The Global Economy

Measurement in Macroeconomics
Tonight’s Main Questions

1. What really is the Gross Domestic Product?
2. How does GDP relate to people’s income?
3. How accurate is GDP as measure of a country’s well-being?
4. What is inflation?
5. How do we measure inflation?
6. What is the Purchasing Power Parity adjustment?
## Value added at the firm level

<table>
<thead>
<tr>
<th>Description</th>
<th>USD (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Revenues</td>
<td>47.5</td>
</tr>
<tr>
<td>- Wages</td>
<td>20.0</td>
</tr>
<tr>
<td>- Cost of goods sold</td>
<td>10.0</td>
</tr>
<tr>
<td>- Interest</td>
<td>7.0</td>
</tr>
<tr>
<td><strong>Net Income</strong></td>
<td><strong>10.5</strong></td>
</tr>
</tbody>
</table>
Gross Domestic product

- GDP equals total value added
- But it also equals the value of final goods and services produced by *domestically located* establishments within a given period

Example

- Firm A sells for $10M to Firm B and for $5M to the public. It pays $12M in wages.
- Firm B sells to the public for $47.5M and buys intermediate goods from Firm A for $10M. It pays wages for $20M and interest for $7M.
The Expenditure Account

\[ Y \equiv C + I + G + NX \]

\[ Y = \text{GDP} \]
\[ C = \text{Private Consumption} \]
\[ I = \text{Private Investment} \]
\[ G = \text{Government Purchases of Goods and Services} \]
\[ NX = \text{Net Export (Export} - \text{Import)} \]
The Expenditure Account

Expenditure Account
Percentage of GDP

Source: Bureau of Economic Analysis
Gross National Product

- Value of final goods and services produced within a given period by establishments *owned by nationals*

\[ \text{GNP} = \text{GDP} + \text{Net Factor Income From Abroad} \]

- NFIA is the difference between income paid to nationals that reside abroad and the income paid to foreigners that reside in the US
Gross National Product

United States – Difference between GNP and GDP
As a percentage of GDP

Source: Bureau of Economic Analysis
Gross National Product

Ireland – GDP and GNP at constant prices
(Billions of 2007 Euros)

Source: Central Statistics Office Ireland

GDP

GNP

Difference

Source: Central Statistics Office Ireland
The Income Account

Compensation of Employees
+ Corporate Profits
+ Net Interest
+ Rental Income
+ Proprietors Income
+ Taxes

National Income
+ Depreciation

GNP
The Income Account

Income Account
Percentage of National Income

Source: Bureau of Economic Analysis
Is GDP a good proxy for well-being?

$51,982 \quad \text{Per-capita GDP (2015)} \quad \$39,029$

34.4 \quad \text{Avg. weekly hours (2015)} \quad 28.6
Is GDP a good proxy for well-being?

Per capita GDP Vs. HDI

Is GDP a good proxy for well-being?


Per capita GDP Vs. Life Expectancy at Birth

Is GDP a good proxy for well-being?

Per capita GDP Vs. Schooling

Problems with the National Accounts

- Mismeasurement of government services
- Ignore household production
- Ignore intangible investment – Trying to fix this
- Ignore underground economy – Trying to fix this
- Environment/pollution
How informative is this graph?

Turkey – Annual Growth Rate of GDP
Current prices – In Turkish Liras

Source: TurkStat
Inflation

• We would like to measure changes in GDP over time

• Problem: the *price level* is not constant

• How do we measure the rate of change of the price level (i.e. inflation)?
Measuring Inflation

- With only one good
  - Nominal GDP is price times quantity: \( Y_t = p_t \times q_t \)
  - Growth rate of nominal GDP equals growth rate in price times growth rate in quantity
    \[
    \frac{Y_t}{Y_{t-1}} = \frac{p_t q_t}{p_{t-1} q_{t-1}} = \frac{p_t}{p_{t-1}} \times \frac{q_t}{q_{t-1}}
    \]

- With more than one good?
  - Nominal GDP is still price times quantity: \( Y_t = \sum_i p_{it} \times q_{it} \)
  - The problem is that prices of different goods grow at different rates. Relative prices change!
## CPI – Example

<table>
<thead>
<tr>
<th>Date</th>
<th>Fish Price</th>
<th>Fish Quantity</th>
<th>Chips Price</th>
<th>Chips Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>0.50</td>
<td>10</td>
<td>0.25</td>
<td>10</td>
</tr>
<tr>
<td>2016</td>
<td>0.75</td>
<td>12</td>
<td>0.50</td>
<td>8</td>
</tr>
</tbody>
</table>

- **Growth Rate of nominal GDP:**

  \[
  \gamma_{NY} = \frac{0.75 \times 12 + 0.50 \times 8}{0.50 \times 10 + 0.25 \times 10} - 1 = 73.33\% 
  \]

- What’s the inflation rate? What’s the growth rate of *real* GDP?
CPI – Example

• Base Year 2015
  - CPI\(_{15}\) = 100 × \(\frac{0.50 \times 10 + 0.25 \times 10}{0.50 \times 10 + 0.25 \times 10}\) = 100
  - CPI\(_{16}\) = 100 × \(\frac{0.75 \times 10 + 0.50 \times 10}{0.50 \times 10 + 0.25 \times 10}\) = 166.7
  - Inflation Rate: \(\pi = \frac{\text{CPI}_{16}}{\text{CPI}_{15}} - 1\) = 66.7\%
  - Growth rate of real GDP: \(\frac{1 + \gamma_{NY}}{1 + \pi} - 1\) = \(\frac{1.733}{1.667} - 1\) = 3.96\%

