The Facts of Economic Growth

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Prepared for the Handbook of Macroeconomics
Outline

• Facts of Frontier Growth (e.g. U.S. or West)
  ◦ Basic facts
  ◦ Growth accounting and components
  ◦ Miscellaneous

• The Spread of Growth
  ◦ Basic facts
  ◦ Development accounting
  ◦ Why such large TFP differences?
GDP per person in the United States

LOG SCALE, CHAINED 2009 DOLLARS

2.0% per year

YEAR

1880 1900 1920 1940 1960 1980 2000

2,000 4,000 8,000 16,000 32,000 64,000
## The Stability of U.S. Growth

<table>
<thead>
<tr>
<th>Period</th>
<th>Growth Rate</th>
<th>Period</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870–2007</td>
<td>2.03</td>
<td>1973–1995</td>
<td>1.82</td>
</tr>
<tr>
<td>1900–1950</td>
<td>2.06</td>
<td>2001–2007</td>
<td>1.72</td>
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<tr>
<td>1950–2007</td>
<td>2.16</td>
<td></td>
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<tr>
<td>1950–1973</td>
<td>2.50</td>
<td></td>
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<tr>
<td>1973–2007</td>
<td>1.93</td>
<td></td>
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</tbody>
</table>
Economic Growth over the Very Long Run

INDEX (1.0 IN INITIAL YEAR)

Per capita GDP

Population

YEAR
### Growth Accounting for the United States

<table>
<thead>
<tr>
<th>Period</th>
<th>Output per hour</th>
<th>$K/Y$</th>
<th>Labor Composition</th>
<th>Labor-Aug. TFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1948–2013</td>
<td>2.5</td>
<td>0.1</td>
<td>0.3</td>
<td>2.0</td>
</tr>
<tr>
<td>1948–1973</td>
<td>3.3</td>
<td>-0.2</td>
<td>0.3</td>
<td>3.2</td>
</tr>
<tr>
<td>1973–1990</td>
<td>1.6</td>
<td>0.5</td>
<td>0.3</td>
<td>0.8</td>
</tr>
<tr>
<td>1990–1995</td>
<td>1.6</td>
<td>0.2</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>1995–2000</td>
<td>3.0</td>
<td>0.3</td>
<td>0.3</td>
<td>2.3</td>
</tr>
<tr>
<td>2000–2007</td>
<td>2.7</td>
<td>0.2</td>
<td>0.3</td>
<td>2.2</td>
</tr>
<tr>
<td>2007–2013</td>
<td>1.7</td>
<td>0.1</td>
<td>0.5</td>
<td>1.1</td>
</tr>
</tbody>
</table>
U.S. Investment in Physical Capital

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U.S. Capital and Labor Shares of Factor Payments

PERCENT

Labor share

Capital share

YEAR

U.S. Educational Attainment

YEARS OF SCHOOLING

By birth cohort

Adult labor force

YEAR

1880 1900 1920 1940 1960 1980 2000

15 14 13 12 11 10 9 8 7
College Graduates and the College Wage Premium

Fraction of hours worked by college-educated workers (left scale)

College wage premium (right scale)
U.S. Research and Development Spending

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Share of Employment in R&D

The chart shows the share of the population employed in R&D from 1950 to 2010 for the United States, OECD, and OECD plus China and Russia. The share of the population in R&D employment generally increases over time for all regions, with the United States leading the trend. The OECD and OECD plus China and Russia follow, with the latter showing a slightly lower trend.

The chart highlights the growth in R&D employment as a percentage of the population, which is an important indicator of investment in research and development and its potential impact on innovation and economic growth.
Total in 2013: 302,000
U.S. origin: 147,000
Foreign share: 51%
Average Annual Hours Worked

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Top Income Inequality

INCOME SHARE OF TOP 0.1 PERCENT

United States

France

YEAR

GDP per person, Top 0.1% and Bottom 99.9%

THOUSANDS OF 2009 CHAINED DOLLARS

YEAR


Top 0.1%

6.86%

0.72%

Bottom 99.9%

1.82%

2.30%
The Real Price of Industrial Commodities

EQUALLY-WEIGHTED PRICE INDEX (INITIAL VALUE IS 100)

YEAR

1900 1920 1940 1960 1980 2000

0 20 40 60 80 100 120 140
The Great Divergence

GDP PER PERSON (MULTIPLE OF 300 DOLLARS)

YEAR

U.S.
U.K.
Japan
Argentina
China
Ghana
The Spread of Economic Growth since 1980

GDP PER PERSON (US=100)

- United States
- Japan
- Western Europe
- Russia
- Brazil
- China
- India
- Sub-Saharan Africa

