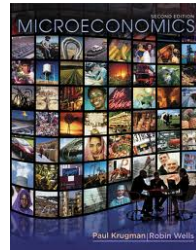


Economics 202 Principles Of Macroeconomics

Professor Yamin Ahmad

Lecture 6

- Measuring GDP
- Real GDP and the Price Level
- Economic Growth and Welfare



Big Concepts

- Ways to Measure GDP
 - Expenditure Approach
 - Income Approach
 - Value Added Approach
- GDP Deflator
- Why measure Economic Growth Rates?...

Note: These lecture notes are incomplete without having attended lectures.

Measuring U.S. GDP

- The Bureau of Economic Analysis uses two approaches to measure GDP:
 - The Expenditure Approach
 - The Income Approach
- An alternative approach is to compute value added at each stage of production

Note: These lecture notes are incomplete without having attended lectures.

The Expenditure Approach

- The *Expenditure Approach* measures GDP as the sum of consumption expenditure, investment, government purchases of goods and services, and net exports.
- [NIPA Table 1.1.5: GDP](#)

Note: These lecture notes are incomplete without having attended lectures.

The Components of Gross Domestic Product in 2010

| | Billions of dollars | Percent of GDP |
|----------------------------|---------------------|----------------|
| GDP (Y) | 14,592 | 100 |
| 1. Consumption (C) | 10,353 | 71 |
| 2. Investment (I) | 1,769 | 12.1 |
| Nonresidential | 1,368 | 9.4 |
| Residential | 355 | 2.4 |
| 3. Government spending (G) | 2,975 | 20.4 |
| 4. Net exports | -505 | -3.5 |
| Exports (X) | 1,746 | 12.0 |
| Imports (IM) | -2,252 | -15.4 |
| 5. Inventory investment | 45.3 | 0.3 |

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The Components of Gross Domestic Product in 2010

- **Consumption:** Approx 71% of US GDP
 - Includes expenditure on durables, which is like investment
- **Investment:** 15% of GDP
 - 12% private, 3% public. We shall ignore the latter;
 - Includes accumulation of inventories of unsold goods and work in progress (very volatile but small on average).
 - For comparison, in 2006, investment was approx 20% of GDP

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The Components of Gross Domestic Product in 2010

- **Government Consumption:** 17% of GDP
 - Thus total public spending on goods and services is only 20% of GDP
 - Does not include spending on pensions, etc., which are like negative income taxes;
 - Including these transfer payments total public spending is approximately 35.6% of GDP.
- **Exports:** 12% of GDP
- **Imports:** 15.4% of GDP

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The Income Approach

- The **Income Approach** measures GDP by summing the incomes that firms pay households for the factors of production they hire.
- [NIPA Table 1.12: National Income by Type of Income](#)
- [NIPA Table 1.10 Gross Domestic Income by Type of Income](#)

Note: These lecture notes are incomplete without having attended lectures.



The Income Approach

- The *National Income and Product Accounts* divide incomes into five categories:
 1. **Compensation of employees**
 - Wages and salaries earned by workers
 2. **Net interest**
 - Interest domestic businesses pay less what the receive, plus interest earned from foreigners
 3. **Rental income**
 - Income landlords receive less expenses such as depreciation
 4. **Corporate profits**
 - Income of corporations after payments to workers and creditors
 5. **Proprietors' income**
 - Income of noncorporate businesses such as small farms, mom-and-pop stores and law partnerships

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The Income Approach

- The sum of these five income components is *net domestic income (or net national income) at factor cost*.
- i.e.:
 - Compensation of Employees
 - + Net Interest Payments
 - + Rental Income
 - + Corporate Profits
 - + Proprietors Income
 -
 - = Net Domestic Income at Factor Cost

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The Income Approach

Two adjustments must be made to get GDP:

6. **Indirect taxes minus subsidies** are added to get from *factor cost* to *market prices*.
 - This gives us **net domestic income or net domestic product**
7. **Depreciation (or capital consumption)** is added to get from *net* domestic product to **gross** domestic product.

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Example of Income Approach

- The table to the right shows the NIPA numbers for the third quarter of 2008
- Calculate Net National Income
- Calculate GDP

| Items | 2008 Q3 |
|---------------------------|---------|
| Compensation of Employees | 8087.6 |
| Proprietors Income | 901 |
| Rental Income | 1080.5 |
| Corporate Profits | 68.5 |
| Net Interest Payments | 1136.4 |
| Indirect Taxes | 1044 |
| Subsidies | 50 |
| Depreciation | 1898 |

Source: Bureau of Economic Analysis; Numbers above are in billions of US dollars

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Value Added Approach: (Exercise)

1. A farmer grows a bushel of wheat and sells it to a miller for \$1.00.
2. The miller turns the wheat into flour and sells it to a baker for \$3.00.
3. The baker uses the flour to make a loaf of bread and sells it to an engineer for \$6.00.
4. The engineer eats the bread.

