

Lecture 2

Measuring Economic Activity

September 2009

Gross Domestic Product

- **Gross Domestic Product (GDP or Y):** Market value of final goods and services newly produced within a country during a fixed period of time.
- **Intermediate goods:** Goods and services used in the process of production.
- Intermediate goods are **not** included in GDP: Avoids double-counting.
- Capital vs. intermediate goods
 - Intermediate: Consumed within one period
 - **Capital:** Not consumed within one period.
 - Capital goods **are** included in GDP.
- **Inventories:** Stocks of goods that firms hold in storage. Changes in inventories **are** included in GDP.

The Value-Added Approach

- **Value Added:** Value of output less value of inputs purchased from other producers.
- Calculate GDP by summing value added across sectors.
- Example:
 - Economy produces \$400 of wheat and \$800 of bread.
 - Baker buys all the wheat for bread.
 - Final goods: \$800
 - Value-added: \$400 by farmer + \$400 by baker = \$800

Other Features of GDP

- Newly produced goods and services only.
- Output assigned by physical location, not citizenship.
 - $GNP = GDP + NFP$
 - GDP = output produced domestically.
 - GNP = **Gross National Product**
= output produced by domestic citizens.
 - NFP = **Net factor payments from abroad**
= foreign income paid to domestic factors
– domestic income paid to foreign factors.
- Fixed period of time: GDP is a flow variable, measured in units per unit of time.
- Each good or service “weighted” by its market value.
- Many non-market activities are excluded.
- Ultimate uses are irrelevant.

Fundamental Identity of National Accounting

- Fundamental Identity of National Accounting:
Total production = total expenditure = total income.
- Total production: Value added
- Total expenditure: $Y = C + I + G + NX$
 - C = consumption
 - G = government purchases of goods and services
 - NX = net exports = exports - imports
 - I = investment = $PFI + II$
 - PFI = private fixed investment
 - II = inventory investment = change in inventories
 - Unsold/unused production goes into II

Fundamental Identity of National Accounting (Continued)

- Total income = $GNP = Y + NFP =$
wages + interest + rents + other business expenses + taxable profits
 - “Wages” include non-wage benefits.
 - Other business expenses include
 - Depreciation: capital that wears out
 - Indirect business taxes
 - Taxable profits = Revenues – wages – interest – rents – other expenses

Fundamental Identity of National Accounting (Continued)

Income Approach to Measuring U.S. GDP, 2007

	\$Billions
Compensation of Employees	7,856.5
Proprietors' Income	1,096.4
Rental Income	144.9
Corporate Profits	1,541.7
Net Interest	739.2
Subtotal	11,378.7
Plus: Indirect taxes, miscellaneous income and Statistical Discrepancy	1054.7
Equals: Net National Product	12,433.4
Plus: Consumption of fixed capital	1,760.0
Equals: Gross National Product	14,193.4
Less: Income receipts from the rest of the world	861.8
Plus: Income payments to the rest of the world	746.0
Equals: Gross Domestic Product (GDP)	14,077.6

Fundamental Identity of National Accounting Illustrated

Coconut Producer

Total Output	\$20.0
Wages	\$5.0
Interest on Loan	\$0.5
Indirect Taxes	\$1.5
Profits	\$13.0

Restaurant

Total Output	\$30.0
Cost of Coconuts	\$12.0
Wages	\$4.0
Indirect Taxes	\$3.0
Profits	\$11.0

Government (Military)

Tax Revenue	\$5.5
Wages	\$5.5

Consumers

Wage Income	\$14.5
Interest Income	\$0.5
Profits	\$24.0
Pre-tax Income	\$39.0
Taxes	\$1.0

Fundamental Identity Illustrated (Continued)

GDP by Product

(Value Added)

V.A.: Coconuts	\$20.0
V.A.: Restaurant	\$18.0
V.A.: Government	\$5.5
GDP	\$43.5

GDP by Expenditures

Consumption	\$38.0
Investment	\$0.0
Government Spending	\$5.5
Net Exports	\$0.0
GDP	\$43.5

GDP by Income

Wage Income	\$14.5
Interest Income	\$0.5
Indirect Taxes	\$4.5
Profits	\$24.0
GDP	\$43.5

National Saving

- Private **disposable income**:

$$DI = Y + NFP + TR + INT - T,$$

T = total taxes,

TR = transfers from government,

INT = interest on government debt,

- Private saving

$$S_p = DI - C.$$

- Government saving/surplus

$$S_g = T - (TR + INT + G)$$

- D = government deficit = $-S_g$

- National saving

$$S = S_p + S_g = Y + NFP - C - G$$

= Resources (income) not consumed.

