Chapter 6: Measuring National Output and Income

Week 2

Presenter: Zheng Zhang

Jan 25, 2012
Table of Contents

1. Calculating GDP
2. Nominal vs Real GDP
3. Appendix
Questions

- What is the definition of GDP? (2011Mid1 M11; 2011Mid1 M13)
- What would be included in GDP? intermediate goods? the change in inventories? Transfer Payment? (2012Mid1 M10; 2012Mid1 E2; 2011Mid1 M16; 2010Mid1 M2)
- What is expenditure approach? (20011Mid1 M14; 2011Mid1 M15)
- What is income approach?
- What is the relationship between these two approaches?
- Is GDP a perfect measure of social welfare? Why? (2011Mid1 M20)
Which of the following is an example of a final good or service?

A. Wheat a bakery purchases to make bread
B. Coffee beans Starbucks purchase to make coffee
C. A tractor purchased by a farmer to cultivate his farm
D. Lumber purchased by a constructive company to use in building houses.
Which of the following is an example of a final good or service?

A. Wheat a bakery purchases to make bread  
B. Coffee beans Starbucks purchase to make coffee  
C. A tractor purchased by a farmer to cultivate his farm  
D. Lumber purchased by a constructive company to use in building houses.

For more information on intermediate goods vs. final goods please read *Additional Reading 2*
2012Mid1 M10 Page 192; 2010Mid1 M30 Page 218
Which of the following would be counted in 2010’s GDP?
A  The value of a loan you take in 2010
B  The value of a TV that was produced in 2009 but not sold until 2010
C  The bonus check a stockbroker gets from his/her company in 2010
D  The value of a bond sold by the federal government

Back
What’s in GDP

Which of the following would be counted in 2010’s GDP?

A. The value of a loan you take in 2010
B. The value of a TV that was produced in 2009 but not sold until 2010
C. The bonus check a stockbroker gets from his/her company in 2010
D. The value of a bond sold by the federal government
What’s in GDP

2012Mid1 M10 Page 192; 2010Mid1 M30 Page 218

Explanation:

- In (B), the TV was an inventory in 2009, so it is included in Y2009 GDP rather than Y2010 GDP.

- (A) and (D) both refer to the values of Financial Instruments sold (loan sold by X in A and T-bond by the Government in D), which is not included in GDP. This is because buying(selling) financial products is classified as 'saving', as opposed to investment(I) as a component of GDP using expenditure approach. See Additional Reading 2.

- (C) is correct because bonus check paid to stockbroker as a reward to her excellent service is a part of her personal income that enters into GDP from income perspective.

Back
What’s in GDP

2010Mid1 M2 Page 213
Which of the following would be directly included in GDP?
A  Purchase of a used home
B  Dutch Boy Paint sold to US Constructors Company
C  The sale of Wall Mart stock
D  All the above will be included in GDP
E  none of the above would be included

Back
What’s in GDP

2010Mid1 M2 Page 213

Which of the following would be directly included in GDP?

A  Purchase of a used home
B  Dutch Boy Paint sold to US Constructors Company
C  The sale of Wall Mart stock
D  All the above will be included in GDP
E  none of the above would be included

For more information go to Additional Reading 2

Back
What’s in GDP

2012Mid1 E2 Page 200 Which of the following transactions would not be counted in GDP? Explain your answers.

(a) The purchase of processors to produce computers.
(b) You buy a new copy of a macroeconomic textbook.
(c) The government pays out social security benefits.
(d) You sell your Illini basketball ticket for $150 outside the arena.
(e) The cost of pollution, estimated at 12 Million, created by a General Motors plant

Back

Zheng Zhang

Chapter 6: Measuring National Output and Income
2012Mid1 E2 Page200 Which of the following transactions would not be counted in GDP? Explain your answers.
Answer: All but (b) would not be counted. Why? (b) is the sale of a newly produced good i.e. macroeconomic textbook that you are going to use as a "mental consumption" (a) is an intermediate good; (c) is a transfer payment; (d) is not officially recorded; (e) is not a cost of production, it is a negative externality estimated in dollars that is not tractable on accounting book. 

