

MEASURING MACROECONOMIC DATA

WEEK 3

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1. MEASURING GDP

THE CRUCIAL IMPORTANCE OF MEASUREMENT

"While the GDP and the rest of the national accounts may seem to be arcane concepts, they are truly among the great inventions of modern times."

Paul Samuelson and William Nordhaus, Nobel Prize winners

- Inaccurate/wrong measurements of macroeconomic aggregates may lead to dangerous or perverse policy measures.
- Private agents may make the wrong decisions.
- The state of the economy and our well-being may give a misleading view of the true state we are living in.
- In fact, in economics, there may be very few things more important than measuring correctly the main macroeconomic aggregates.

THE THREE METHODS OF MEASURING GDP

- The Production Approach
- The Expenditure Approach
- The Income Approach

- They are alternative ways of estimating the same value
- Due to measurement errors they lead to approximate values for GDP

THE PRODUCTION APPROACH

Definition: GDP. In the production approach, we define GDP as the *current market value* of all *final* goods and services (G&S) *newly* produced in the economy during a *given* period of time.

- "Market value": to exclude G&S not subject to market transactions
- "Final": to exclude transactions of intermediate G&S
- "Newly": to exclude transactions of G&S that were produced in the past
- "Given": to limit the period under consideration: a quarter, or a year
- $GDP = \sum$ Gross Value Added by each firm

PRODUCTION APPROACH: SPECIAL IMPUTATIONS

- **Housing owner services:** rents are considered in the computation of GDP because it is a service that is being provided to someone and is subject to a market transaction. Therefore, in the same way, the owner of a house does not pay rent, but is benefiting from a similar service. So, in the computation of GDP these "implicit" rents are considered in the calculation of GDP.
- **Government provision of goods:** public-goods like schooling, medical services, police, and others, are not subject to market transactions, but they are counted for GDP by their cost reported in the Budget.
- **Inventories:** firms' holdings of raw materials, unfinished goods, and unsold finished goods and their value is included in the GDP.

THE EXPENDITURE APPROACH

The expenditure approach allows us to get information on the different components of spending that add up to GDP. The national income accounts divide spending into four basic categories of **final goods and services (G&S)**:

$$Y = C + I + G + NX \quad (1)$$

- Y : GDP
- C : Personal Consumption expenditures
- I : Investment expenditures
- G : Government expenditures (only on G&S)
- NX : Net Exports = Exports – Imports

THE EXPENDITURE APPROACH: COMPOSITION

TABLE 2.1 GDP AND ITS COMPONENTS, 2012

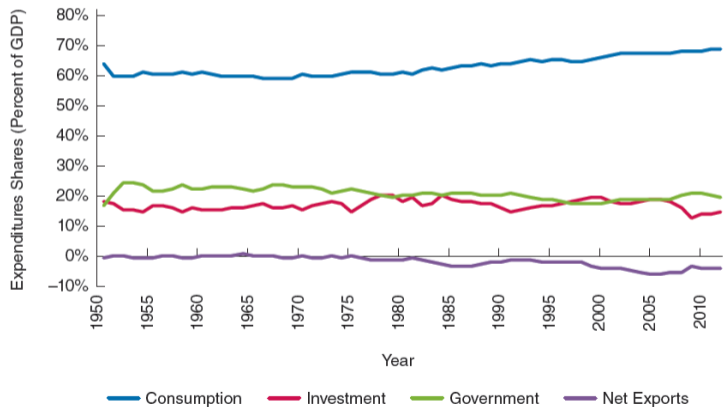
	Billions of Dollars	Percent of GDP
Personal consumption expenditure (C)	11,286	68.7
Consumer durables	1,231	7.5
Nondurable goods	2,595	15.8
Services	7,459	45.4
Investment (I)	2,500	15.2
Fixed investment	2,018	12.3
Inventory investment	13	0.14
Residential investment	469	2.9
Government purchases (G)	3,151	19.2
Federal	1,275	7.8
State and local	1,875	11.4
Net exports (NX)	- 516	- 3.1
Exports	2,214	13.5
Minus imports	2,730	16.6
Total = GDP (Y)	16,420	100.0

Source: Bureau of Economic Analysis. Table 1.1.5. www.bea.gov/national/nipaweb/SelectTable.asp?Selected=Y

Note: Numbers may not add up to the totals due to rounding.

