Macroeconomic Data

The Plan

- Overview of macroeconomic data...
  - GDP: What it is, How it's measured.
  - Real vs. Nominal: Separating prices from quantities.
  - Measuring labor market performance.
  - FRED: How to get data.

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GDP

- GDP = Gross Domestic Product
- GDP = the market value of final goods and services newly produced within a nation during a fixed period of time.
  - **Market value** (it allows to add up different products, but misses home production; black economy; non-traded government services)
  - **New goods** (i.e., not second-hand exchanges)
  - **Within a nation**: domestic location (not citizenship)
  - A measure of **final** goods and services (why? See next slide)
  - **Gross** of depreciation, i.e., it does not embody capital consumption due to wear and tear (Example: reduction in value of a car used by a taxi company)

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Three Ways to Compute GDP

How to compute GDP:

- GDP = Value added: Sales minus material input costs (intermediate inputs).
- GDP = Income: Payments to labor and capital (profits, rental income).
- GDP = Expenditure: Purchases of final goods and services, including exports minus imports

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GDP as Value Added

- Value added = sales − material input costs
- Example
  - Farmer produces wheat, sells it for 100
  - Miller buys wheat, produces flour, sells it for 175
  - Baker buys flour, makes bread, sells it for 300
- What is value added for each producer?
- What is GDP?

Intermediate vs Final Goods

- Why not sum over all goods?
  - TO AVOID DOUBLE COUNTING!
- Another example:
  - Goodrich Corporation manufactures and sells components and systems for aircraft. Say that it produces just one system per year for Boeing, worth $10M.
  - Boeing buys the system for its 787 aircraft; total value of the airplane is $80M.
  - The landing system produced by Goodrich is included in the $80M! The value of the final good (the airplane) includes the value of the intermediate parts (engines, frame, navigation system, etc.)

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GDP as Income

- GDP = payments to labor and capital
- In income but not in GDP
  - Capital gains
  - Interest on government debt
  - Net foreign income
- In GDP but not in income
  - Depreciation
- Bottom line GDP ≈ income

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GDP as Final Sales

- GDP = purchases of final goods and services, including exports minus imports
- Final goods/service purchases broken down in the following way...

  $GDP = C + I + G + NX.$
  - C = final sales new goods to households, "consumption"
  - I = final sales of new capital goods to firms, "investment"
  - G = purchases of new goods and services by government
  - NX = net exports, exports - imports

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More on Consumption, Investment, etc.

- C = final sales new goods to households, "consumption"
  - Includes, things like durable (i.e. long lasting) goods, nondurables, services.
- I = final sales of new capital goods to firms, "investment"
  - That is a physical asset used by firms in future production.
  - Includes: Firms spending on plant and equipment, residential spending by consumers and landlords on housing, change firms inventories
- G = purchases of new goods and services by government
  - Does NOT include transfer payments (i.e. food stamps/unemploymen insurance).

Problems in Measuring GDP

- How to measure government services?
  - Valued at cost, i.e. use the second approach (income side) to measure GDP.
- Ignores household production
- Ignores intangible investment
- Ignores "underground" economy
- Environment/Pollution
- Separate point — the formula $Y = C + I + G + NX$ says nothing about causality.

GDP Identities

- Now try the extended example.

Prices and Quantities

- We would like to measure changes in ...
  - quantities over time
  - quantities across countries
  - price changes over time
- Problem:
  - many goods in the economy
  - relative prices change across time
  - relative prices are different across locations

Language Prices and Quantities

- Terminology
  - GDP at current prices: "nominal" (value = price × quantity)
  - GDP at base-year prices: "real" (quantity)
  - GDP at PPP adjusted prices: "real" (quantity)
- Ok, how to we go from "nominal" to "real"?

With only one good: no problem!

- GDP *equals* price *times* quantity:

$$Y_t = p_t \times q_t$$

- Growth rate in GDP *equals* growth rate in price *times* growth rate in quantity

$$\frac{Y_t}{Y_{t-1}} = \frac{p_t q_t}{p_{t-1} q_{t-1}} = \frac{p_t}{p_{t-1}} \times \frac{q_t}{q_{t-1}}$$

With multiple goods?

	Fish		Chips	
Date	Price	Quantity	Price	Quantity
2016	0.50	10	0.25	10
2017	0.75	12	0.50	8

- The problem is that relative prices change!
- How to we go from "nominal" to "real"? Two ways to do this . . .
  - GDP Deflator
  - Consumer Price Index (Mankiw 2-2).

