Declining Trend TFP Growth (US)

Figure 1 ‘Smoothed’ trend TFP growth using complete sample

source: Crafts and Mills (2017)
...juxtaposed with new technologies

Public-Private Technology

Embodied Technology

Learning Technology

Harvesting Technology
...and other puzzling trends

- Continued weak investment in EU (to lesser extent in US)
- Labor share of income declining
- Return to tangible capital remains low
- Mark-ups are on the increase
- Profit distribution among firms more skewed
- Global frontier growth appears robust
Rapidly Changing Technology!
Not just upward shift of production possibilities or interactions between factors.
The familiar neoclassical ‘production technology’ $AF(K, L)$ no longer matches facts.
Romer-style aggregate growth models also have trouble explaining recent trends.
Lucas/Hopenhayn/Melitz production with fixed intangible investment, stochastic productivity and firm dynamics (entry, optimal size, exit) match facts better.
The new production technologies have implications for economic and legal institutions and for individual and societal choices.
Features of Hopenhayn (1992) production technology:

- Initial intangible investment generates productivity draw
- Ex-ante expected profit is zero, and profit among incumbents is skewed
- Equilibrium has entry/exit of firms and heterogeneous productivity among incumbent firms

With change to this new production technology, we are observing:

- Volatility of firm outcomes increase with use of new technology
- Share of intangibles in total investment increases
- Income share of flexible factors decrease
- Total rents increase and distribution of income becomes more skewed
Will measured TFP growth remain low?

- Crafts: This question fits into the 'too difficult' box.
- Technology for the coming decade is mostly available now
- Its productivity impact may be mismeasured
  - Relationship between producer and consumer surplus shifting
  - Blurring of GDP-production and asset boundaries
- Allocation and selection mechanisms are key
  - Wellbeing doubling in a generation: 2.5% per annum growth. But, could be higher or lower.
  - Do we observer innovative entrants?
  - Do markets allow strong reallocation to highly productive firms
Example: Productivity Enhancing Reallocation in Europe

- Bartelsman, Lopez-Garcia, Presidente (2018) using CompNet data:
  \[ \Delta x_{i,c,s,t} = \beta_1 \Delta \text{cycle}_{c,s,t} + \beta_2 \text{Rel.prod}_{i,c,s,t-3} + \gamma \text{FE} + \varepsilon_{i,c,s,t} \]

- Do resources flow to more productive firms?
  - \( \Delta \) gives 3 year growth; \( x \) is either capital or labor
  - Rel.prod gives log of productivity relative to industry mean in initial year.
  - Cycle is an exogenous 'downstream demand indicator'
  - \( i \), denotes a 'representative firm' (one of the 25 transition cells); \( c \): country; \( s \): sector; \( t \): year
  - FE are fixed effects: \( C \times S \times S_{t-3}, C \times T, S \times T \)
Baseline estimates of PER

\[ \Delta x_{i,c,s,t} = \beta_1 \Delta \text{cycle}_{c,s,t} + \beta_2 \text{Rel. prod}_{i,c,s,t-3} + \gamma \text{FE} + \varepsilon_{i,c,s,t} \]

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
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<tbody>
<tr>
<td>( \Delta ) Cycle</td>
<td>0.039</td>
<td>0.185***</td>
</tr>
<tr>
<td></td>
<td>(0.0304)</td>
<td>(0.0465)</td>
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<tr>
<td>Rel. prod_{t-3}</td>
<td>0.815***</td>
<td>0.483***</td>
</tr>
<tr>
<td></td>
<td>(0.0845)</td>
<td>(0.0616)</td>
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<tr>
<td>Observations</td>
<td>8,064</td>
<td>8,064</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.489</td>
<td>0.503</td>
</tr>
<tr>
<td>Fixed Effects</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
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FE: Country*Sector*Size_3; Country*Year; Sector*Year

Robust standard errors in parentheses

*** \( p < 0.01 \), ** \( p < 0.05 \), * \( p < 0.1 \)
Cross-country differences in PER: the role of regulation

\[ ... + \beta_3 \text{Rel.prod}_{i,c,s,t-3} \text{Regulatory Indicator}_{c,s,t-3} ... \]

<table>
<thead>
<tr>
<th>Regulatory Indicator</th>
<th>( \Delta L )</th>
<th>( \Delta K )</th>
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<tbody>
<tr>
<td>Concentration of sales, top-10</td>
<td>-0.231*</td>
<td>-0.175**</td>
</tr>
<tr>
<td>Price-cost margin</td>
<td>-0.211*</td>
<td>-0.133</td>
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<tr>
<td>Employment Protection (OECD)</td>
<td>-0.659**</td>
<td>-0.003</td>
</tr>
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*** \( p < 0.01 \), ** \( p < 0.05 \), * \( p < 0.1 \)
Growth Boosting Policy

- Stimulate the production of new ideas and new technology: *IP and market power vs open source*+
- Encourage firms to invest in (adopt) welfare enhancing technology: *carrot and stick; flexible markets*
- Keep circular flow of consumption and production going smoothly: *income distribution, watch for winner-take-all*
- Allay societal fears about jobs, income, future: *clear narrative about future potential of technology*
- Encourage socially beneficial aspects of new technologies: *well regulated platforms and directed innovation*
Technology Caveats

- Beware of hypes: AI is not yet 'general', but solves very specific problems
- Don’t worry unduly about 'singularity', or machines taking over human work.
- Positive spillovers often are balanced by negatives
- Consider long adoption lags
- Don’t overestimate the near future, but don’t underestimate the longer horizon

see: Rodney Brooks (2017)