Back
The single largest expenditure component in GDP is

A  government spending
B  net exports
C  investment
D  consumption

Back
The single largest expenditure component in GDP is

A  government spending
B  net exports
C  investment
D  consumption

Back
GDP and welfare

GDP is not a perfect measure of social welfare and the society’s economic well-being because

A it does not include all economic activities in the economy

B it does not say anything about the distribution of income.

C GDP accounting rules do not adjust for production that causes negative externalities.

D All of the above

Back
GDP and welfare

GDP is not a perfect measure of social welfare and the society’s economic well-being because

A. it does not include all economic activities in the economy under the underground economy.
B. it does not say anything about the distribution of income. Inequality.
C. GDP accounting rules do not adjust for production that causes negative externalities.
D. All of the above.

Back
<table>
<thead>
<tr>
<th></th>
<th>Table of Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calculating GDP</td>
</tr>
<tr>
<td>2</td>
<td>Nominal vs Real GDP</td>
</tr>
<tr>
<td>3</td>
<td>Appendix</td>
</tr>
</tbody>
</table>
Questions

- What is the Real(Nominal)GDP? (2011Mid1 M17 M18)
- Why do we need Real GDP?
- How is Real(Nominal) GDP calculated?
- How is the grow rate of Real(Nominal)GDP calculated? (2012Mid1 M11-16; 2011Mid1 E1)
### Figure 1: Prices and Output for a three-good economy over two years

<table>
<thead>
<tr>
<th>Production</th>
<th>Price Per Unit</th>
<th>GDP in Year 1 in Year 1 Prices</th>
<th>GDP in Year 2 in Year 1 Prices</th>
<th>GDP in Year 1 in Year 2 Prices</th>
<th>GDP in Year 2 in Year 2 Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Year 1 Q₁</td>
<td>Year 2 Q₂</td>
<td>P₁</td>
<td>P₂</td>
<td>P₁xQ₁</td>
<td>P₂xQ₂</td>
</tr>
<tr>
<td>Good A</td>
<td>6</td>
<td>11</td>
<td>$0.50</td>
<td>$0.40</td>
<td>$3.00</td>
</tr>
<tr>
<td>Good B</td>
<td>7</td>
<td>4</td>
<td>$0.30</td>
<td>$1.00</td>
<td>$2.10</td>
</tr>
<tr>
<td>Good C</td>
<td>10</td>
<td>12</td>
<td>$0.70</td>
<td>$0.90</td>
<td>$7.00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$12.10</td>
</tr>
</tbody>
</table>

- **Real GDP**: measured in base year(subject to choice) prices.
- **Nominal GDP**: measured in current prices.
Example in PEQ 2

<table>
<thead>
<tr>
<th>Base Year</th>
<th>Y1 N.GDP</th>
<th>Y1 R.GDP</th>
<th>Y2 N.GDP</th>
<th>Y2 R.GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>(5) 12.1</td>
<td>(5) 12.1</td>
<td>(8) 19.2</td>
<td>(6) 15.1</td>
</tr>
<tr>
<td>Year 2</td>
<td>(5) 12.1</td>
<td>(7) 18.4</td>
<td>(8) 19.2</td>
<td>(8) 19.2</td>
</tr>
</tbody>
</table>

- So Nominal GDP is always the same, but Real GDP varies depending upon the choice of base year.
- Nominal and Real GDPs are always the same for the base year.

back
Example in PEQ 2

- The rate of change in Nominal GDP: \( \frac{19.2-12.1}{12.1} \times 100\% = 58.68\% \)
- The rate of change in Real GDP using Y1 as base: \( \frac{15.1-12.1}{12.1} \times 100\% = 24.79\% \)
- The rate of change in Real GDP using Y2 as base: \( \frac{19.2-18.4}{12.1} \times 100\% = 4.42\% \)
- Geometric Average of Real GDP growth rate:
  Step 1: \( \sqrt{(1 + 0.2479) \times (1 + 0.442)} = 1.1411 \) (or 114.11%)
  Step 2: \( 1.1411 \times 100\% - 1 = 14.11\% \) So G.A. of Real GDP growth rate is 14.11%

back
How to calculate GDP deflator?  

