Understanding the World Economy
Master in Economics and Business

Why are some countries richer than others? – Part 1

Lecture 1

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Practical matters

Course website

http://econ.sciences-po.fr/staff/nicolas-coeurdacier

Link to Master E&B

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No office hours but meetings can be easily organized. Just drop me an email.
Practical matters

Suggested textbooks

- Macroeconomics, S. Williamson, 4\textsuperscript{th} edition.
- Macroeconomics, Charles. I. Jones, 2\textsuperscript{nd} edition.

Other material

Slides for the course as well as additional readings/references posted on my website.
Practical matters

Grading

– 40% homework (group of 4 people). To be handed back at lecture 9.

Find an important policy question (YES/NO) which deals with a subject of macroeconomics. Find related academic articles (IMF, OECD, *Economic Policy*, World Bank, NBER or CEPR WP...) and press articles (FT, The Economist,...) which tackle the question. In a 6 pages document (4000 words max.), provide a critical answer to the question.

– 60% final exam: Multiple choice, short exercise(s), short essay. See website for example.
Practical matters

Homework suggestions

• Will Chinese growth slowdown?
• Is ICT a Third Industrial Revolution?
• Should the Anglo-Saxon labour market be the inspiration for reform in continental Europe?
• Should governments reduce legal working hours to fight unemployment?
• Should monetary policy target asset prices as well as consumers prices?
• Should the ECB tolerate more inflation?
• Should governments bailout banks in difficulties?
• Should governments use actively fiscal policy to stabilize output?
• Should governments make reductions of public debt and fiscal deficits their immediate priority?
• Have global financial markets spread the 2008 financial crisis worldwide?
• Should Greece leave the eurozone? (or should Iceland join?)

.....

These are just suggestions. You are free to choose another topic as long as related to macro topics covered in class! Avoid very broad questions. Please contact me once you have chosen your question.
Lecture 1: Why are some countries richer than others? – Part 1

1. What is macroeconomics?

2. Defining GDP

3. Economic growth - the Solow model
Micro and Macro

Microeconomics
• Focuses on the behavior of a single agent (firms, households, government)
• or a single market (the market for mushroom soups)
• Partial equilibrium

Macroeconomics
• Focuses on the behavior of the aggregate variables
• Prices and quantities
• General equilibrium
Macroeconomic discussion often focuses on the short/medium term...

Outlook for the World Economy?

- What will happen to house prices?
- Should the ECB raise interest rates?
- Will governments reduce debt and deficits?
- Will unemployment fall next year?
Macroeconomic discussion often focuses on the short/medium term...

US business cycle fluctuations (% deviations from trend)

Source: Federal Reserve Economic Data
...but also long term-issues

U.S. Gross domestic product per capita, 1870-2010
...but also long term-issues

Gross domestic product per capita, 1870-2010 (log-scale)
Course Syllabus

- Long-term economic growth (1/2)
- Labour Market and Unemployment (3)
- Inequalities (4)
- Money and Inflation (5)
- Business cycle fluctuations (6/7)
- Monetary Policy (8)
- Fiscal Policy (9)
- Exchange rates and open economy macroeconomics (10/11)
- Financial crises (12)
1. What is macroeconomics?

2. Defining GDP

3. Economic growth - the Solow model
Definition of GDP

- GDP (Gross Domestic Product) is the most important variable in macroeconomics.
- GDP measures aggregate production or aggregate output.
- GDP is a flow variable measured usually during a yearly or a quarterly period.
- GDP per capita indicates the level of development of a country. Massive variations across countries.
Real GDP per capita and shares of global population

Source: World Bank, 2011 Data
Measuring GDP: National Income Accounting

<table>
<thead>
<tr>
<th>Level</th>
<th>Product</th>
<th>Price</th>
<th>Labour</th>
<th>Capital</th>
</tr>
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<tbody>
<tr>
<td>Retailer</td>
<td>10 tables</td>
<td>@$400 each</td>
<td>1200</td>
<td>800</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>10 tables</td>
<td>@$200 each</td>
<td>700</td>
<td>300</td>
</tr>
<tr>
<td>Forester</td>
<td>Wood</td>
<td>$1000</td>
<td>900</td>
<td>100</td>
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</table>
Measuring GDP: National Income Accounting