YEAR


5 10 20 40 80
Convergence in the OECD

Growth Rate, 1960-2011

GDP Per Person (US=1) in 1960
The Lack of Convergence Worldwide

GROWTH RATE, 1960 - 2011

GDP PER PERSON (US=1) IN 1960
Divergence since 1960

Standard deviation of log GDP per person (left scale)

Ratio of GDP per person, 5th Richest to 5th Poorest (right scale)
The Very Long-Run Distribution

<table>
<thead>
<tr>
<th>“Bin”</th>
<th>1960</th>
<th>2010</th>
<th>Long-Run</th>
<th>Years to “Shuffle”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 percent</td>
<td>14</td>
<td>29</td>
<td>27</td>
<td>1470</td>
</tr>
<tr>
<td>Between 5 and 10 percent</td>
<td>21</td>
<td>12</td>
<td>9</td>
<td>1360</td>
</tr>
<tr>
<td>Between 10 and 20 percent</td>
<td>25</td>
<td>13</td>
<td>8</td>
<td>1040</td>
</tr>
<tr>
<td>Between 20 and 40 percent</td>
<td>18</td>
<td>16</td>
<td>8</td>
<td>1120</td>
</tr>
<tr>
<td>Between 40 and 80 percent</td>
<td>14</td>
<td>18</td>
<td>28</td>
<td>1450</td>
</tr>
<tr>
<td>More than 80 percent</td>
<td>7</td>
<td>12</td>
<td>20</td>
<td>1500</td>
</tr>
</tbody>
</table>
The Distribution of World Income by Population

SHARE OF WORLD POPULATION (PERCENT)

1960

2011

China

India

DAILY INCOME PER PERSON

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## Development Accounting

<table>
<thead>
<tr>
<th></th>
<th>GDP per worker, $y$</th>
<th>$(K/Y)^{\alpha/(1-\alpha)}$</th>
<th>Human capital, $h$</th>
<th>TFP</th>
<th>Share to TFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>...</td>
</tr>
<tr>
<td>France</td>
<td>0.790</td>
<td>1.184</td>
<td>0.840</td>
<td>0.795</td>
<td>55.6%</td>
</tr>
<tr>
<td>U.K.</td>
<td>0.733</td>
<td>1.015</td>
<td>0.780</td>
<td>0.925</td>
<td>46.1%</td>
</tr>
<tr>
<td>Japan</td>
<td>0.683</td>
<td>1.218</td>
<td>0.903</td>
<td>0.620</td>
<td>63.9%</td>
</tr>
<tr>
<td>Argentina</td>
<td>0.376</td>
<td>1.109</td>
<td>0.779</td>
<td>0.435</td>
<td>66.5%</td>
</tr>
<tr>
<td>China</td>
<td>0.136</td>
<td>1.137</td>
<td>0.713</td>
<td>0.168</td>
<td>82.9%</td>
</tr>
<tr>
<td>India</td>
<td>0.096</td>
<td>0.827</td>
<td>0.533</td>
<td>0.217</td>
<td>67.0%</td>
</tr>
<tr>
<td>Malawi</td>
<td>0.021</td>
<td>1.107</td>
<td>0.507</td>
<td>0.038</td>
<td>93.6%</td>
</tr>
<tr>
<td>Average</td>
<td>0.194</td>
<td>0.978</td>
<td>0.694</td>
<td>0.286</td>
<td>64.3%</td>
</tr>
<tr>
<td>1/Average</td>
<td>5.146</td>
<td>1.022</td>
<td>1.440</td>
<td>3.496</td>
<td>70.4%</td>
</tr>
</tbody>
</table>
The Share of TFP in Development Accounting

PERCENT

GDP PER WORKER, 2010 (US=1)
Taxes and Growth in the United States

- **GROWTH RATE (PERCENT)**
- **TAX SHARE (PERCENT)**

**Total government revenues as a share of GDP (right scale)**

**Annual growth of GDP per person (moving average, +/-5 years, left scale)**
Tax Revenues as a Share of GDP

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The Distribution of TFPR in 4-digit Manufacturing

![Graph showing the distribution of TFPR in 4-digit manufacturing for U.S., China, and India.](image-url)
Technology Adoption is Speeding Up Over Time

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Conclusion: Missing facts?

• Trade and growth
  ◦ Something like Sachs-Warner — open economies grow faster for awhile?

• Spread of growth feeds the frontier
  ◦ PhD’s in science/engineering in China

• Other
  ◦ Hsieh-Moretti misallocation of population across space
  ◦ Karabarbounis-Neiman factor shares for other countries