**Bonus! This is a concept in chapter 7**

- GDP deflator is an index to measure the change in general price level.
- **Formula:** \( \frac{\text{Nominal GDP in year } X}{\text{Real GDP in year } X} \times 100 \)

<table>
<thead>
<tr>
<th>Base Year</th>
<th>Y1 GDP Deflator</th>
<th>Y2 GDP Deflator</th>
<th>Inflation rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>100</td>
<td>127.2</td>
<td>27.2%</td>
</tr>
<tr>
<td>Year 2</td>
<td>65.8</td>
<td>100</td>
<td>52%</td>
</tr>
</tbody>
</table>

*back*
Further Thinking
What if I don’t know the prices of goods for a given year X but I want to compare the real GDP of this year with another year Y given the full info on the quantities of goods?
Is it possible? What about nominal GDP comparison? See 2011Mid1 E1 Part3 Page 209. back
Further Thinking
What if I know that nominal GDP is less than real GDP for a year X? (See 2010Mid1 M27 Page213)
Check if the next two statements are 100% true:
- the price level in year X is lower than the price level in base year
- the year X can not be base year

back
Use the following information to answer the next six questions (11-16). Assume this economy produces only two goods, Good A and Good B.

<table>
<thead>
<tr>
<th></th>
<th>Output</th>
<th>Prices($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 1</td>
<td>Year 2</td>
</tr>
<tr>
<td>Good A</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Good B</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
11. What is nominal GDP in year 2?

A  100
B  120
C  80
D  158
E  None of the above
11. What is nominal GDP in year 2?

A 100
B 120
C 80
D 158
E None of the above

$40 \times 1\$ + 100 \times 0.8\$ = 120\$

Back
12. What is real GDP in year 2, using year 1 as the base year?

A  120
B  60
C  100
D  116
E  None of the above

Back
12. What is real GDP in year 2, using year 1 as the base year?

A 120  
B 60  
C 100  
D 116  
E None of the above

\[ 40 \times 1$ + 100 \times 0.4$ = 80$ \]

Back
13. What is real GDP in year 1, using year 1 as the base year?

A  108
B  60
C  100
D  80
E  None of the above

Back
13. What is real GDP in year 1, using year 1 as the base year?

A  108

B  60

C  100

D  80

E  None of the above

\[20 \times 1$ + 100 \times 0.4$ = 60$

Back
14. What is real GDP in year 1, using year 2 as the base year?

A  116
B  60
C  80
D  120
E  None of the above

Back
14. What is real GDP in year 1, using year 2 as the base year?

A 116
B 60
C 80
D 120
E None of the above

$20 \times 1\$ + 100 \times 0.8\$ = 100\$

Back
Nominal GDP vs Real GDP

15 Using year 2 as the base year, what is the growth rate of real GDP from year 1 to year 2?

A  100%
B  -17%
C  -50%
D  20%
E  None of the above

Back
15 Using year 2 as the base year, what is the growth rate of real GDP from year 1 to year 2?

A 100%
B -17%
C -50%
D 20%
E None of the above

\[
\frac{120 - 100}{100} \times 100\% = 20\%
\]

This is the growth rate of real GDP using year 2 as the base year.

Back
Nominal GDP vs Real GDP

16 After 1996, the government agency charged with calculating GDP growth rates updated their technique to better reflect actual growth. Using this method, real GDP from year 1 to 2 grew by?

A  33%
B  20%
C  43%
D  26%
E  28%

Back
16 After 1996, the government agency charged with calculating GDP growth rates updated their technique to better reflect actual growth. Using this method, real GDP from year 1 to 2 grew by?

A 33%
B 20%
C 43%
D 26%
E 28%

\[
\frac{80-60}{60} \times 100\% = 33\%
\]

This is the growth rate of real GDP using year 1 as the base year; Taking a geometric average of 1.20 and 1.33 gives

\[
\sqrt{(1 + 0.2) \times (1 + 0.33)} \times 100\% = 126\%
\]

so real GDP grew by 126% - 1 = 26% under new technique.
Use the following information to answer the next three questions. Assume this economy produces only two goods, Good A and Good B.