Three different ways to compute GDP

1. **Expenditure approach**:
   
   GDP = total spending on all *final* goods and services produced in the economy

2. **Income approach**:
   
   GDP = all income received by economic agents contributing to production

3. **Value added approach**
   
   GDP = sum of value-added to goods and services across all productive units in the economy
   
   Value Added = increase in the value of goods as a result of the production process.
   
   Value Added = Value of production - Value of intermediate goods
**Measuring GDP: National Income Accounting**

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<td>Wood</td>
<td>$1000</td>
<td>900</td>
<td>100</td>
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**Method 1 = Expenditure approach**: GDP = 10*$400 = $4000

**Method 2 = Income Approach**: GDP = $2800 + $1200 = $4000

**Method 3 = Value-added**: GDP = 10*($400-$200)+(10*$200-$1000)+$1000 = $4000

Very important to notice that we measure *value added*. Adding value of output at each stage instead of value added would lead to double or triple counting.
Share of value-added across sectors
Selected developed countries 1800-2000

Agriculture

Manufacturing

Services

Log of GDP per capita (1990 international $)

Belgium    Spain    Finland    France    Japan
Korea    Netherlands    Sweden    United Kingdom    United States
Expenditure approach

• GDP = total spending on all *final* goods and services produced in the economy

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

• Y : Nominal GDP
• C: Consumption Expenditures
• I : Investment Expenditures
• G: Government Expenditures
  – Transfer payments not included. Why?
• NX : Net exports
  \[ NX = \text{total export of goods & services minus total imports of goods & services} \]
U.S and China expenditure components (% of GDP)

Output = $Y = rK + wL$

with capital incomes (rK), labour incomes (wL) and output (Y)

- Capital share = \( \frac{rK}{Y} \); Labour share = \( \frac{wL}{Y} \)
- Capital share goes up if return per unit of capital (r) or capital stock (K) increase.
- Labour share goes up if wages w or labour supply L increase.

\[
\frac{\text{Capital share}}{\text{Labour share}} = \left( \frac{r}{w} \right) \left( \frac{K}{L} \right)
\]

- Usually relative quantities (K/L) and relative prices (r/w) and move in opposite direction. Why?
- Stable labour and capital shares?
The U.S. labour share (1929-2012)

Source: Bureau of Economic Analysis
### Nominal and Real GDP

<table>
<thead>
<tr>
<th></th>
<th>Production Year 1</th>
<th>Production Year 2</th>
<th>Price Year 1</th>
<th>Price Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retailer</td>
<td>10 tables</td>
<td>10 tables</td>
<td>@$400 each</td>
<td>@$450 each</td>
</tr>
</tbody>
</table>

Between year 1 and year 2:
Real GDP unchanged = 10 tables = 4000$ at Year 1 Price
Nominal GDP has increased by 12.5%, from 4000$ to 4500$
Inflation = 12.5%
Nominal and Real GDP

<table>
<thead>
<tr>
<th>Retailer</th>
<th>Production Year 1</th>
<th>Production Year 2</th>
<th>Price Year 1</th>
<th>Price Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 tables</td>
<td>12 tables</td>
<td>@$400 each</td>
<td>@$450 each</td>
</tr>
</tbody>
</table>

Between year 1 and year 2:
Real GDP increased by 20%
Nominal GDP has increased by 35%, from $4000 to $5400
Inflation = 12.5%
Some important issues with GDP

• GDP different from national income (GNI)

• GDP fails to capture non-market activity
  – Home production, informal sector or black market activity

• GDP excludes:
  – Capital gains on assets, financial and non-financial.