Current Account Surplus

- Current account Surplus (CA) = $NX + NFP$: Net resources transferred abroad
- Domestic saving is either spent on domestic investment, or shipped abroad.

$$\begin{aligned} S &= GNP - C - G \\ &= I + CA. \end{aligned}$$

- $I = S - CA$: Investment is paid for either by domestic saving or foreign lending.
- Uses-of-saving identity:

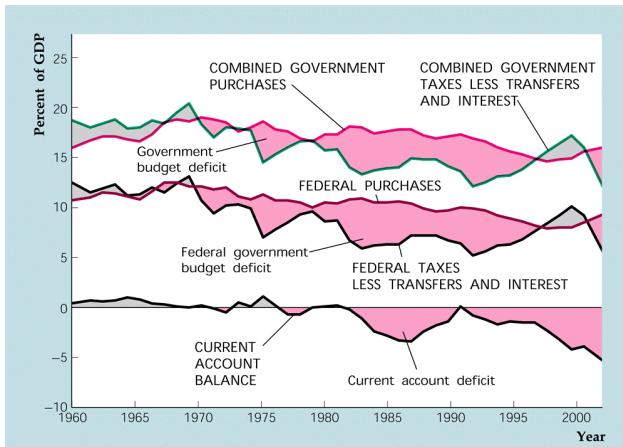
$$\begin{aligned} S_p &= I + CA - S_g \\ &= I + CA + D \end{aligned}$$

Private Saving = Investment + Foreign Lending + Gov't Deficit

- Twin deficits: $D \uparrow \Rightarrow CA \downarrow$, **if** $S_p - I$ does not change.

Uses-of-Saving Identity

Figure 5.8 The government budget deficit and the current account in the United States, 1960-2002



Abel and Bernanke, *Macroeconomics*, Copyright © 2005 Pearson Addison-Wesley. All rights reserved.

- National Wealth = domestic physical assets + net foreign assets
- Domestic financial assets cancel out, foreign financial assets do not.
 - **Asset:** A property or legal claim that stores value
 - **Liability:** An asset owed to another party
 - Domestic financial assets \approx domestic financial liabilities
- Stocks vs. flows
 - **Flows:** measured per unit of time
 - **Stocks:** measured at a point in time
 - A stock is a cumulation of flows.
- Wealth is a stock, the cumulation of net saving/investment.

Quantity Indices

- Real vs. nominal
 - **Nominal:** money values
 - **Real:** Physical Quantities
- Nominal GDP in year j :
 - $NGDP_j = P_j^A Q_j^A + P_j^B Q_j^B + \dots$,
 - Superscripts denote type of good (apples, bananas), subscripts denote year.
- Growth in nominal GDP represents growth in physical quantities and growth in prices.
 - Use quantity indices to measure growth in quantities.
 - Use price indices to measure growth in prices (inflation).

Quantity Indices (continued)

- Nominal GDP in year j :
 - $NGDP_j = P_j^A Q_j^A + P_j^B Q_j^B + \dots$,
 - Superscripts denote type of good (apples, bananas), subscripts denote year.
- Real GDP in year j , using base-year-0 prices:
 $RGDP_j^0 = P_0^A Q_j^A + P_0^B Q_j^B + \dots$
 - Superscripts on $RGDP_j^i$ denote base year: prices from base year i
 - Subscripts on $RGDP_j^i$ denote year for which quantities are being measured: quantities from year j .
- Choice of base year can matter.

Chain-Weighted Quantity Indices

- Moving base year: handles changing relative prices.
- Compare, say, years 1 and 2.
- Using year-1 prices, calculate real GDP in both years and the **gross** growth rate of real GDP, $G_1 = \frac{RGDP_2^1}{RGDP_1^1}$.
- Using year-2 prices, calculate real GDP in both years and the gross growth rate of real GDP, $G_2 = \frac{RGDP_2^2}{RGDP_1^2}$.
- Find the **geometric average** growth rate, $G_C = \sqrt{G_1 G_2}$.
- If year 1 is the base year:

$$RGDP_1^C = NGDP_1,$$

$$RGDP_2^C = RGDP_1^C \times G_C.$$

- Keep calculating average growth rates and “chain” together.