*Compute & compare
value added at each stage of production
and GDP*

Note: These lecture notes are incomplete without having attended lectures

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Final goods, value added, and GDP

- GDP = value of final goods produced
= sum of value added at all stages of production.
- The value of the final goods already includes the value of the **intermediate** goods, so including **intermediate** and **final** goods in GDP would be double-counting.
- Gross Domestic Product (at current prices)
= Value of goods and services
less cost of intermediate inputs
= $P_1Q_1 + P_2Q_2 + \dots + P_nQ_n$

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Real GDP and the Price Level

- **Real GDP** is the value of final goods and services produced in a given year when valued at constant prices.
- Calculating Real GDP
 - The first step in calculating real GDP is to calculate **nominal GDP**, which is the value of goods and services produced during a given year valued at the prices that prevailed in that same year.

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Real GDP and the Price Level

- The table provides data for 2010 and 2011.
- In 2010, nominal GDP is:
 - Expenditure on balls \$100
 - Expenditure on bats \$100
- Nominal GDP \$200

| Item | Quantity | Price |
|-------------|----------|---------|
| 2010 | | |
| Balls | 100 | \$1.00 |
| Bats | 20 | \$5.00 |
| 2011 | | |
| Balls | 160 | \$0.50 |
| Bats | 22 | \$22.50 |

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Real GDP and the Price Level

- In 2011, nominal GDP is:
 - Expenditure on balls \$80
 - Expenditure on bats \$495
- Nominal GDP \$575

| Item | Quantity | Price |
|-------------|----------|---------|
| 2010 | | |
| Balls | 100 | \$1.00 |
| Bats | 20 | \$5.00 |
| 2011 | | |
| Balls | 160 | \$0.50 |
| Bats | 22 | \$22.50 |

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Real GDP and the Price Level

- The old method of calculating real GDP was to value each year's output at the prices of a base year—the *base year prices method*.
- Suppose 2010 is the base year and 2011 is the current year.

| Item | Quantity | Price |
|-------------|----------|---------|
| 2010 | | |
| Balls | 100 | \$1.00 |
| Bats | 20 | \$5.00 |
| 2011 | | |
| Balls | 160 | \$0.50 |
| Bats | 22 | \$22.50 |

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Real GDP and the Price Level

- Expenditure on balls in 2011 valued at 2010 prices is \$160.
- Expenditure on bats in 2011 valued at 2010 prices is \$110.
- Real GDP in 2011 (base-year prices method) is \$270.

| Item | Quantity | Price |
|-------------|----------|---------|
| 2010 | | |
| Balls | 100 | \$1.00 |
| Bats | 20 | \$5.00 |
| 2011 | | |
| Balls | 160 | \$0.50 |
| Bats | 22 | \$22.50 |

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Practice Question:

| Item | 2006 | | 2007 | | 2000 |
|-----------|--------|----------|--------|----------|-------|
| | Price | Quantity | Price | Quantity | Price |
| Apples | \$1 | 100 | \$1.50 | 200 | \$2 |
| Bananas | \$0.50 | 100 | \$1 | 100 | \$1 |
| Chocolate | \$2 | 200 | \$1 | 400 | \$1 |

From the table above:

- Calculate Nominal GDP in 2006 and 2007.
- Suppose that 2000 is the base year. Calculate Real GDP in 2006 and 2007.
- What is the percentage change in real GDP?

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Real GDP and the Price Level

- The new method of calculating real GDP, which is called the **chain-weighted output index** method, uses the prices of two adjacent years to calculate the real GDP growth rate.
- This calculation has four steps described on the next slide.

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Real GDP and the Price Level

- Step 1: Value last year's production and this year's production at *last year's prices* and then calculate the growth rate of this number from last year to this year.
- Step 2: Value last year's production and this year's production at *this year's prices* and then calculate the growth rate of this number from last year to this year.
- Step 3: Calculate the average of the two growth rates. This average growth rate is the growth rate of real GDP from last year to this year.
- Step 4: Repeat steps 1, 2, and 3 for each pair of adjacent years to link real GDP back to the base year's prices.