• GDP a measure of welfare?
  – Does not include some important dimensions of welfare (civil rights, education, inequalities...)
  – Not all GDP based activity is welfare enhancing – e.g prices may not capture social value – environmental pollution.
From GDP to GNI (or GNP)

**Add transfers from abroad [UK nationals]**
- remitted profits from UK firms foreign operations
- interest payments and dividends received from overseas investments
- remittances from UK residents based overseas
- grants received from foreign governments

**Deduct transfers to foreigners [non UK nationals]**
- remitted profits from foreign firms UK operations
- interest payments and dividends received from foreign investments in the UK
- remittances from overseas residents based in the UK
- grants paid by UK government
Difference between GDP and GNI (% of GDP)

Source: OECD Main Economic Indicators and Quarterly National Accounts, International Monetary Fund, 2009.
Size of the underground economy: estimates
(% of GDP)

Source: World Bank, 1999-2006 average
Welfare and GDP

“Gross National Happiness is more important than Gross National Product.” Bhutan’s King Jigme Singye Wangchuk

“The gross national product does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. It measures neither our courage, nor our wisdom, nor our devotion to our country. It measures everything, in short, except that which makes life worthwhile, and it can tell us everything about America except why we are proud to be Americans.” U.S. Senator Robert F. Kennedy, 1968
Measuring Welfare

- Economists and international organizations have developed indices to measure the welfare of countries beyond GDP per capita.

- Indices measuring various dimensions of welfare: health, education, income inequality, leisure, institutional quality...

- The UN’s Human Development Index: HDI is a weighted average of indicators of health (life expectancy), schooling and income per head.

- Index developed by Jones and Klenow, Stiglitz-Sen-Fitoussi (OECD Better Life Index)...
### Welfare and income across countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Welfare $\lambda$</th>
<th>Per capita Income</th>
<th>Log Ratio</th>
<th>LifeExp</th>
<th>C/Y</th>
<th>Leisure</th>
<th>C Ineq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>100.0</td>
<td>100.0</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>France</td>
<td>91.5</td>
<td>70.3</td>
<td>0.263</td>
<td>0.176</td>
<td>-0.085</td>
<td>0.067</td>
<td>0.106</td>
</tr>
<tr>
<td>Sweden</td>
<td>91.2</td>
<td>79.4</td>
<td>0.139</td>
<td>0.181</td>
<td>-0.186</td>
<td>0.010</td>
<td>0.135</td>
</tr>
<tr>
<td>Japan</td>
<td>82.8</td>
<td>71.3</td>
<td>0.149</td>
<td>0.265</td>
<td>-0.154</td>
<td>-0.026</td>
<td>0.063</td>
</tr>
<tr>
<td>Norway</td>
<td>81.0</td>
<td>112.8</td>
<td>-0.331</td>
<td>0.148</td>
<td>-0.598</td>
<td>0.019</td>
<td>0.100</td>
</tr>
<tr>
<td>Germany</td>
<td>77.4</td>
<td>74.4</td>
<td>0.039</td>
<td>0.098</td>
<td>-0.195</td>
<td>0.047</td>
<td>0.089</td>
</tr>
<tr>
<td>Ireland</td>
<td>69.6</td>
<td>96.4</td>
<td>-0.325</td>
<td>0.069</td>
<td>-0.454</td>
<td>-0.022</td>
<td>0.082</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>59.0</td>
<td>83.4</td>
<td>-0.345</td>
<td>0.239</td>
<td>-0.433</td>
<td>-0.151</td>
<td>-0.000</td>
</tr>
<tr>
<td>Singapore</td>
<td>56.7</td>
<td>117.1</td>
<td>-0.726</td>
<td>0.139</td>
<td>-0.685</td>
<td>-0.180</td>
<td>-0.000</td>
</tr>
<tr>
<td>South Korea</td>
<td>45.2</td>
<td>58.3</td>
<td>-0.254</td>
<td>0.078</td>
<td>-0.290</td>
<td>-0.118</td>
<td>0.076</td>
</tr>
<tr>
<td>Argentina</td>
<td>21.8</td>
<td>26.2</td>
<td>-0.181</td>
<td>-0.121</td>
<td>-0.108</td>
<td>0.048</td>
<td>-0.000</td>
</tr>
<tr>
<td>Chile</td>
<td>19.7</td>
<td>30.9</td>
<td>-0.451</td>
<td>0.029</td>
<td>-0.254</td>
<td>-0.026</td>
<td>-0.199</td>
</tr>
<tr>
<td>Thailand</td>
<td>10.9</td>
<td>18.1</td>
<td>-0.507</td>
<td>-0.158</td>
<td>-0.207</td>
<td>-0.043</td>
<td>-0.099</td>
</tr>
<tr>
<td>South Africa</td>
<td>4.5</td>
<td>17.4</td>
<td>-1.351</td>
<td>-0.931</td>
<td>-0.053</td>
<td>0.061</td>
<td>-0.427</td>
</tr>
<tr>
<td>Botswana</td>
<td>4.3</td>
<td>25.1</td>
<td>-1.767</td>
<td>-0.852</td>
<td>-0.574</td>
<td>-0.008</td>
<td>-0.333</td>
</tr>
<tr>
<td>Vietnam</td>
<td>4.0</td>
<td>5.9</td>
<td>-0.378</td>
<td>-0.082</td>
<td>-0.269</td>
<td>-0.020</td>
<td>-0.006</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>3.1</td>
<td>8.3</td>
<td>-0.972</td>
<td>-0.983</td>
<td>0.155</td>
<td>-0.050</td>
<td>-0.094</td>
</tr>
<tr>
<td>Kenya</td>
<td>1.9</td>
<td>2.8</td>
<td>-0.388</td>
<td>-0.394</td>
<td>0.104</td>
<td>0.059</td>
<td>-0.157</td>
</tr>
</tbody>
</table>