<table>
<thead>
<tr>
<th>Production</th>
<th>Price Per Unit ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 1</td>
</tr>
<tr>
<td>Good A</td>
<td>40</td>
</tr>
<tr>
<td>Good B</td>
<td>100</td>
</tr>
</tbody>
</table>
Q1: Using the data in the table, calculate real GDP for years 2 and year 3 using year 2 as the base year. How much did year 3 real GDP grow by in real terms in this case?
Q1: Using the data in the table, calculate real GDP for years 2 and year 3 using year 2 as the base year. How much did year 3 real GDP grow by in real terms in this case?

Real GDP for Year 2 = 60 × $1.00 + 100 × $0.80 = $140.00
Q1: Using the data in the table, calculate real GDP for years 2 and year 3 using year 2 as the base year. How much did year 3 real GDP grow by in real terms in this case?

Real GDP for Year 2 = $60 \times 1.00 + 100 \times 0.80 = $140.00$

Real GDP for Year 3

= $100 \times 1.00 + 120 \times 0.80 = $196.00$

Real GDP Growth Rate = \frac{196 - 140}{140} \times 100 \% = 40 \%
Q1: Using the data in the table, calculate real GDP for years 2 and year 3 using year 2 as the base year. How much did year 3 real GDP grow by in real terms in this case?

Real GDP for Year 2 = $60 \times 1.00 + 100 \times 0.80 = $140.00$

Real GDP for Year 3

= $100 \times 1.00 + 120 \times 0.80 = $196.00$

Real GDP Growth Rate = \( \frac{196 - 140}{140} \times 100\% = 40.00\% \)
Q2: Now calculate real GDP for years 2 and 3 with year 3 as the base year for prices. How much did year 3 real GDP expand relative to year 2 in this case?

Real GDP for Year 2 = $60 \times \frac{1}{20} + 100 \times \frac{1}{10} = $182.00

Real GDP for Year 3 = $100 \times \frac{1}{20} + 120 \times \frac{1}{10} = $252.00

Real GDP Growth Rate = \frac{252 - 182}{182} \times 100 = 38.46\%
Q2: Now calculate real GDP for years 2 and 3 with year 3 as the base year for prices. How much did year 3 real GDP expand relative to year 2 in this case?

Real GDP for Year 2 = $60 \times 1.20 + 100 \times 1.10 = 182.00$

Real GDP for Year 3 = $100 \times 1.20 + 120 \times 1.10 = 252.00$

Real GDP Growth Rate = \frac{252 - 182}{182} \times 100 = 38.95\%
Q2: Now calculate real GDP for years 2 and 3 with year 3 as the base year for prices. How much did year 3 real GDP expand relative to year 2 in this case?

Real GDP for Year 2 = 60 × $1.20 + 100 × $1.10 = $182.00
Real GDP for Year 3 = 100 × $1.20 + 120 × $1.10 = $252.00

Real GDP Growth Rate = \frac{252 - 182}{182} × 100 = \frac{70}{182} × 100 ≈ 38.27%
Q2: Now calculate real GDP for years 2 and 3 with year 3 as the base year for prices. How much did year 3 real GDP expand relative to year 2 in this case?

Real GDP for Year 2 = \(60 \times \$1.20 + 100 \times \$1.10 = \$182.00\)

Real GDP for Year 3
\[ = 100 \times \$1.20 + 120 \times \$1.10 = \$252.00 \]

Real GDP Growth Rate = \[
\frac{252-182}{182} \times 100\% = 38.46\%
\]

back
3. What is the geometric average growth rate of real GDP between years 2 and 3?

Answer: Step 1:
\[ \sqrt{\left( \frac{1}{40} \right) \times \left( \frac{1}{38} \right)} \times 100\% = 139\%/23\% \]

Step 2:
\[ 139\%/23\% - 1 = 39\%/23\% \]
3. What is the geometric average growth rate of real GDP between years 2 and 3?

Answer: Step 1: \( \sqrt{(1 + .40) \times (1 + .38)} \times 100\% = 139.23\% \)
3. What is the geometric average growth rate of real GDP between years 2 and 3?

Answer: Step 1: \( \sqrt{(1 + 0.40) \times (1 + 0.38) \times 100\%} = 139.23\% \)

Step 2: \( 139.23\% - 1 = 39.23\% \)
3. What is the geometric average growth rate of real GDP between years 2 and 3?