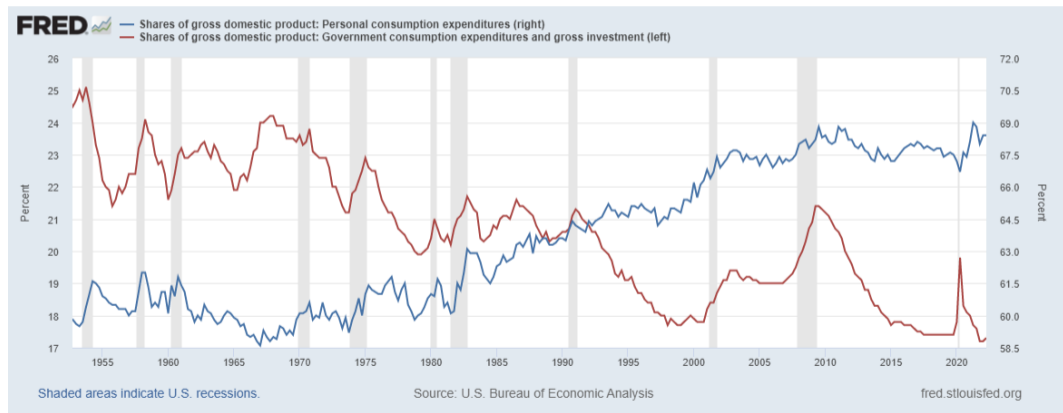
THE EXPENDITURE APPROACH: TIME SERIES I

Apparently, the expenditure components of GDP have remained relatively stable over time. A figure in the textbook may give such an impression.



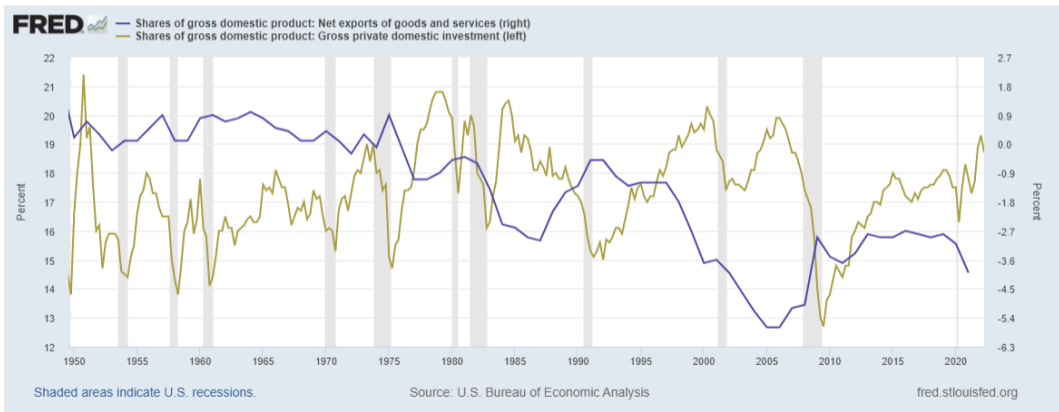
THE EXPENDITURE APPROACH: TIME SERIES II

Be careful with appearances. The impression from the previous figure ... is wrong. Private Consumption has gone up; Public Consumption has gone down.



THE EXPENDITURE APPROACH: TIME SERIES III

Be careful with appearances. Private Investment has remained relatively stable (its mean); Net Exports have gone down.



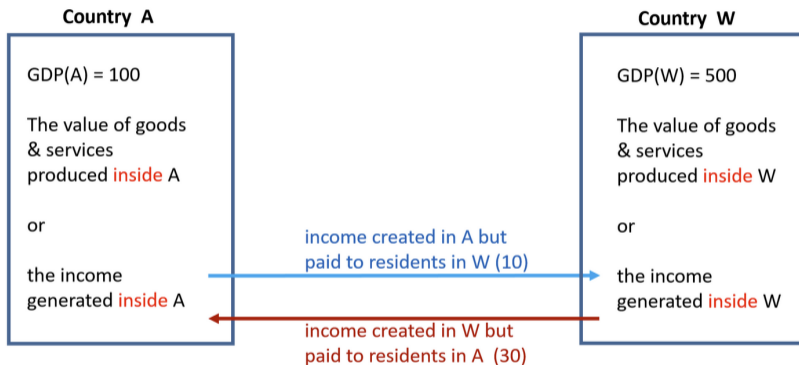
THE INCOME APPROACH

The third way of measuring GDP, the income approach, involves adding up all the incomes received by households and firms in the economy, including profits and tax revenue to the government.