Note: The table shows the consumption-equivalent welfare calculation based on equation (7). The second line for each country shows life expectancy, the ratio of consumption to income, annual hours worked per capita, and the standard deviation of log consumption. Results for additional countries can be downloaded at [http://www.stanford.edu/~chad/BeyondGDP400.xls](http://www.stanford.edu/~chad/BeyondGDP400.xls).

Source: Jones and Klenow, AER 2016 (2007 data)
GDP per capita and welfare highly correlated

Source: Jones and Klenow, AER 2016 (2007 data)
Lecture 1: Why are some countries richer than others? – Part 1

1. What is macroeconomics?

2. Defining GDP

3. Economic growth - the Solow model
What are the engines of economic growth?

• The full picture is complicated and involves many different aspects.
• Focus first on just one factor - capital accumulation. Increases in the stock of physical capital (buildings and machinery).
• Stress many other things important – not least how efficiently this capital stock is used. Capital is just a starting point.
Production function

Output
produced

Buildings and machinery

Labour input

Technical knowledge and efficiency

Today focus on first input – capital accumulation
Production function

- Output $Y_t$ (at date $t$) is produced using inputs (capital $K_t$ and labour $L_t$) more or less efficiently.
- Production function:
  \[
  Y_t = f(K_t, L_t) = A_t(K_t)^\alpha (L_t)^{1-\alpha}
  \]
  $A_t$ is an efficiency parameter (think ‘technology’). Also called ‘Total Factor Productivity’ (TFP).
  $0 < \alpha < 1$: share of capital in value added.
  $Y_t$ is increasing in inputs $K_t$ and $L_t$ and efficiency $A_t$. 
Production function

\[ Y_t = A_t(K_t)^\alpha (L_t)^{1-\alpha} \]

Constant returns to scale with respect to both inputs. Double \( K_t \) and \( L_t \), double \( Y_t \).

Decreasing returns to scale to each input \((0 < \alpha < 1)\): each additional unit of input brings less and less output.

Output per capita (with \( k_t = \frac{K_t}{L_t} = \text{capital per capita} \)):

\[ \frac{Y_t}{L_t} = y_t = A_t(K_t/L_t)^\alpha = A_t(k_t)^\alpha \]
Higher capital stock per capita increases output per capita

Output per worker $y$

Capital per worker $k$

$y = A k^\alpha$

Low $k$  high $k$
Higher TFP increases output per capita

\[ y = Ak^\alpha \]

Output per worker \( y \)

Capital per worker \( k \)

Increase in \( A \)
How does capital accumulation work?