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Real GDP and the Price Level

Using numbers from our previous example, we have done step 1:

- 2010 production at 2010 prices (GDP in 2010) is \$200.
- 2011 production at 2010 prices is \$270.
- The 2011 growth rate in 2010 prices is 35 percent.

| Item | Quantity | Price |
|-------------|----------|---------|
| 2010 | | |
| Balls | 100 | \$1.00 |
| Bats | 20 | \$5.00 |
| 2011 | | |
| Balls | 160 | \$0.50 |
| Bats | 22 | \$22.50 |

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Real GDP and the Price Level

Step 2:

- 2010 production at 2011 prices is \$500.
- 2011 production at 2011 prices (GDP in 2011) is \$575.
- The 2011 growth rate in 2011 prices is 15 percent.

| Item | Quantity | Price |
|-------------|----------|---------|
| 2010 | | |
| Balls | 100 | \$1.00 |
| Bats | 20 | \$5.00 |
| 2011 | | |
| Balls | 160 | \$0.50 |
| Bats | 22 | \$22.50 |

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Real GDP and the Price Level

Step 3:

- The 2011 growth rate in 2010 prices is 35 percent.
- The 2011 growth rate in 2011 prices is 15 percent.
- The average of these two growth rates is 25 percent.
- Real GDP in 2011 with 2010 as the base year is \$250.

| Item | Quantity | Price |
|-------------|----------|---------|
| 2010 | | |
| Balls | 100 | \$1.00 |
| Bats | 20 | \$5.00 |
| 2011 | | |
| Balls | 160 | \$0.50 |
| Bats | 22 | \$22.50 |

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Real GDP and the Price Level

Step 4:

- Because we're calculating real GDP in 2011 at 2010 prices, step 4 is completed!
- Real GDP in 2010 is \$200.
- Real GDP in 2011 is \$250.

| Item | Quantity | Price |
|-------------|----------|---------|
| 2010 | | |
| Balls | 100 | \$1.00 |
| Bats | 20 | \$5.00 |
| 2011 | | |
| Balls | 160 | \$0.50 |
| Bats | 22 | \$22.50 |

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Chain-Weighted Real GDP

- Over time, relative prices change, so the base year should be updated periodically.
- In essence, **chain-weighted real GDP** updates the base year every year, so it is more accurate than constant-price GDP.
- Textbooks usually use constant-price real GDP, because:
 - the two measures are highly correlated.
 - constant-price real GDP is easier to compute.

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Calculating the Price Level

- The average level of prices is called the **price level**.
- One measure of the price level is the **GDP deflator**, which is an average of the prices of the goods in GDP in the current year expressed as a percentage of the base year prices.

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Real GDP and the Price Level

- Nominal GDP and real GDP are calculated in the way that you've just seen.
- $\text{GDP Deflator} = (\text{Nominal GDP} / \text{Real GDP}) \times 100$.
- In 2010, the GDP deflator is $(\$200 / \$200) \times 100 = 100$.
- In 2011, the GDP deflator is $(\$575 / \$250) \times 100 = 230$.

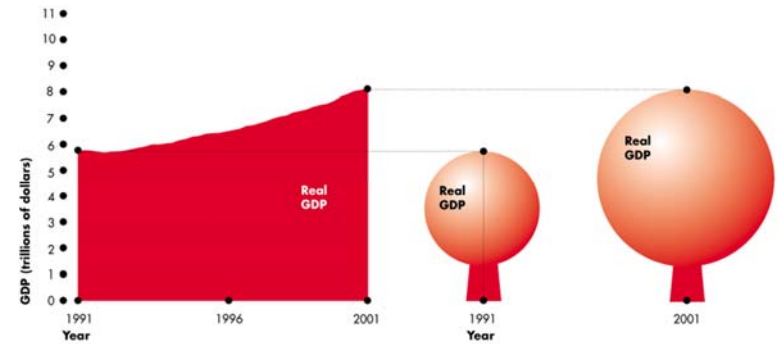
| Year | Nominal GDP | Real GDP | GDP deflator |
|------|-------------|----------|--------------|
| 2010 | \$200 | \$200 | 100 |
| 2011 | \$575 | \$250 | 230 |

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Real GDP and the Price Level

- Deflating the GDP Balloon
 - Nominal GDP increases because production—real GDP—increases.



(a) Nominal GDP and real GDP

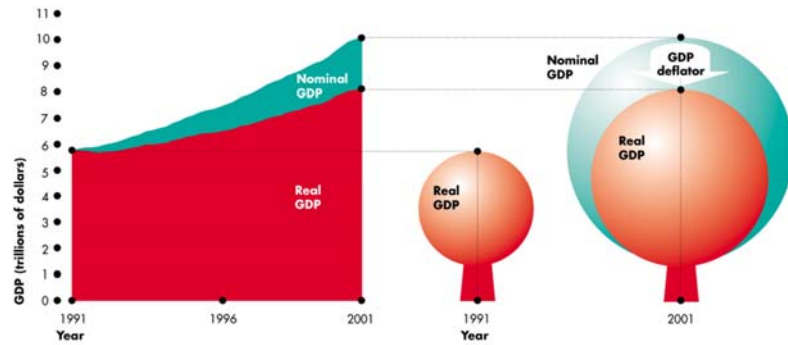
(b) The GDP balloon

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Real GDP and the Price Level

- Deflating the GDP Balloon
 - Nominal GDP also increases because prices rise.