Answer: Step 1: \( \sqrt{(1 + .40) \times (1 + .38)} \times 100\% = 139.23\% \)
Step 2: \( 139.23\% - 1 = 39.23\% \)

Note: if you are asked to calculate the average real GDP for year 3, use arithmetic average, i.e. chain-weighted average real GDP for year 3 in this case is \( \frac{196.00 + 252.00}{2} = \$224.00 \)
GDP per Capita

The following table gives some figures from a forecast of real GDP (in 2005 dollars) and population done in mid-2010.

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP 2010</td>
<td>$13,406.00 billion</td>
</tr>
<tr>
<td>Real GDP 2011</td>
<td>$13,808.18 billion</td>
</tr>
<tr>
<td>Population 2010</td>
<td>308.00 million</td>
</tr>
<tr>
<td>Population 2011</td>
<td>311.08 million</td>
</tr>
</tbody>
</table>

hw14 Q1
hw14 Q2
hw14 Q3
Calculate the forecast Real GDP growth rate between 2010 and 2011.

GDP growth rate is

\[
\frac{13808.18 - 13406.00}{13406.00} \times 100\% = 3\%
\]

back
Calculate the forecast population growth rate between 2010 and 2011.

Population growth rate is

\[
\frac{311.08 - 308}{308} \times 100\% = 1\%
\]

\textit{back}
Calculate the projected per Capita real GDP for 2010 and 2011.

Notice that real GDP and population are in different units!!! so Per Capita Real GDP 2010 is
\[
\frac{13406.00 \times 10^{10}}{308.00 \times 10^7} = \frac{13406.00 \times 10^3}{308.00} = 43525.97 \text{ Per Capita Real GDP 2010 is }
\]

Per Capita Real GDP 2010 is \[
\frac{13808.18 \times 10^{10}}{311.08 \times 10^7} = \frac{13808.18 \times 10^3}{311.08} = 44387.87
\]

Calculate the forecast per capita GDP growth rate
\[
\frac{44387.87 - 43525.97}{43525.97} \times 100\% = 1.98\%
\]
Table of Contents

1. Calculating GDP
2. Nominal vs Real GDP
3. Appendix
Comparison of three pairs of concepts

(a) \textit{GDP} vs. \textit{GNP}

(b) \textit{Indirect Tax} vs. \textit{Direct Tax}

(c) \textit{Gross Private Domestic Investment} vs. \textit{Net Domestic Investment}
GDP vs. GNP

- **GNP** measures the output generated by a country’s enterprises (whether physically located domestically or abroad) while **GDP** measures the total output produced within a country’s borders, whether produced by that country’s own local firms or by foreign firms. For example, the profits of a US-owned company operating in the UK will only count towards US GNI and UK GDP.

- GNP=GDP+Factor Income (generated by national assets overseas) paid from the rest of the world-Factor Income paid to the rest of the world.
Indirect Tax vs. Direct Tax

A **Direct Tax** is one imposed upon an individual person (juristic or natural) or on property while **Indirect Taxes** (e.g. sales tax or a value added tax (VAT)) are imposed only if and when a taxable transaction occurs, so people have the freedom to engage in or refrain from such transactions; whereas a direct tax is imposed upon a person (unconditionally) such as income-tax or head-tax, which is imposed on the basis of the person’s very life or existence, or a property tax which is imposed upon the owner by virtue of ownership, rather than commercial use. So generally indirect taxes can be shifted while direct taxes can not.
Indirect Tax vs. Direct Tax

Where do **direct taxes** and **indirect taxes** fit into GDP calculation? In slide 14 on page 20, national income is actually **net national income** which includes factor incomes such as compensation of employees, undistributed corporate profits (after depreciation and before direct tax) and gross mixed incomes (rents, interests, proprietor’s income). After depreciation is added, it becomes **GNP at factor costs**. After net indirect tax is added, it becomes **GNP**.
Gross Private Domestic Investment (GPDI) vs. Net Investment (NI)

- **GPDI** consists of nonresidential investment, residential investment and the change in inventories. **NI = GPDI - depreciation.** (Homework Chapter 6 Q11)

- Net investment = beginning-of-year capital stock - end-of-year capital stock because end-of-year capital stock is "net of depreciation". (Homework Chapter 6 Q12)