• How does increasing the capital stock lead to higher output?

The marginal product of capital (MPK) is the increase in output that comes from increasing the capital stock *leaving everything else unchanged*.

• The MPK can be:
  • decreasing (Solow model) – each new machine adds less than the last
  • constant (Endogenous Growth I – AK) – each new machines adds the same as the last
  • increasing (Endogenous Growth II – Poverty Trap) – each new machine adds more than the last
THE RETURN ON CAPITAL
Diminishing Marginal Product of Capital

\[ Y = A (K)^\alpha (L)^{1-\alpha} \]

\[ MPK = \frac{\partial Y}{\partial K} = \alpha A (L/K)^{1-\alpha} \]
THE RETURN ON CAPITAL
Constant Marginal Product of Capital

\[ \alpha = 1 \]
\[ Y = AK \]
\[ MPK = \frac{\partial Y}{\partial K} = A \]
THE RETURN ON CAPITAL
Increasing Marginal Product of Capital

Return on Capital
(MPK)

Capital $K$

$\alpha > 1$

$Y = A (K)^\alpha (L)^\beta$

$MPK = \frac{\partial Y}{\partial K} = \alpha A(K)^{\alpha-1} (L)^\beta$
Decreasing MPK

- Assumptions about MPK purely technological – no economics involved.
- Different assumptions may be needed for different technologies.
- We stick on **decreasing** returns - neoclassical production function with $0 < \alpha < 1$ and $k = \frac{K}{L} =$ capital per capita:

\[
MPK = \frac{\partial Y}{\partial K} = \alpha A(k)^{\alpha-1}
\]

Remark: Different assumptions lead to dramatically different implications. What would cross country growth patterns look like if MPK were initially increasing and then became decreasing?
Decreasing MPK

Output per worker $y$

Capital per worker $k$

$y = Ak^\alpha$

$\Delta y_1 > \Delta y_2$
Will countries which invest more grow faster?

• Ultimately - No
• Short Term - Yes

• In long-run, investment affects only level not growth of output.
• To show this we need to add some economics to our technology assumption – need to introduce investment.
The Solow growth model

Production: \( Y_t = A_t(K_t)^\alpha (L_t)^{1-\alpha} \)

Capital accumulation:
\[
K_{t+1} = (1 - \delta)K_t + I_t
\]

\( \delta = \) depreciation rate; \( I_t = \) investment

\( I_t = \) Savings = constant fraction \( s \) of income:
\[
I_t = sY_t = sA_t(K_t)^\alpha (L_t)^{1-\alpha}
\]

Capital obeys to:
\[
K_{t+1} = (1 - \delta)K_t + sA_t(K_t)^\alpha (L_t)^{1-\alpha}
\]
The Solow growth model: steady state

\[ K_{t+1} = (1 - \delta)K_t + sA_t(K_t)^{\alpha} (L_t)^{1-\alpha} \]

Assuming for now constant \( L_t \) and \( A_t \).

In per capita terms: \( k_{t+1} = (1 - \delta)k_t + sA (k_t)^{\alpha} \)

\[ k_{t+1} - k_t = sA (k_t)^{\alpha} - \delta k_t \]

Steady-state defined as: \( k_{t+1} = k_t = k^* \)

\[ \delta k^* = sA (k^*)^{\alpha} \]

Steady-state capital and output per worker:

\[ k^* = \left( \frac{sA}{\delta} \right)^{1/(1-\alpha)}; \quad y^* = A (k^*)^{\alpha} \]
Steady-state capital stock per worker

\[ i = \delta k \]

\[ i = sA k^\alpha \]
Convergence to the steady state

• **When capital stock is low:**
  Each new machine leads to a big increase output.
  The amount of output needed to replace machines that have worn out is low.
  As a result output increases.

