Lecture 2 Measurement I
Economic Aggregates

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3 Approach to Measure GDP

Source: National Income and Product Accounts (NIPA)

1. **Product (value-added) approach**: sum of value added to all goods and services across all productive units in the economy
2. **Expenditure approach**: sum of spending on all final goods and services produced in the economy
3. **Income approach**: sum of all income received by economic agents contributing to production

If no measurement error, all should give the same answer!

3 Approach to Measure GDP: Example

Variable	Quantity ($M)		
	Coconut Producer	Restaurant	Government
Revenue*	20	30	5.5
sales for consumption	8	30	-
sales as intermediate	12	0	-
Costs	7	19	5.5
wages	5	4	5.5
interest on loan	0.5	-	-
cost of intermediates	-	12	-
taxes*	1.5	3	-
After-Tax Profits**	13	11	-

* government gets revenue from taxes on producers and consumers, spends wages to provide defense services
** profits are revenues minus costs

Question: how to calculate GDP?

The Product Approach

Question: What is the value added by each agent?

- **Coconut Producer**: Final good $\$20M$, no intermediate input
- **Restaurant**: Final goods $\$30M$, with intermediate input $\$12M$ from Coconut Producer
  - value added: $30 - 12 = 18M$
- **Government**: Defence services, valued at cost $\$5.5M$
- **GDP**: $20 + 18 + 5.5 = 43.5M$

The Expenditure Approach

Question: What is the total spending?

- **Formula**: $Y = C + I + G + NX$
- **Consumption** (C): "sale for consumption" row
  - To Coconut Producer: $8M$
  - To Restaurant: $30M$
- No investment (I) and net export (NX).
- **Government** (G): defense service $5.5M$
- **GDP** (Y): $38 + 5.5 = 43.5M$

Income Approach

Question: how much does agent earn?

- **Workers**: wages $5M$ from Coconut Producer, $4M$ from Restaurant and $5.5M$ from Government
- **Firms**:
  - After-tax Profits: $13M$ to Coconut Producer and $11M$ to Restaurant
  - Interest on loan: $0.5M$ for Coconut Producer
- **Government**: Taxes $1.5M$ from Coconut Producer and $3M$ from Restaurant
  - Expenditure is $5.5M \Rightarrow$ budget deficit
- **GDP**: $5 + 4 + 5.5 + 13 + 11 + 0.5 + 1.5 + 3 = 43.5M$

Income-Expenditure Identity: Income earned goes to expenditure

Prices in GDP measurement

The revenue row is calculated by $10M$ coconuts $\times$ $\$2$ each

- What if coconut price increases to $\$3$ next year?

Solution: common price index across different time

Two ways to build common price index:

1. GDP deflator: common GDP standard
2. Consumer Price Index (CPI): common consumption basket (Q)

Prices in GDP measurement (Cont.)

- GDP deflator: ratio between nominal and real GDP
  1. Calculate real GDP relative to base year by base year price level
     - E.g. $RealGDP_{2020}$ = Cost of Q_{2020} at P_{2000}, use 2000 as base year
     - While $NominalGDP_{2020}$ = Cost of Q_{2020} at P_{2020}
     - Problem: choose which year? $\Rightarrow$ "chain-weighting" (rolling base)
  2. Calculate ratio: $\frac{NominalGDP_{2020}}{RealGDP_{2020}} \times 100$
- CPI: normalize consumption basket of base year as 100, relative to other year
  - E.g. $CPI_{2020} = \frac{\text{Cost of } Q_{2000} \text{ at } P_{2020}}{\text{Cost of } Q_{2000} \text{ at } P_{2000}} \times 100$, use 2000 as base year
  - Problem:
    1. ΔP outside of consumption basket & not accounted
    2. new goods & services introduced, old goods & services obsolete

Example: Nominal v.s. Real GDP

- **Nominal GDP**: value of goods & services at current price
- **Real GDP**: value of goods & services at base year price

	Apples		Oranges		GDP Measure		
Year	Quantity	Price	Quantity	Price	Nominal	Real (base year =1)	Real (base year = 2)
1	50	$1.00	100	$0.80	$130	$130	$222.5
2	80	$1.25	120	$1.60	$292	$176	$292