• Base Year 2016
  - CPI\(_{15}\) = 100 × \(\frac{0.50 \times 12 + 0.25 \times 8}{0.75 \times 12 + 0.50 \times 8}\) = 61.54
  - CPI\(_{16}\) = 100 × \(\frac{0.75 \times 12 + 0.50 \times 8}{0.75 \times 12 + 0.50 \times 8}\) = 100
  - Inflation Rate: \(\pi = \frac{\text{CPI}_{16}}{\text{CPI}_{15}} - 1\) = 62.5\%
  - Growth rate of real GDP: \(\frac{1 + \gamma_{NY}}{1 + \pi} - 1\) = \(\frac{1.733}{1.625} - 1\) = 6.65\%
Working with the CPI

<table>
<thead>
<tr>
<th>Year</th>
<th>Nominal GDP (Current Prices)</th>
<th>CPI (Base 2005)</th>
<th>Real GDP (2005 Prices)</th>
<th>Inflation (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>12,562.2</td>
<td>96.769</td>
<td>12,981.6</td>
<td>3.34</td>
</tr>
<tr>
<td>2005</td>
<td>13,381.6</td>
<td>100.000</td>
<td>13,381.6</td>
<td>3.34</td>
</tr>
<tr>
<td>2006</td>
<td>14,066.4</td>
<td>102.524</td>
<td>13,720.1</td>
<td>2.52</td>
</tr>
<tr>
<td>2007</td>
<td>14,685.3</td>
<td>106.736</td>
<td>13,758.5</td>
<td>4.11</td>
</tr>
<tr>
<td>2008</td>
<td>14,549.9</td>
<td>106.713</td>
<td>13,634.6</td>
<td>-0.02</td>
</tr>
<tr>
<td>2009</td>
<td>14,566.5</td>
<td>109.716</td>
<td>13,276.6</td>
<td>2.81</td>
</tr>
<tr>
<td>2010</td>
<td>15,230.2</td>
<td>111.293</td>
<td>13,684.7</td>
<td>1.44</td>
</tr>
<tr>
<td>2011</td>
<td>15,785.3</td>
<td>114.701</td>
<td>13,762.1</td>
<td>3.06</td>
</tr>
<tr>
<td>2012</td>
<td>16,297.3</td>
<td>116.719</td>
<td>13,962.8</td>
<td>1.76</td>
</tr>
<tr>
<td>2013</td>
<td>16,999.9</td>
<td>118.487</td>
<td>14,347.5</td>
<td>1.51</td>
</tr>
<tr>
<td>2014</td>
<td>17,735.9</td>
<td>119.278</td>
<td>14,869.4</td>
<td>0.67</td>
</tr>
<tr>
<td>2015</td>
<td>18,287.2</td>
<td>120.064</td>
<td>15,231.3</td>
<td>0.66</td>
</tr>
<tr>
<td>2016</td>
<td>18,905.5</td>
<td>122.575</td>
<td>15,423.6</td>
<td>2.09</td>
</tr>
</tbody>
</table>

Data is from the Bureau of Economic Analysis and the Bureau of Labor Statistics. Nominal and Real GDP are expressed in billions of US Dollars.
United States – GDP – 1950q1–2017q2

Trillions of US Dollars

Source: Bureau of Economic Analysis and Bureau of Labor Statistics

2005 Prices

Current Prices

1952q1 1960q1 1970q1 1980q1 1990q1 2000q1 2017q2

Source: Bureau of Economic Analysis and Bureau of Labor Statistics
NORWAY – Per Capita GDP – 1950–2014
2005 US Dollars

Source: Penn World Table, ver. 9.0
2005 US Dollars

PPP

Non–PPP


Source: Penn World Table, ver. 9.0

Slide 25 Gian Luca Clementi
Takeaways

1. What really is the Gross Domestic Product?
   ○ It is the sum of value added across all establishments located within the borders
   ○ It is also the total value of final goods produced. That is, it is identical to the sum of Consumption, Investment, Government Expenditures, and the Trade Balance

2. How does GDP relate to people’s income?
   ○ National Income is simply the Gross National Product, net of depreciation
   ○ National Income accrues to labor (compensation of employees) and to capital (corporate profits, rental income, interest income)
   ○ Proprietors’ income consists of both labor and capital income
3. How accurate is GDP as measure of a country’s well-being?
   - GDP is an imperfect measure of aggregate value added, because it mismeasures or misses altogether activities that are not priced.
   - There is more to well-being than what is included in value added – other determinants of well-being must be considered.
   - Still, GDP is positively correlated with most of the other indicators of human development.

4. What is inflation?
   - It is simply the growth rate of the price level.
5. How do we measure inflation?
   - The most used measure is the Consumer Price Index
   - According to the CPI, inflation is the rate of growth in the value of a given basket of goods and services

6. What is the Purchasing Power Parity adjustment?
   - The PPP adjustment consists in evaluating every country’s GDP with the same set of prices
   - It eliminates fluctuations due to erratic changes in exchange rates
   - It eliminates deviations due to mere differences in the price level