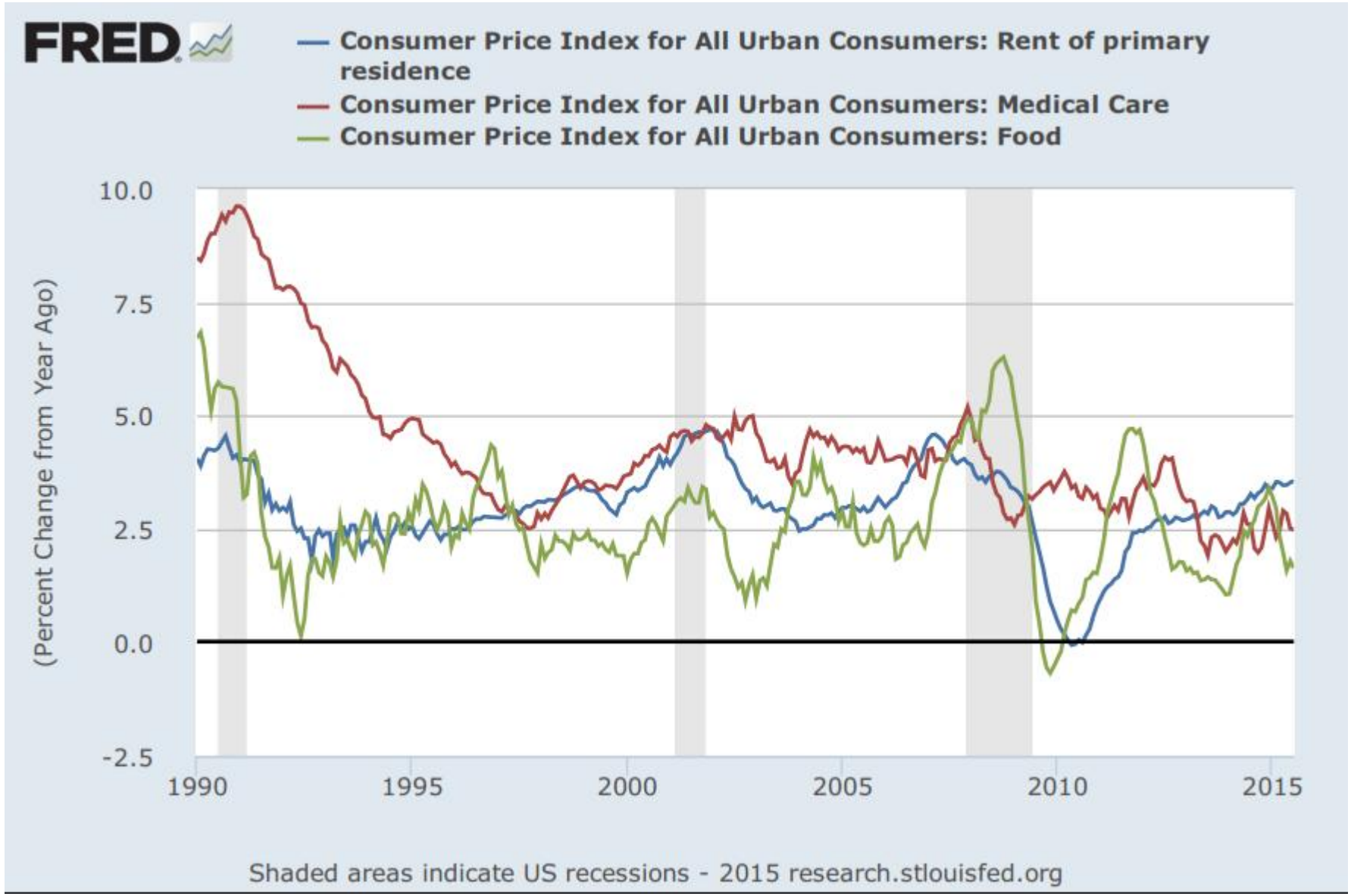
  Y= **C** + **I** + **G** + **NX**
- Any G&S produced in US

