Technical Change and Productivity

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THE FUTURE OF PRODUCTIVITY: CAN DIGITAL TRANSFORMATION MAKE A DIFFERENCE?

Productivity Commission
Wellington, 13 February 2018
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Outline

1. The OECD’s Going Digital Project

2. Some data on productivity growth

3. Possible drivers and policy issues
   - Diffusion
   - Structural change and resource allocation
   - Competition and business dynamics
   - Measurement

4. Some conclusions and policy implications
1. THE OECD’S GOING DIGITAL PROJECT
1. We are in a **new phase** of the digital transformation, ...
... with a wide range of new digital technologies emerging ...

Cloud computing

Internet of Things

Big data

Artificial intelligence

3D printing

Blockchain
..., that provide new opportunities for all sectors in the economy:

- Public Admin.
- Health
- Retail
- Agriculture
- Science & Education
- Transportation
- Manufacturing
Horizontal initiative across the OECD (involving all key policy areas), mandated by Ministers, to:

1. Better understand the digital transformation and its impacts on the economy and society;

2. Provide policy makers with the tools needed to develop a pro-active, whole-of-government policy response;

3. Help overcome the gap between technological change and policy development.
... includes in-depth work on some key policy questions, such as productivity growth.

Jobs, skills and the nature of work

Well-being & inclusion

Productivity, competition & market openness

Measurement
2. SOME EVIDENCE ON PRODUCTIVITY GROWTH
2. Productivity growth has **slowed down** in much of the world ...

**Annualised growth of labour productivity (GDP per hour worked)**

... and underpins the slowdown in OECD potential growth ...

**Contribution to potential per capita output growth (% pts unless otherwise noted)**

- Capital per worker
- Potential employment rate
- MFP
- Active population rate
- Potential per capita growth (%)


**Pre-crisis: MFP story**

**Post-crisis: K story**
The slowdown has ignited a spirited debate

T-Pessimists:
• Gordon
• Cowen
• Thiel
• ...

T-Optimists:
• Brynjolfsson
• McAfee
• Mokyr
• Jovanovic
• ...

The Economist: America's lost oomph
There are many possible explanations for the slowdown

1. Technological factors
   - “transition costs” of Adoption and diffusion of GPT (Griliches, 1957; David, 1991; Jovanovic and Rousseau, 2005)

2. A “return to normal” effect …after nearly a decade of exceptional IT-fueled gains (Fernald, 2014)

3. Transitional productivity growth dynamics due to rising resource misallocation (Gopinath et al., 2015):

4. Cyclical factors – e.g. demand conditions and monetary policy (Anzoategui, et al., 2016)

5. Measurement (Byrne, et al., 2016)? (…or not)
Despite the slowdown, the world’s most productive firms still manage rapid productivity growth, …

The productivity gap between the globally most productive firms and other firms has widened.

Note: "Frontier firms" is the average labour productivity (value added per worker) of the 100 or 5% globally most productive firms in each two-digit industry. "Non-frontier firms" is the average of all firms, except the 5% globally most productive firms.

In some sectors, the productivity divergence between leaders and laggards is even more marked

The divergence in multi-factor productivity growth

ICT services

Non-ICT services

Note: Excluding the financial sector

At the national level, the divergence in productivity is more marked at the **bottom of the distribution**

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**Source:** OECD MultiProd project, March 2017.

**Note:** The figure plots the estimated year dummies of a regression of log-productivity dispersion (labour productivity, LP, on the left, and multifactor productivity à la Wooldridge, MFP_W, on the right), respectively, at the top (90th and 50th percentiles ratio, solid line) and at the bottom (50th and 10th percentiles ratio, dashed line) within country-sector pairs, using data from the following countries: AUS, AUT, BEL, CHL, DNK, FIN, FRA, HUN, ITA, JPN, NLD, NOR, NZL, SWE. The graphs can be interpreted as the cumulated growth rates of dispersion at the top and the bottom of the distribution within each country and sector over the period. For instance, in 2012 LP dispersion in manufacturing is roughly 3% higher than in 2001 for the top, and 10% for the bottom.
3. SOME DRIVERS AND POLICY ISSUES
A new version of Solow’s productivity paradox? Some factors may play a role:

– Diffusion
– Structural change and resource allocation
– Competition and business dynamics
– Measurement
A. Diffusion: While most firms are connected, few make effective use of advanced ICT ...