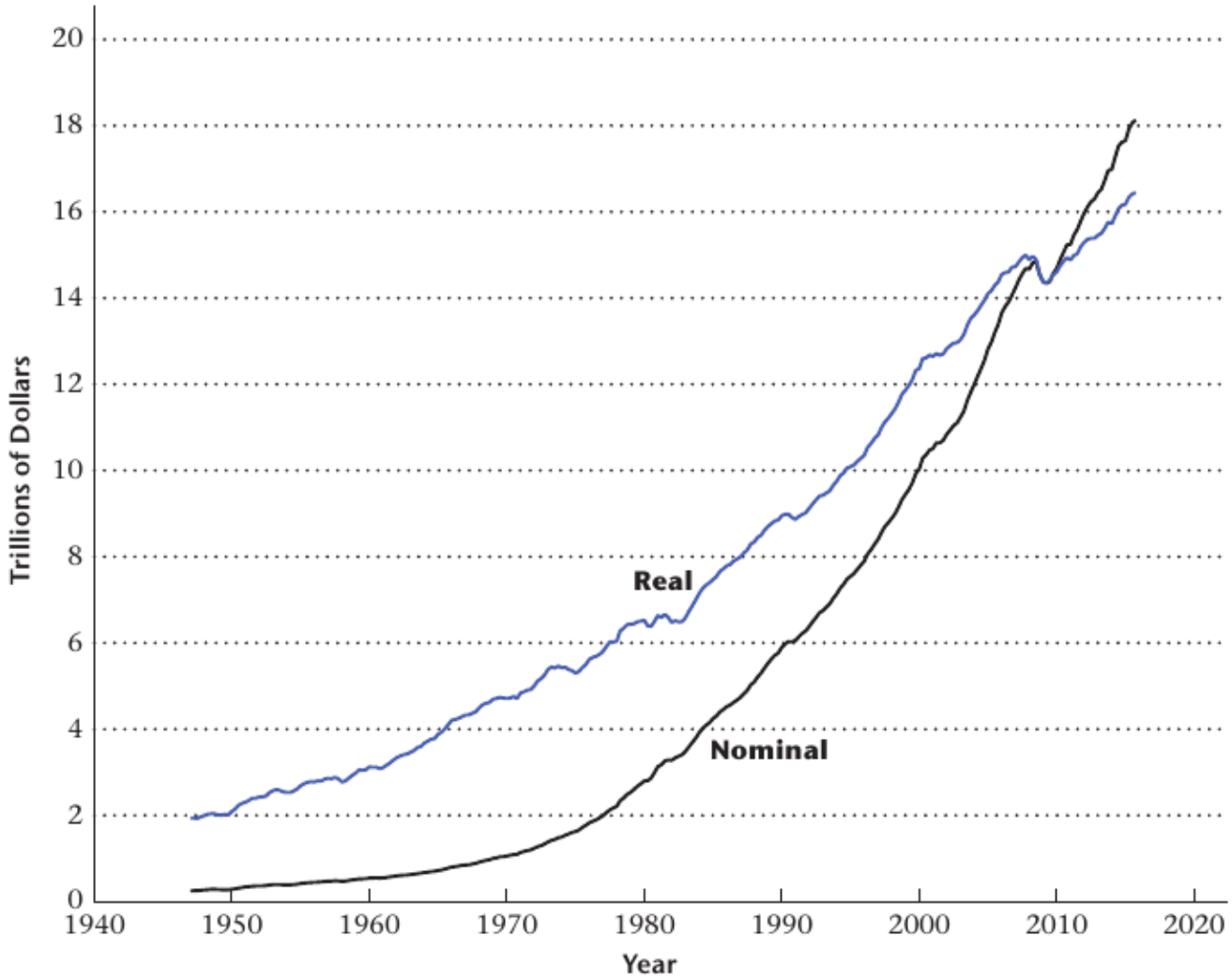
Choice of base year affects the GDP measure!

alternative: chain-weighting

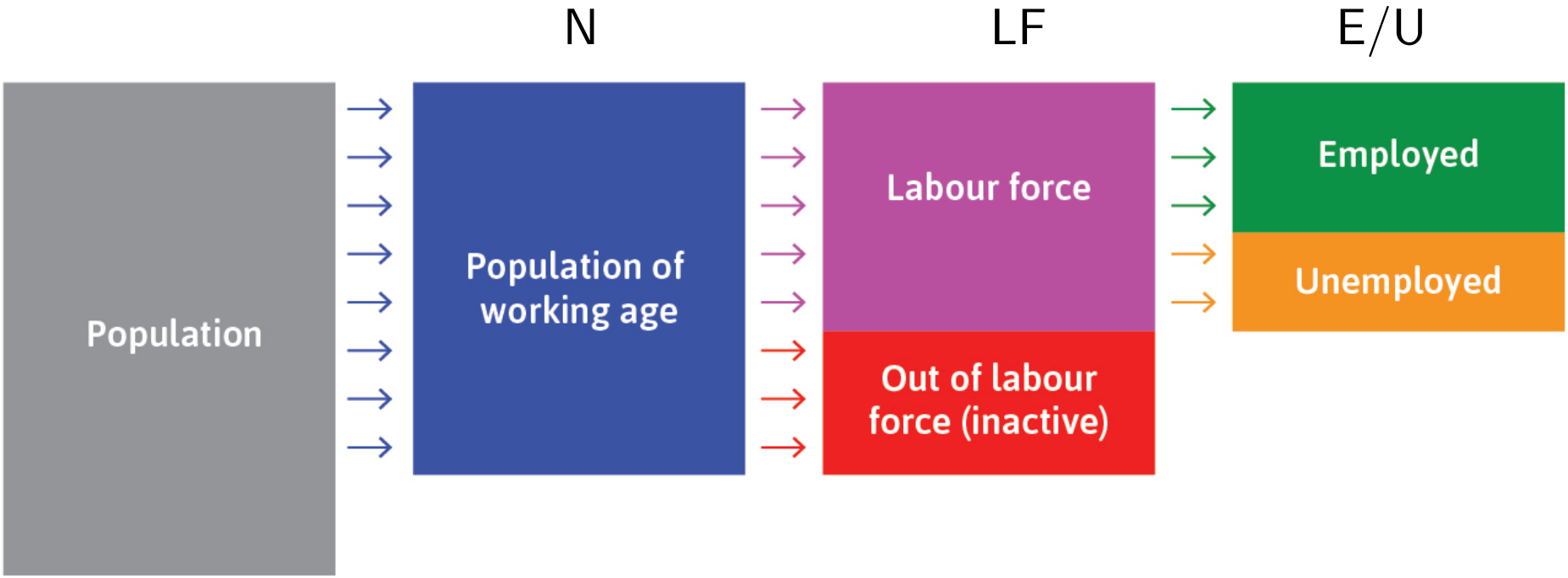
Data: Nominal v.s. Real GDP

- inflation growth + economics growth = nominal grows faster than real
- **Question**: What year is the base year on this graph?
- Ans: 2009, when Nominal = Real

Figure 2.1 Nominal GDP and Chain-Weighted Real GDP



Population Composition



- participation rate $= \frac{LF}{N}$
- unemployment rate $= \frac{U}{LF}$
- employment rate $= \frac{E}{N}$