- Compensation of employees +
- Other income: rents and interest income +
- Corporate profits +
- Depreciation +
- Net factor income (NFI)

NFI = income received by US residents from investments abroad
– income created in the US but paid to foreign residents abroad

NFI, GDP AND GNP: AN EXAMPLE



$$\begin{aligned} \text{GNP(A)} &= \text{GDP(A)} \\ &+ \text{income created in W but paid to residents in A} \\ &- \text{income created in A but paid to residents in W} \end{aligned} \left. \vphantom{\begin{aligned} \text{GNP(A)} &= \text{GDP(A)} \\ &+ \text{income created in W but paid to residents in A} \\ &- \text{income created in A but paid to residents in W} \end{aligned}} \right\} \text{Net factor income (NFI(A))}$$

$$\text{GNP(A)} = \text{GDP(A)} + \text{NFI(A)} = 100 + (30 - 10) = 120.$$

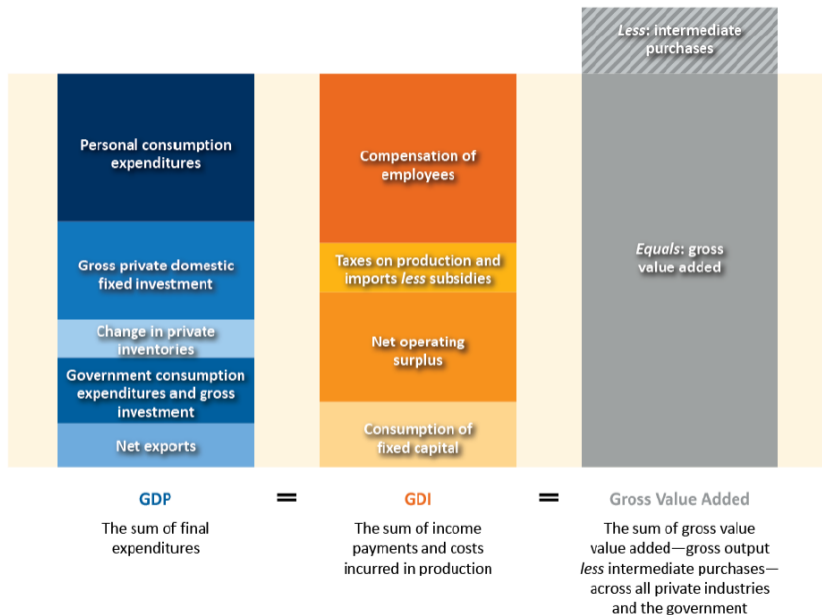
THE INCOME APPROACH: DISPOSABLE INCOME

There is another concept of income that is also very important in macroeconomics:
Private Disposable Income

Private disposable income =

- income received by the private sector
- + payments made to the private sector by the government
- taxes paid to the government

From:
 Bureau
 Economic
 Analysis
 (2019)
 pag.9



2. PRICE INDEXES

REAL VERSUS NOMINAL GDP

- Nominal variables: variables measured at *current prices*
- Real variables: variables measured at *constant prices*
- So Real GDP is just:

$$Real\ GDP = \frac{Nominal\ GDP}{Price\ level} \quad (2)$$

- How do we measure the "Price level"?
- The technique of price indexes will do that for us.

TECHNIQUES TO CONSTRUCT PRICE INDEXES

- Built upon a fixed base year.
- Built upon a chain-weighting process. **Not covered, due to lack of time.**

FIXED BASE YEAR INDEXES: AN EXAMPLE

Suppose an economy produces only apples & oranges: periods 1,2:

	Apples	Oranges
Quantity in Year 1	$Q_1^a = 50$	$Q_1^o = 100$
Price in Year 1	$P_1^a = \$1.00$	$P_1^o = \$0.80$
Quantity in Year 2	$Q_2^a = 80$	$Q_2^o = 120$
Price in Year 2	$P_2^a = \$1.25$	$P_2^o = \$1.60$

- What is the level of Nominal GDP for periods 1 and 2?
- What is the rate of growth of Nominal GDP between these two periods?
- What is the level of Real GDP for both periods, at prices of period 1?
- What is the growth rate of Real GDP between these two periods, using period 1 as the base year?

