Total Factor Productivity & Resource Misallocation
A Literature Review
by Jie Cao
Agenda

- The Big Picture – Economic Growth
  - The Facts to Be Explained
  - A Framework for Analysis
  - The Current Consensus

- Zoom In – TFP / Misallocation
  - Decompose TFP
  - Efficiency
  - Resource Misallocation

- My Tentative Research Topic
The Big Picture
The Facts to Be Explained

- Large differences in GDP per capita across countries
  - Klenow (2006)
  - $90^{th}/10^{th}$: 25.6 (2000 PPP per capita, 83 countries)
  - $75^{th}/25^{th}$: 8.8
  - S.D. of logs: 1.16
  - Data Source: Penn World Table (PWT6.1)

- Differences in rate of growth
A Framework for Analysis

- **GDP per capita**
  - Factor accumulation:
    - Physical capital
    - Human capital

- **Input factors & Productivity**
  - Productivity:
    - Measuring productivity
    - Productivity = Technology * Efficiency

- **Fundamentals / Social Infrastructure**
  - Government;
  - Culture;
  - Geography, Climate, and Natural Resources;
  - Inequality;
The Current Consensus

- Cross-country GDP per capital variation largely due
  - NOT to differences in input factors (physical and human capital)
  - BUT to the efficiency of factor use

- Important Papers
  - Mankiw, Romer and Weil (1992)
  - Klenow and Rodriguez-Clare (1997); Hall & Jones (1999); Prescott (1998)
  - Caselli (2005); Klenow (2006)
Klenow (2006)

- Production Function: \( Y = K^\alpha (AhL)^{1-\alpha} \)
  - \( Y \): PPP GDP; \( pop \): population; \( L \): hours worked; \( h \): human capital per worker; \( K \): PPP physical capital; \( A \): a residual - TFP

- Growth / Development Accounting

\[
\frac{Y}{pop} = \frac{L}{pop} \left( \frac{K}{Y} \right)^{\frac{\alpha}{1-\alpha}} \left( \frac{h}{Y} \right)^{\frac{1}{2}} \left( \frac{A}{Y} \right)^{\frac{1}{3-6}}
\]
Zoom In
Decompose TFP

- Why large differences in TFP across countries?

- Decompose TFP (Weil 2004 text book)
  - $TFP(A) = \text{Technology}(T) \times \text{Efficiency}(E)$
  - $T$: knowledge about combining factors to produce output
  - $E$: how effectively $T$ and factors are used

- Technology ($T$) – Endogenous Growth Literature
Efficiency Matters

- Explaining cross-country income variation
  - Efficiency matters ($E$) more than technology ($T$)
  - One Table from Baily and Solow (2001)

Table: Productivity in Selected Industries in the Early 1990s (Baily and Solow, 2001)

<table>
<thead>
<tr>
<th>Industry</th>
<th>United States</th>
<th>Japan</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobiles</td>
<td>100</td>
<td>127</td>
<td>84</td>
</tr>
<tr>
<td>Steel</td>
<td>100</td>
<td>110</td>
<td>100</td>
</tr>
<tr>
<td>Food Processing</td>
<td>100</td>
<td>42</td>
<td>84</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>100</td>
<td>51</td>
<td>42</td>
</tr>
<tr>
<td>Aggregate Productivity</td>
<td>100</td>
<td>67</td>
<td>89</td>
</tr>
</tbody>
</table>
Catalogue Efficiency (Hsieh & Klenow 2009)

- **Within-firm/sector inefficiency**
  - Barriers to technology adoption
  - Slow technology diffusion
  - Technology Differences
  - Parente and Prescott (1994, 1999, 2000); Howitt (2000);
    Klenow and Rodriguez-Clare (2005)

- **Cross-firm/sector inefficiency**
  - Resource misallocation across firms / sectors

- **Other inefficiency**
  - Unproductive activities; Idle Resources
What is Resource Misallocation (Weil 2004)

- Policy Distortion Lowers TFP
  - Bad policies -> distortions
  - Distortions -> inefficient allocation of resources across sectors/ firms
  - Inefficient resource allocation -> lower aggregate TFP
What Causes Misallocation - Examples

- Huge literature on specific policy distortions
  o Favorable loans to unproductive firms
    ▪ Peek and Rosengren (2005) on Japan banking system
  o Financial frictions such as borrowing constraint or cost
    ▪ Banerjee and Duflo (2005); Buera, Kaboski and Shin (2009); Moll (2010); Midrigan and Xu (2009);
    ▪ Hosono (2010)
  o Tax deals or subsidies to state-owned firms
  o Labor market regulation
    ▪ Hopenhayn and Rogerson (1993); Lagos, (2006)
  o Restriction on firm size
    ▪ Guner, Ventura, and Xu, (2008)
Restuccia and Rogerson (2008)

- Impact of policy distortions on aggregate TFP
  o Not a particular policy distortion
  o But a class of policies that generates idiosyncratic distortions

- Modeling Strategy
  o A growth model with heterogeneous firms (Hopenhayn 1992)
  o Relate policy distortions to taxes on output, capital or labor

- Policy distortions causes sizable decreases in aggregate TFP
  o Simulations based on model calibrated to U.S. data

- Provide a general empirical measure of distortions
Hsieh and Klenow (2009)

- Measure across-firm misallocation in manufacturing sector (China and India)
  o Monopolistic competition with heterogeneous firms
    ▪ a simpler version of Melitz (2003)
  o Distortions modeled as tax on output, capital and labor
    ▪ following Restuccia & Rogerson (2007)
- Find sizable misallocation relative to the U.S.
  o Removing distortions increases manufacturing TFP by
    ▪ 30%-50% in China
    ▪ 40%-60% in India.
My Tentative Research Topic (1)

- Apply a similar framework to data from China
- Examine the productivity of state-owned enterprises (SOEs) relative to non-SOEs
- Questions to be asked
  o Relative to non-SOEs, how productive are SOEs?
    ▪ Overall
    ▪ Within each 4-digit industrial sector
  o What’s the extent of resource misallocation?
  o Relative productivity of SOEs vs. share of SOEs in a sector?
    ▪ Does relative productivity increase as competition increases?
My Tentative Research Topic (2)

- What I know now
  - SOEs are much bigger on average than non-SOEs

- What I expect to see
  - SOEs are less productive than non-SOEs
  - Sizable resource misallocations between SOEs and Non-SOEs
  - SOEs productivity correlated with sector competition

- One further related question/puzzle
  - Why over invest SOEs and under invest non-SOEs
  - Liu and Zhu (2010) provide unsatisfactory answers