Chain-Weighted Quantity Indices: Exercise

	Year 1	Year 2	Year 3
Quantity Apples	50	80	90
Quantity Oranges	100	120	140
Price Apples	\$1.00	\$1.25	\$2.00
Price Oranges	\$0.80	\$1.60	\$2.00
Nominal Output			
Gross Growth Rate	NA		
Real Output at Year-1 prices			
Gross Growth Rate	NA		
Real Output at Year-2 prices			
Gross Growth Rate	NA		
Real Output at Year-3 prices			
Gross Growth Rate	NA		
2-Year Geometric Averages (G_C)	NA		
Chain-weighted Output: Year-1 base			
Chain-weighted Output: Year-2 base			

- **GDP Deflator:**

- Nominal Value = Real Value \times Price \Rightarrow Price = $\frac{\text{Nominal Value}}{\text{Real Value}}$

- GDP Deflator using base year-0 prices:

$$\text{GDP Deflator}_j^0 = \frac{NGDP_j}{RGDP_j^0} \times 100.$$

- Calculate chain-weighted deflator with chain-weighted GDP.
- Fixed-weight Price Indices (e.g., **Consumer Price Index**)

- Calculate total cost of a “basket” of goods.

- $CPI_j^0 = \frac{\text{Cost of year-0 basket at year-}j \text{ prices}}{\text{Cost of year-0 basket at year-0 prices}} \times 100.$

- Inflation: $\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$, where P_t is some price index.
- (ex-ante) Real interest rate: $r = i - \pi^e$
 - i = Nominal interest rate
 - π^e = expected inflation

Price Indices: Exercise

	Year 1	Year 2	Year 3
Quantity Apples	50	80	90
Quantity Oranges	100	120	140
Price Apples	\$1.00	\$1.25	\$2.00
Price Oranges	\$0.80	\$1.60	\$2.00
Nominal Output	\$130	\$292	\$460
Chain-weighted Output: Year-1 base	\$130	\$173.28	\$199.48
Chain-weighted GDP Deflator			
Inflation per Deflator	NA		
Year-1 Output at Each Year's Prices			
CPI based on Year-1 Output Basket			
Inflation per Year-1 CPI	NA		
Year-2 Output at Each Year's Prices			
CPI based on Year-2 Output Basket			
Inflation per Year-2 CPI	NA		

Price Indexing Problems

- Problem 1: Changes in relative prices lead to changes in relative quantities. Chain weighting should fix this.
- Problem 2: Quality improvements.
- Problem 3: Pricing new goods (before they enter the market).
- Important policy issue:
 - Some Federal programs are indexed to the CPI.
 - If the CPI overstates inflation, government deficits are unnecessarily high.
 - Boskin commission.

Labor Market Measurement

- Categories
 - **Employed:** Worked during past week
 - **Unemployed:** Not working but looking
 - **Labor force** = employed + unemployed
 - **Not in labor force:** not working, not looking
- **Unemployment rate** = unemployed/labor force
- **Labor force participation rate** = labor force/population
- **Labor market tightness:** Degree of difficulty firms face in hiring workers.
- Labor measurement problems
 - No adjustments for hours of work.
 - **Discouraged workers:** move from unemployed to NILF \Rightarrow UR drops!
 - No adjustment for intensity of search.

Principal Sources

- 1 Andrew B. Abel and Ben S. Bernanke, *Macroeconomics*, fifth edition, (Addison-Wesley, 2005), chapters 2, 3 and 5. (Figure downloaded from http://wps.aw.com/aw_abelbern_macrocon_5/0,8751,1139460-,00.html.)
- 2 Stephen D. Williamson, *Macroeconomics*, third edition, (Addison-Wesley, 2007), chapter 2.

Chain-Weighted Quantity Indices: Exercise

	Year 1	Year 2	Year 3
Quantity Apples	50	80	90
Quantity Oranges	100	120	140
Price Apples	\$1.00	\$1.25	\$2.00
Price Oranges	\$0.80	\$1.60	\$2.00
Nominal Output			
Gross Growth Rate	NA		
Real Output at Year-1 prices			
Gross Growth Rate	NA		
Real Output at Year-2 prices			
Gross Growth Rate	NA		
Real Output at Year-3 prices			
Gross Growth Rate	NA		
2-Year Geometric Averages (G_C)	NA		
Chain-weighted Output: Year-1 base			
Chain-weighted Output: Year-2 base			

Price Indices: Exercise

	Year 1	Year 2	Year 3
Quantity Apples	50	80	90
Quantity Oranges	100	120	140
Price Apples	\$1.00	\$1.25	\$2.00
Price Oranges	\$0.80	\$1.60	\$2.00
Nominal Output	\$130	\$292	\$460
Chain-weighted Output: Year-1 base	\$130	\$173.28	\$199.48
Chain-weighted GDP Deflator			
Inflation per Deflator	NA		
Year-1 Output at Each Year's Prices			
CPI based on Year-1 Output Basket			
Inflation per Year-1 CPI	NA		
Year-2 Output at Each Year's Prices			
CPI based on Year-2 Output Basket			
Inflation per Year-2 CPI	NA		