(a) Nominal GDP and real GDP

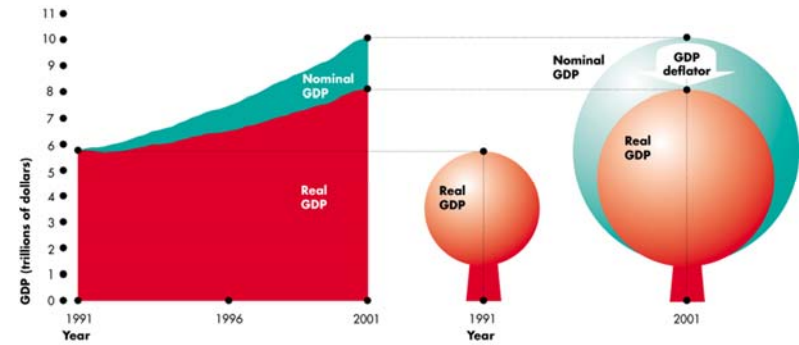
(b) The GDP balloon

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Real GDP and the Price Level

- Deflating the GDP Balloon
 - We use the GDP deflator to let the air out of the nominal GDP balloon and reveal real GDP.



(a) Nominal GDP and real GDP

(b) The GDP balloon

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Measuring Economic Growth

- We use real GDP to calculate the economic growth rate.
- The **economic growth rate** is the percentage change in the quantity of goods and services produced from one year to the next.
- We measure economic growth so we can make:
 - Economic welfare comparisons
 - International welfare comparisons
 - Business cycle forecasts

Note: These lecture notes are incomplete without having attended lectures.

Economic Welfare Comparisons

- Economic welfare measures the nation's overall state of economic well-being.
- Real GDP is not a perfect measure of economic welfare for seven reasons:
 1. Quality improvements tend to be neglected in calculating real GDP so the inflation rate is overstated and real GDP understated.
 2. Real GDP does not include household production, that is, productive activities done in and around the house by members of the household.

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Economic Welfare Comparisons

- Economic welfare measures the nation's overall state of economic well-being.
- Real GDP is not a perfect measure of economic welfare for seven reasons:
 3. Real GDP, as measured, omits the underground economy, which is illegal economic activity or legal economic activity that goes unreported for tax avoidance reasons.
 4. Health and life expectancy are not directly included in real GDP.

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Economic Welfare Comparisons

- Economic welfare measures the nation's overall state of economic well-being.
- Real GDP is not a perfect measure of economic welfare for seven reasons:
 5. Leisure time, a valuable component of an individual's welfare, is not included in real GDP.
 6. Environmental damage is not deducted from real GDP.
 7. Political freedom and social justice are not included in real GDP.

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International Comparisons

- Real GDP is used to compare economic welfare in one country with that in another.
- Two special problems arise in making these comparisons.
 - Real GDP of one country must be converted into the same currency units as the real GDP of the other country, so an exchange rate must be used.
 - The same prices should be used to value the goods and services in the countries being compared, but often are not.

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Measuring Economic Growth

- Using the exchange rate to compare GDP in one country with GDP in another country is problematic because prices of particular products in one country may be much less or much more than in the other country.
- Using the exchange rate to value Chinese GDP in dollars leads to an estimate that U.S. real GDP per person was 69 times Chinese real GDP per person.

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Business Cycle Forecasts

- Real GDP is used to measure business cycle fluctuations.
- These fluctuations are probably accurately timed but the changes in real GDP probably overstate the changes in total production and people's welfare caused by business cycles.

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Review Questions:

1. What are the two approaches to calculating GDP? What formula depicts these two approaches?
2. For each approach, what items have to be added up to calculate GDP?
3. What adjustments need to be made to total income to make it equal to GDP?
4. What is the difference between nominal and real GDP? Why would we want to calculate real GDP?
5. How is real GDP calculated by the base year prices method? What is the intuition behind calculating real GDP this way?
6. What are some problems with calculating real GDP by the base year prices method?
7. What are the four steps involved in calculating real GDP by the chain-weighted method?
8. What is the GDP Deflator? How is it calculated?
9. What are some of the reasons for calculating real GDP?
10. For each reason, explain some of the problems associated with using real GDP for that purpose.

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