PERIOD 1 BASE YEAR: NOMINAL GDP

- Nominal GDP is simply current prices multiplied by current quantities

$$GDP_1 = 50 \times 1 + 100 \times 0.8 = 130 \text{ dollars}$$

$$GDP_2 = 80 \times 1.25 + 120 \times 1.6 = 292 \text{ dollars}$$

- Nominal GDP grows between periods 1 and 2 at a rate

$$\left(\frac{GDP_2}{GDP_1} - 1 \right) = 124.6\%$$

PERIOD 1 BASE YEAR: REAL GDP

- If period 1 is the base year, $realGDP_1$ has to be equal to nominal GDP1

$$realGDP_1 = GDP_1 = 130 \text{ dollars}$$

- $realGDP_2$ is calculated as if prices remain constant (equal to period 1)

$$realGDP_2 = 80 \times 1 + 120 \times 0.8 = 176 \text{ dollars}$$

- Then, using period 1 as the base year, real GDP grows between periods 1 and 2 at a rate

$$g_{b1} = \left(\frac{realGDP_2}{realGDP_1} - 1 \right) = 35.38\%$$

PERIOD 2 BASE YEAR: NOMINAL GDP

- Nominal GDP in period 1 and period 2 do not change if we change the base year. By definition *they are measured at current prices*.
- However, real GDP will change for both periods, as we will see next.

PERIOD 2 BASE YEAR: REAL GDP

- If period 2 is the base year, $realGDP_2$ has to be equal to nominal GDP_2

$$realGDP_2 = GDP_2 = 80 \times 1.25 + 120 \times 1.6 = 292 \text{ dollars}$$

- $realGDP_1$ is calculated as if prices remain constant (equal to period 2)

$$realGDP_1 = 50 \times 1.25 + 100 \times 1.6 = 222.5 \text{ dollars}$$

- Then, using period 2 as the base year, real GDP grows between periods 1 and 2 at a rate

$$g_{b2} = \left(\frac{realGDP_2}{realGDP_1} - 1 \right) = 31.23\%$$

BASE YEAR: PERIOD-1 VS PERIOD-2

- Using period 1 as the base year, real GDP grows at:

$$g_{b1} = 35.38\%$$

- Using period 2 as the base year, real GDP grows at:

$$g_{b2} = 31.23\%$$

- So we are left with no definitive answer, if we update the base year.
- From time to time, National Accounts have to update the base year.
- Problem: every time we update the base year, we rewrite the economy's history.
- How to overcome this problem? Apply the **Chain Weighted Index** method.
- Don't have time for covering this point.

CALCULATE THE PRICE INDEX

- After choosing one base year, we can calculate the Price Index by applying

$$Real\ GDP = \frac{Nominal\ GDP}{Price\ level} \quad (3)$$

- Let's assume year-1 as the base year. The Price Index level for year-1 (PI_1) is:

$$PI_1 = NominalGDP_1 / RealGDP_1 = 130 / 130 = 1$$

- The Price Index level for year-2 comes

$$PI_2 = NominalGDP_2 / RealGDP_2 = 292 / 176 = 1.659$$

- Rate of inflation=? The rate of inflation is rate of change in the Price Index:

$$inflation = (1.659 - 1) / 1 = 65.9\%$$

- Exercise: derive the rate of inflation, using year-2 as the base year and compare.

DIFFERENT MEASURES OF INFLATION

In National Accounts there are more than one measure of inflation. The most important ones are:

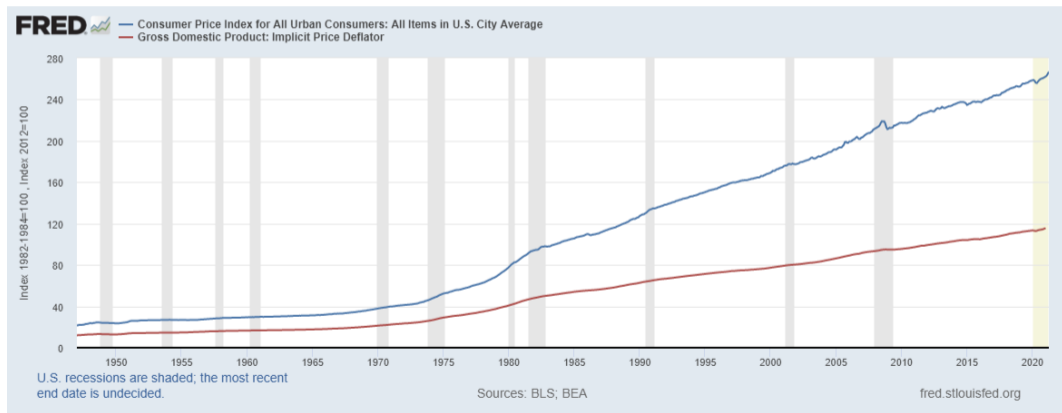
- **GDP deflator:** it includes all the components of GDP and is calculated as:

$$GDP\ Deflator = \frac{Nominal\ GDP}{Real\ GDP}$$

- **Consumer Price Index (CPI):** it is widely used as the "measure of inflation" and is calculated using a basket of goods that are representative of the consumption patterns within the country.
- **Housing Price Index:** developed by Nobel Prize winner Robert Shiller and the S&P ratings company.

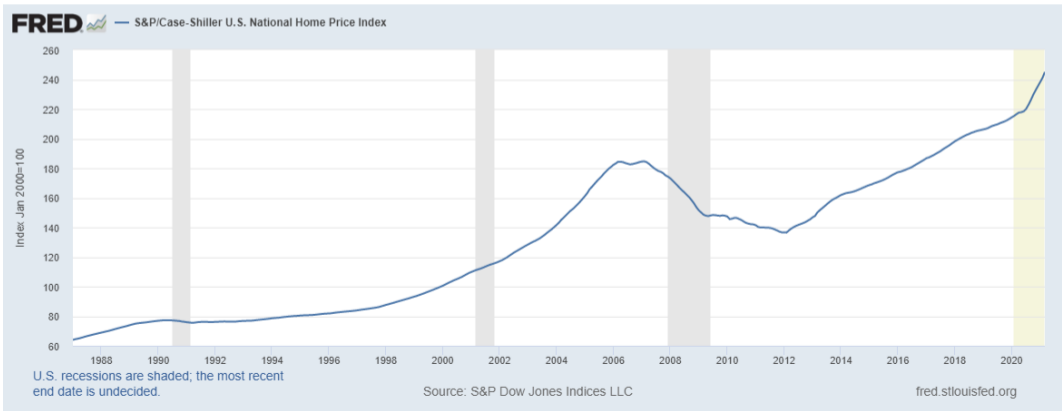
GDP DEFLATOR VS CPI

Goods & Services bought for private consumption saw their prices increasing more than those of the other components of GDP since the 1940's.



THE HOUSING PRICE INDEX

The Housing Price Index started to be developed only in the 1980s. Nowadays, it is one of the most important macroeconomic variables because of the tremendous impacts that a housing bubble may have on the entire economy. The financial crisis that started in 2007 was triggered by the burst of a housing bubble.



SOME CAUTION WITH PRICE INDEXES

- A wrong measure of a price index will lead to a wrong measure of real GDP and social well-being.
- With the introduction of *new goods*, the GDP deflator is artificially greater than its true value, underestimating the true value of real GDP.
- The *quality improvements* are so dramatic that it seems impossible to get a truly accurate measure for the Real GDP deflator. A personal computer may cost today (in real terms) the same as in 1990. But a today's computer can do what a million computers could not do in 1990.
- Another point (usually not mentioned in more conventional textbooks): *sustainability*. A higher depreciation rate leads to lower real Income. If we are polluting too much, repairing to guarantee sustainability should be much higher than currently is. This implies that we are consuming too much above what is the "really" sustainable level of real Income.

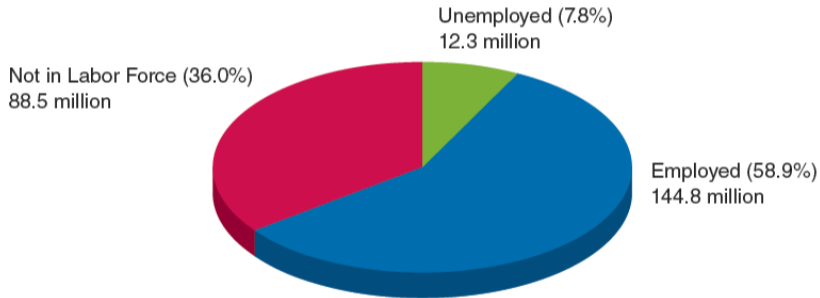
3. OTHER IMPORTANT MACRO AGGREGATES

ADULT CIVILIAN POPULATION

The total adult civilian population [16 years, 66 years] is divided into 2 major groups:

- **Labor Force** = Number of Employed + Number of Unemployed
 - **Employed.** If the person is working, either full time or part time, during the past week, or was temporarily away from his or her job because of illness, vacation, or the inability to get to work because of bad weather.
 - **Unemployed.** If the person did not work during the past week, but had looked for a job over the previous four weeks, or was waiting to return to a job from which he or she had been laid off.
- **Not in the labor force.** If the person did not work during the past week and had not looked for a job over the previous four weeks.