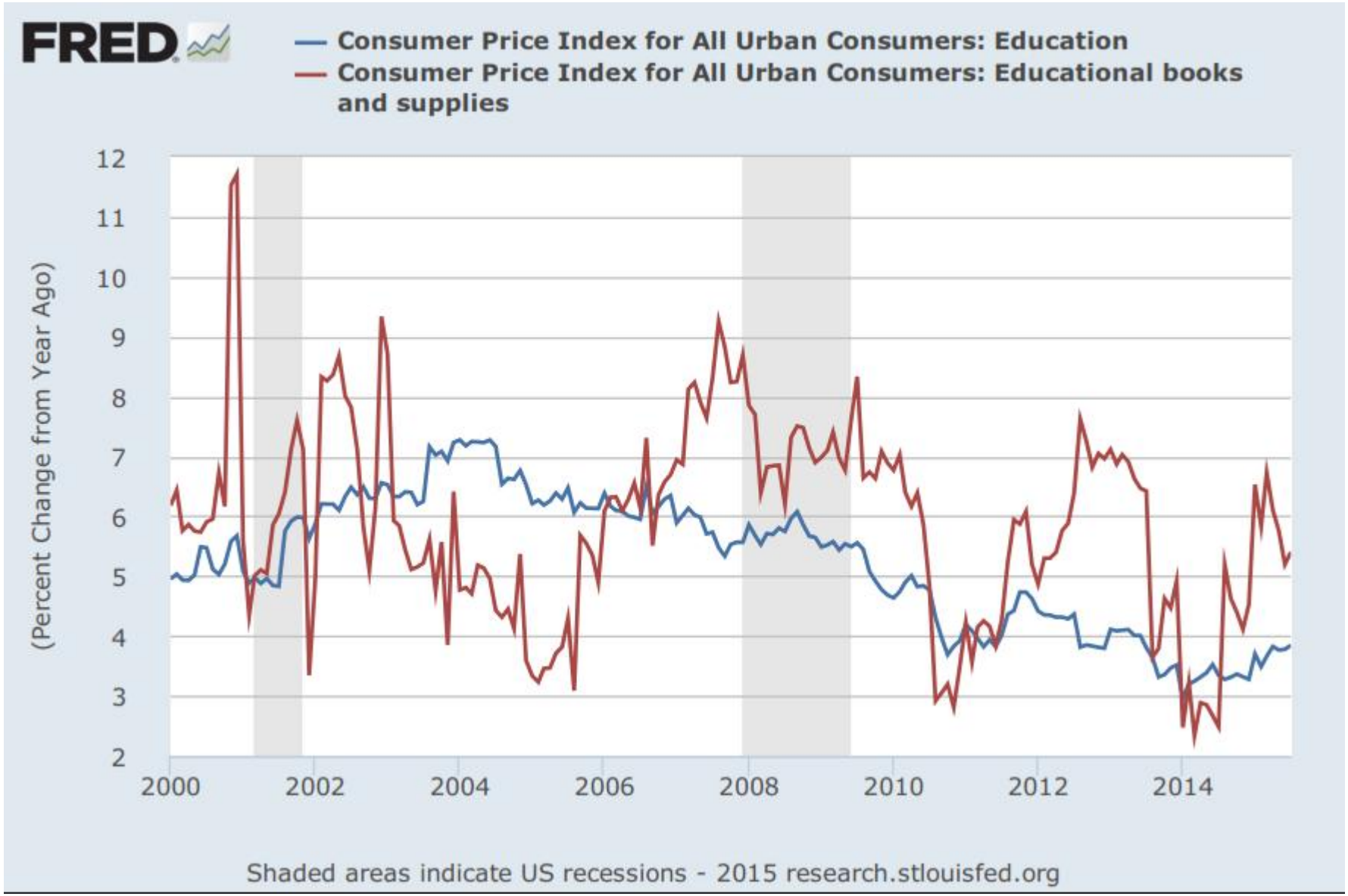
CPI

- Fixed quantity (or basket)
- Purchased by consumers
- C component of GDP
- G&S consumed by households in US

Inflation rates: CPI and GDP deflator




FRED
Consumer Price Index for All Urban Consumers: Rent of primary residence
Consumer Price Index for All Urban Consumers: Medical Care
Consumer Price Index for All Urban Consumers: Food
(Percent Change from Year Ago)
10.0
7.5
5.0
2.5
0.0
-2.5
1990
1995
2000
2005
2010
2015
Shaded areas indicate US recessions - 2015 research.stlouisfed.org


FRED
Consumer Price Index for All Urban Consumers: Education
Consumer Price Index for All Urban Consumers: Educational books and supplies
(Percent Change from Year Ago)
12
11
10
9
8
7
6
5
4
3
2
2000
2002
2004
2006
2008
2010
2012
2014
Shaded areas indicate US recessions - 2015 research.stlouisfed.org