Approach #1: GDP Deflator Approach

- Basic Idea
  - Pick a base year
  - Evaluate current year quantities at base year prices

    2017 Real GDP in 2016 dollars $= p_{f,2016} q_{f,2017} + p_{c,2016} q_{c,2017}$
- To compute inflation?
  - Compute the Price Deflator $= \frac{\text{Nominal GDP}}{\text{Real GDP}}$.
  - Inflation is the **growth rate** of the price deflator.

GDP Deflator Approach

	Fish		Chips	
Date	Price	Quantity	Price	Quantity
2016	0.50	10	0.25	10
2017	0.75	12	0.50	8

- 2016 GDP

$$\text{Nominal GDP} = 0.50 \times 10 + 0.25 \times 10 = 7.5$$
$$\text{Real GDP} = 0.50 \times 10 + 0.25 \times 10 = 7.5$$

- 2017 GDP

$$\text{Nominal GDP} = 0.75 \times 12 + 0.50 \times 8 = 13.0$$
$$\text{Real GDP} = \mathbf{0.50} \times 12 + \mathbf{0.25} \times 8 = 8.0$$

GDP Deflator Approach

	Fish		Chips	
Date	Price	Quantity	Price	Quantity
2016	0.50	10	0.25	10
2017	0.75	12	0.50	8

- Real GDP Growth in percent

$$100 \times (\ln(2017 \text{ Real GDP}) - \ln(2016 \text{ Real GDP})) =$$
$$100 \times (\ln(8.0) - \ln(7.5)) = 6.45$$

GDP Deflator Approach

	Fish		Chips	
Date	Price	Quantity	Price	Quantity
2016	0.50	10	0.25	10
2017	0.75	12	0.50	8

- Price Deflator

$$\text{2016 P.D.} = \frac{\text{2016 Nominal GDP}}{\text{2016 Real GDP}} = 1$$
$$\text{2017 P.D.} = \frac{\text{2017 Nominal GDP}}{\text{2017 Real GDP}} = 1.625$$

GDP Deflator Approach

	Fish		Chips	
Date	Price	Quantity	Price	Quantity
2016	0.50	10	0.25	10
2017	0.75	12	0.50	8

- Inflation in percent

$$100 \times (\ln(2017 \text{ P.D.}) - \ln(2016 \text{ P.D.})) =$$
$$100 \times (\ln(1.625) - \ln(1)) = 48.6$$

Approach #2: CPI-Price Index Approach

- Basic Idea
  - Pick a base year
  - Construct a price index and evaluate current year prices at base year quantities:

    2017 Price Index in 2016 dollars $= p_{f,2017}q_{f,2016} + p_{c,2017}q_{c,2016}$

- See Mankiw 2-2. Work through this at home.

CPI-Price Index Approach

	Fish		Chips	
Date	Price	Quantity	Price	Quantity
2016	0.50	10	0.25	10
2017	0.75	12	0.50	8

2016 Price Index $= 0.50 \times 10 + 0.25 \times 10 = 7.5$

2017 Price Index $= 0.75 \times \mathbf{10} + 0.50 \times \mathbf{10} = 12.5$

CPI-Price Index Approach

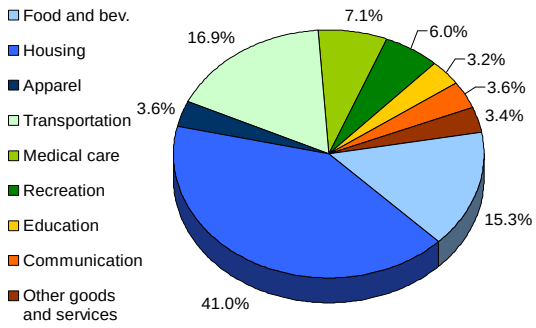
	Fish		Chips	
Date	Price	Quantity	Price	Quantity
2016	0.50	10	0.25	10
2017	0.75	12	0.50	8

- Inflation in percent

$100 \times (\ln(2017 \text{ Price Index}) - \ln(2016 \text{ Price Index})) =$

$$100 \times (\ln(12.5) - \ln(7.5)) = 51.1$$

Composition of the US CPIs "basket"



GDP Price Deflator vs CPI

Three key conceptual differences. . .

- GDP price deflator measures changes in prices for entire economy.

  CPI only measures prices of goods and services bought by consumers.

- GDP price deflator only measures changes in prices for domestic production. International effects are netted out.