ADULT CIVILIAN POPULATION: USA (2013)



DIFFERENT KINDS OF UNEMPLOYMENT

- The **natural** rate of unemployment
 - The rate that would prevail if the economy were neither in a boom nor in a bust.
 - It is the sum of *frictional* and *structural* unemployment
 - ▶ **Frictional** unemployment: workers being between jobs in the dynamic economy
 - ▶ **Structural** unemployment: labor market failing to match up workers and firms in the market
- **Cyclical** unemployment
 - The difference between the actual rate and the natural rate.
 - Associated with short-run fluctuations in output.
- Actual unemployment: sum of **frictional**, **structural**, and **cyclical** unemployment

MEASURING INTEREST RATES

An interest rate is the cost of borrowing, or the price paid for the rental of funds (money). In a market economy there are a large number of interest rates, but we will concentrate on short term interest rates. In this group, the most important are:

- **Federal funds rate.** The interest rate charged on overnight loans between banks (referred to as federal funds because the loans are of deposits that are held at the Federal Reserve). The Federal Reserve targets this rate to conduct monetary policy.
- **Three-Month Treasury Bill.** The interest rate on U.S. Treasury bills (government bonds with maturities of three-months). Interest rates on Treasury bills are a general indicator of short-term interest rate movements.
- **London Inter-Bank Offered Rate (LIBOR).** The interest rate that banks in London offer each other for inter-bank loans. It is a good indicator of short-term interest rate developments in international markets.

REAL VERSUS NOMINAL INTEREST RATES

- **Nominal interest** rates are only relevant for arbitrage/speculation.
- For decision making about real economic activity (long term real investment, buying a house), relevant is the *real interest rates*.
- **The Fisher equation.** This equation highlights a simple but very important relationship:

$$r = i - \pi \quad (4)$$

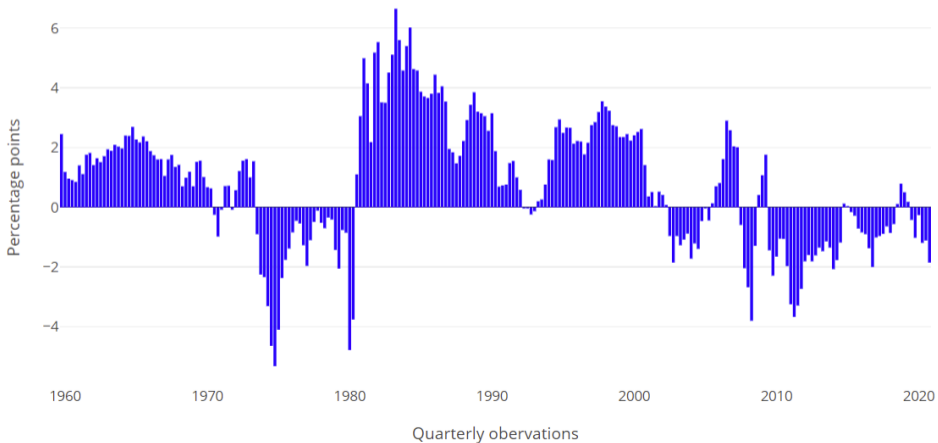
i : nominal interest rate, r : real interest rate, π : inflation rate

- Under normal conditions, nominal interest can not go below 0%.
- What about real interest rates?

CAN REAL INTEREST RATES BE NEGATIVE?

3-Month Treasury Bills rate minus CPI rate: USA (1959.Q4–2020.Q4)

Real Interest Rate: USA (1959.Q4--2020.Q4)



4. READINGS

READINGS

- Read Chapter 2 of the adopted textbook:

Frederic S. Mishkin (2015). *Macroeconomics: Policy & Practice*, Second Edition, Pearson Editors.

- For the issue of Price Indexes, it is better if you read the section 2.3 "Nominal and Real GDP and Price Indices" in Chapter 2, pages 68–71, in the following textbook:

Stephen Williamson (2018). *Macroeconomics*, Sixth Edition, Pearson Editors.