

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. $RealGDP_{2020} = \text{Cost of } Q_{2020} \text{ at } P_{2000}$, use 2000 as base year
- While $NominalGDP_{2020} = \text{Cost of } Q_{2020} \text{ at } P_{2020}$
- **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

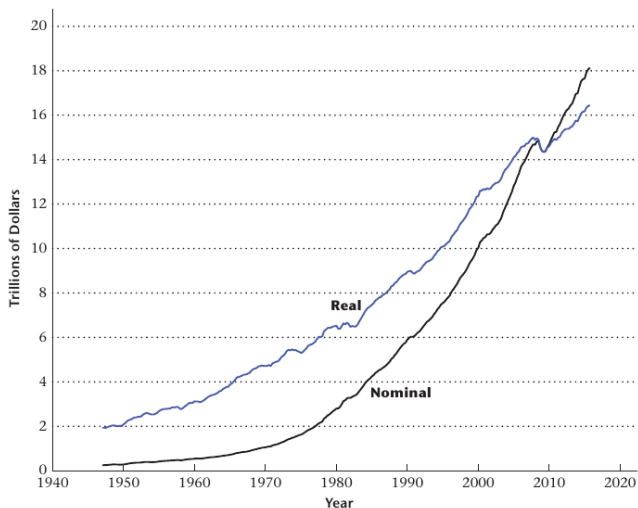
Choice of base year affects the GDP measure!

alternative: chain-weighting

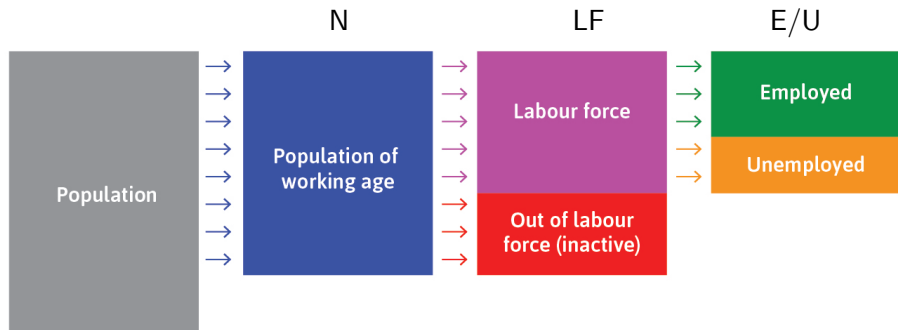
Data: Nominal v.s. Real GDP

- 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 = $\frac{E}{N}$

Appendix