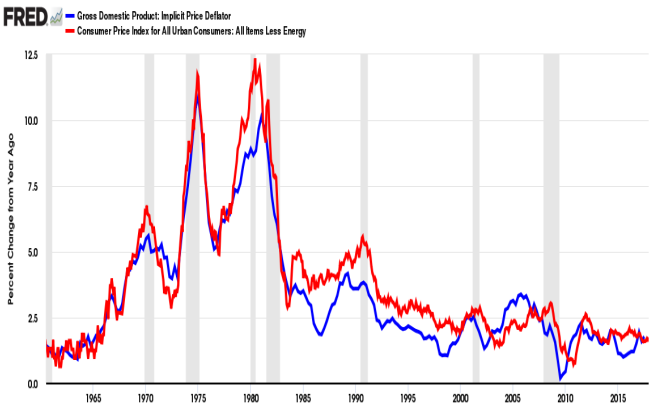
  CPI includes both domestically and imported goods.

- More subtle. They are different types of price indexes.

  GDP price deflator, the basket of goods can change. It will not completely reflect the costs of higher prices.

  CPI fixes the basket, but prices change. It will not reflect substitution effects as relative prices change.

GDP Price Deflator vs CPI



Cross-Country Comparisons

- Same problem as before: Prices differ across countries, but we want to compare quantities
- Similar solutions
  - Most common: Evaluate quantities at a common set of prices
  - PPP = "Purchasing Power Adjustment"

Measuring the Performance of the Labor Market. . .

Categories of the population

- Employed: working at a paid job
- Unemployed:not employed but looking for a job
- Labor force: the amount of labor available for producing goods and services; employed plus unemployed
- Not in the labor force: not employed, not looking for work

The Unemployment Rate and Labor Force Participation...

Two important labor force concepts

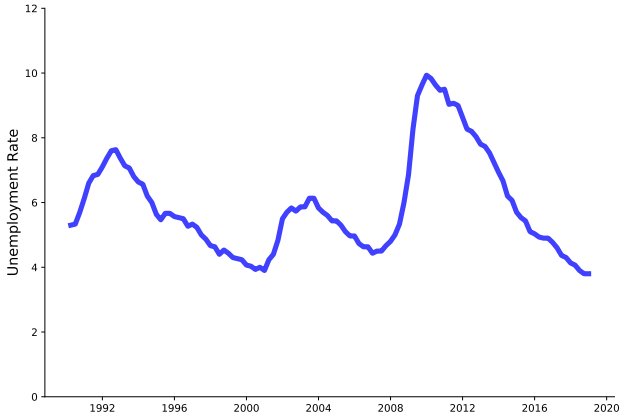
- Unemployment rate: percentage of the labor force that is unemployed

$$= 100 \times \frac{\text{Unemployed}}{\text{Labor force}}$$

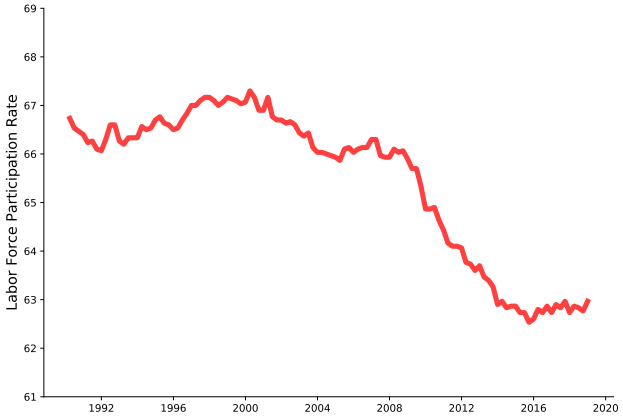
- Labor force participation rate: the fraction of the adult population that "participates" in the labor force, i.e. is working or looking for work

$$= 100 \times \frac{\text{Labor force}}{\text{Labor force} + \text{Not in Labor Force}}$$

US Unemployment Rate



US Labor Force Participation



Your Friend FRED

- Federal Reserve Economic Database (FRED): http://research.stlouisfed.org/fred2/
  - Basic tutorials
  - Mobile apps
  - Excel add-ins for Windows and Mac
- Basic graph: Enter code in FRED search box
- Edit graph to change dates, frequency, appearance, units, etc.
- PDF of graph
- Download data into Excel spreadsheet

FRED Data in Excel

- Start at FRED home page
- Graph the first data series that you wish to download
- Click Edit Graph
  1. Adjust the date range, frequency, units
  2. Click Add data series
  3. Enter new data code in the search box, repeat step 1 and click Redraw Graph
  4. Repeat steps (1) to (3) until the series are all graphed
- Click Download Data in Graph
- Save the Excel file for further analysis of data