Macroeconomics

MECN 450
Winter 2004

Topic 2:
Long Run Growth
Long-run Growth

Diagnostics: What are the Sources of Growth?
- Growth Accounting
- Investment and Capital Accumulation
- Productivity Growth

Prescriptions: What determines whether countries grow or stagnate?
- The Solow growth model

Long-run Growth

A snapshot of the growth experience in industrialized macro-economies
Ranking these countries from lowest to highest initial GDP per capita, examine their subsequent growth:

<table>
<thead>
<tr>
<th>Country</th>
<th>percent growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1870-1996</td>
</tr>
<tr>
<td>Japan</td>
<td>2.7%</td>
</tr>
<tr>
<td>Germany</td>
<td>2.0%</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.9%</td>
</tr>
<tr>
<td>Canada</td>
<td>2.1%</td>
</tr>
<tr>
<td>France</td>
<td>1.8%</td>
</tr>
<tr>
<td>US</td>
<td>1.7%</td>
</tr>
<tr>
<td>UK</td>
<td>1.4%</td>
</tr>
<tr>
<td>Australia</td>
<td>1.3%</td>
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</tbody>
</table>
What are the important features of growth among the industrialized countries?

- All grew very quickly for long periods of time
- Growth sped up post-WWII
- The initially “poorest” grew the most quickly –
- There is a tendency to converge

What governs this growth process?

- We can break down the growth of output into
  - Growth in inputs (capital and labor)
  - Growth in productivity
Growth Accounting

- Production: combining capital and labor together to produce output
- Productivity: governs how efficiently capital and labor produce output

Two countries can take the same amounts of capital and labor, and produce different amounts of output ... one has higher productivity than the other.

How can we isolate and measure productivity?

- We measure inputs and we measure output - so productivity will be a “residual”
- Suppose we increased all inputs by 5% each - how much would you expect output to go up?
Data gives us the following two estimates:
- If capital increases by 10%, output increases by 3%
- If labor increases by 10%, output increases by 7%

These are the “elasticities” that Abel & Bernanke calculate:
- The “elasticity of output with respect to capital” is 0.3
  (= 3/10, the ratio of the percentages above)
- The “elasticity of output with respect to labor” is 0.7
  (= 7/10, the ratio of the percentages above)

So, if capital and labor both go up by 5%, what happens to output?
- The increase in capital increases output by .3 × 5% = 1.5%
- The increase in labor increases output by .7 × 5% = 3.5%
- In sum, output increases by 1.5% + 3.5% = 5%
  (This is exactly the same as the input increase because the two elasticities sum to one.)

What does this imply about “returns to scale”?
- A short tangent on “production functions”....
Suppose instead, you observe that capital and labor both go up by 5%, but output goes up by more than 5%?

Productivity must have increased! But by how much?

Expected output growth = 
\[0.3 \times \text{growth}(K) + 0.7 \times \text{growth}(L)\]

Productivity growth = \text{growth}(Y) - 
\[0.3 \times \text{growth}(K) + 0.7 \times \text{growth}(L)\]

*Productivity growth* is the growth in output not explained by growth in inputs.

Using this decomposition of growth...

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>1.42</td>
<td>1.40</td>
<td>1.13</td>
<td>1.34</td>
<td>1.71</td>
</tr>
<tr>
<td>Capital</td>
<td>0.11</td>
<td>0.77</td>
<td>0.69</td>
<td>0.56</td>
<td>0.98</td>
</tr>
<tr>
<td>Total inputs</td>
<td>1.53</td>
<td>2.07</td>
<td>1.82</td>
<td>1.90</td>
<td>2.69</td>
</tr>
<tr>
<td>Pdvty</td>
<td>1.01</td>
<td>1.53</td>
<td>-0.27</td>
<td>1.02</td>
<td>0.76</td>
</tr>
<tr>
<td>Output</td>
<td>2.54</td>
<td>3.70</td>
<td>1.55</td>
<td>2.92</td>
<td>3.45</td>
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The important features of 20th century US growth are

- Steady growth in inputs throughout
- Very high productivity growth in the ‘50s and ’60s
- Productivity slowdown after 1973
- Productivity recovery in the 1990s?

Growth of Inputs: Labor

- Should we increase the labor force in order to increase output?
- More strongly, should we increase population growth in order to increase output growth?
- What happens to output per capita when we increase the labor force (without increasing capital or productivity)?
Growth of Inputs: Capital

- How does an economy accumulate more capital?
- In a closed economy, it can save.
- Is this a good prescription for developing economies?
- In an open economy, these economies can borrow in order to invest.

Capital: saving and investment

- Recall, in an open economy $S = I + CA$
- $I$ can exceed domestic savings if there are capital inflows from abroad
- $I = S + \text{net capital inflows} = S + KFA$

(This means that $KFA = -NX \ldots$ remember why are these related?)
Capital: saving and investment

So far, we have considered this only as an accounting statement.

How do we know that Savings, Investment, and Capital Flows will equilibrate?

In a closed economy, saving = investment

Desired Saving, $S^d$

Desired Investment, $I^d$

Equilibrium $r^*$

Equilibrium $S = I$
In an open economy, saving and investment need not be equal;

Desired Saving, $S^d$

Desired Investment, $I^d$

Capital Inflows = KFA surplus

Developing economies often have trade deficits and financial account surpluses
On net, they tend to import goods and have capital inflows
Equivalently, they invest more than they save
If closed, these economies would tend to have high interest rates
When open, they borrow from abroad
Which countries tend to have trade deficits? ... surpluses?

<table>
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<th>Current Account Balance (billions)</th>
<th>1999</th>
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<tr>
<td>US</td>
<td>-331</td>
</tr>
<tr>
<td>Brazil</td>
<td>-25</td>
</tr>
<tr>
<td>Germany</td>
<td>-19</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>+0.4</td>
</tr>
<tr>
<td>China</td>
<td>+16</td>
</tr>
<tr>
<td>France</td>
<td>+37</td>
</tr>
<tr>
<td>Japan</td>
<td>+107</td>
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*Productivity Growth*

- Growth accounting demonstrates three ways to increase output
  - increase labor
  - increase capital
  - increase productivity
- Which of these is “better”?
Productivity growth slowed down in the ‘70s

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Did it recover in the 1990s?

The data suggest that productivity improved in the 1990s, especially in the latter half.
Average productivity growth per year in 70s and 80s: 1.4%  1995-00: 2.5%

Is this a *New Industrial Revolution*?

*Or is it just a cyclical effect?*

- Look at the times when productivity *fell*
- What was happening in the economy during these times?
- What could be happening during a boom (like the 1990s)?
Current data shows...

If productivity growth has recovered ... WHY?

Robert Gordon (Northwestern) argues that productivity has risen by about 1 percentage point per year
- 1/3 of this is “cyclical” and won’t continue
- 1/3 can be explained by measurement issues
- 1/3 is in the industrial sector, specifically computer hardware manufacturing

Productivity growth in computer production was 13% per year 1995-98
Even the most pessimistic estimates are **HUGE**…

- Gordon estimates at most 0.5% per year increase in productivity growth
- Other estimates are about 1% per year

Even half a percent per year adds $1.2 trillion to the federal budget surplus over 10 years.

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These estimates feed into...

- Fiscal policy: can we afford to cut taxes since income (and therefore tax revenue) will continue to grow quickly?
- Monetary policy: can the economy continue to grow without inflation?