• **When capital stock is (too) high:**
  Each new machine leads to a small increase in output.
  Every period a substantial part of output is needed to replace machines that have worn out.
  Eventually output decreases.
  Key to these results is **decreasing marginal return on capital**.
Higher savings increase the steady-state capital stock

For steady state investment per worker, we have:

\[ i = \delta k \]

If savings increase (Higher \( s \)), then the steady state capital stock increases:

\[ i = sA k^\alpha \]

Diagram:

- Steady state investment per worker
- Capital per worker \( k \)
- \( k^* \) and \( k^{**} \) represent steady states with different savings rates.
Higher TFP increases the steady-state capital stock

Steady state investment per worker

Capital per worker $k$

$\delta k$

Higher $A$

$i = sA k^\alpha$

$k^*$

$k^{**}$
Optimal consumption and welfare

- A high savings rate leads to high income but low consumption
- A low savings rate leads to low income but high consumption

Consumption per worker in the steady-state

$$c^* = (1 - s)A (k^*)^\alpha = (1 - s)A\left(\frac{SA}{\delta}\right)^{\alpha/(1-\alpha)}$$

The “Golden rule” - level of savings that maximizes consumption in the steady state. Theory suggests that optimal rate around 30-35% of GDP
Saving rates (% of GDP)
Selected countries, average 2010-2015.

Source: World Bank
The Solow growth model: dynamics

Steady-state: \( k^* = \left( \frac{SA}{\delta} \right)^{1/(1-\alpha)} \)

Dynamics: \( k_{t+1} = (1 - \delta)k_t + sA \left( k_t \right)^{\alpha} \)

\[ \rightarrow k_{t+1} = f(k_t) \text{ with } k^* = f(k^*) \]

Convergence: \( k_t \) converges to \( k^* \).

As \( k_t \) approaches \( k^* \), the growth rate of \( k_t \) (and output \( y_t \)) decreases.

The **further** away from \( k^* \) a country is, the **faster** it grows.
Dynamics of the capital stock per worker

\[ k_{t+1} = f(k_t) \]

\[ k_{t+1} = k_t \]
Implications of the Solow growth model

1. Countries always eventually reach their steady state
2. In the steady state/long run growth only comes from TFP. Countries at their steady state no longer grow from capital accumulation. Think of the OECD economies as those at their steady state.
3. Richer countries should grow slower than poorer ones: Higher returns on investment in poorer countries. Emerging markets are moving towards a steady state and growing fast.

According to this story we would expect countries to “catch up” with economically most advanced nations
Catch up amongst Europe’s big 4

GDP per capita (log-scale, USD)

Source: Maddison, GGDC and DataStream
Asian Tigers: growth miracle?

• In the post-war period we have witnessed astonishing levels of growth in the “Asian Tigers”.

• The press and political commentators:
  • Bad for the West: Take our jobs
  • Western leaders and CEO’s should look at the Tigers and learn how to improve efficiency.

• Economists: No growth miracle. Just accumulation of inputs.
Average Growth GDP per capita 1966-2009

Source: Penn WT 6.3 and DataStream.
Asian Tigers: growth miracle?

- Some differences in the sources of growth. BUT: Increased capital stock MOST important factor for all of them.
- Krugman: “Perspiration rather than inspiration”!
- Too rapid development? No gains from the learning curve? Does it matter?
  - No: They got much richer anyway
  - Yes: Some have paid for it - those that were young early on in the process: Low income, high savings
  - Future? Need to shift from extensive to intensive margin
Summary

- Macroeconomics is about short/medium-term fluctuations of the main aggregate economic variables but also about long-term issues, such as long-term economic development.
- GDP measures the quantity of goods and services produced, looking at incomes of residents, their expenditures on final goods and services or the value added of different producers.
- GDP is the outcome of a production process mixing inputs (capital & labor) and a given technology (TFP).
- The Solow model focuses on explaining cross-country income differences through capital accumulation. The assumption of decreasing marginal product of capital implies convergence. Countries with higher investment rates are richer but, at the steady state, all countries grow at the rate of technological progress.