Diffusion of selected ICT tools and activities in enterprises, OECD countries, 2010 and 2016

As a percentage of enterprises in each employment size class

StatLink: http://dx.doi.org/10.1787/888933619600
... and SMEs are lagging, even in technologies well suited to them

Enterprises using cloud computing services, by firm size, 2016

As a percentage of enterprises in each employment size class

Source: OECD Digital Economy Outlook 2017, StatLink: http://dx.doi.org/10.1787/888933585495
There are also still large differences in digital intensity by industry...

... and we know little about the spread of business models & the role of complementary investment

Proportion of frontier firms in time $t$ according to their frontier status in $t-2$

**B. Structural Change:** Entry into the global frontier has become more entrenched amongst the top firms ...

**A: MFPR**

- Manufacturing
- Services

**B: Mark-up corrected MFPR**

- Manufacturing
- Services
... while the share of young firms is declining, and that of non-viable old firms is growing.

### Share of firms

<table>
<thead>
<tr>
<th>Per cent</th>
<th>MFPR relative to viable old firms</th>
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</thead>
</table>

#### Young firms (0-5 years)

#### Mature firms (6-10 years)

#### Non-viable old firms (older than 10 years)

**Notes:** Non-viable old firms are those older than 10 years that record negative profits over at least two consecutive years. The omitted group are firms older than 10 years that do not record negative profits over at least two consecutive years (viable old firms).


**Declining firm turnover:** fewer young firms, while marginal firms increasingly survive.

**A higher productivity threshold for entry,** while marginal firms survive despite a collapse in their MFPR.
Observed increase in gap
Increase in gap due to slow deregulation

<table>
<thead>
<tr>
<th>Industry</th>
<th>Observed Increase</th>
<th>Slow Deregulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>2.3%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Energy</td>
<td>2.3%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Retail</td>
<td>2.4%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Legal and accounting</td>
<td>3.8%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Technical services</td>
<td>3.9%</td>
<td>1.7%</td>
</tr>
</tbody>
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MFP divergence was perhaps inevitable due to structural changes in the global economy but policy could have worked harder.
C. Business Dynamism: More generally, business dynamism across OECD countries is in decline, ...

Source: OECD DynEmp v.2 database.
... reflecting a broad-based decline in entry rates,
... and a declining contribution of entrants to aggregate productivity growth...

Source: OECD Multiprod, May 2017
... as well as a growth in mark-ups, in particular in digitally intensive sectors

Mark-up growth in digital intensive vs less digital intensive sectors, 2001-2014

Source: OECD estimates based on Orbis® data.
Some possible factors influencing the decline in business dynamism (to be explored further)

- Decline in growth of labour force and ageing (Karahan, et al., 2016)
- Concentration effects and winner-take-all/most dynamics (especially in some sectors)
- Automation
- Globalisation (Decker, et al., 2016) – young firms may be able to grow in other countries – plus impact of growing import penetration
- Sensitivity to credit constraints, housing market dynamics (David and Haltiwanger, 2014)
- Increases in the costs of job search
- ....
- Thus far: mainly US literature (and recent work in Australia), even though phenomenon is a much broader one.
D. Is measurement the problem?

- GDP is an adequate concept to measure market production, but concerns have arisen over a number of areas...
  - Prices and volumes
  - New forms of intermediation services
  - Free and subsidised consumer products
  - Consumers as producers
  - Certain assets not being measured
  - Cross border flows
... e.g. price indices for ICT assets and communication services, ...

Average annual growth rate in percentage, 2010-2015 (or latest available year)

Australia and France showed declines of more than 3% per year

UK showed increases of nearly 3% per year

Notes: Data reported for Spain for ICT equipment and Computer software and database correspond to the period 2010-2014. Data reported for Austria for Communication services correspond to the period 2011-2015.

... with important potential impacts on GDP growth

Average annual growth rate in percentage, 2010-2015 (or latest available year)

Using lower bound price indices

Belgium shows largest impact 0.4%-points

Most countries show around 0.2%-points
4. CONCLUSIONS AND POLICY IMPLICATIONS
Some thoughts on the **future of productivity** ...

- The **diffusion** of advanced digital technologies (e.g. big data, robotics, AI) in OECD countries **is still underway** – it will take time, especially for SMEs, and in many sectors.
- It’s **not just about technology diffusion** – changes in organisations, business models, worker’s skills and processes will take even more time (and may be difficult for many firms).
- The impacts of digital technologies will also **require more structural change** within & across industries, as digitally-intensive firms grow and less digitally-intensive firms decline.
- The **slowdown in business dynamism and the slow pace of structural reform** also limits the impacts of digital technologies.
- There are growing questions and some emerging evidence on the state of **competition in the digital economy**
- Inadequate **measurement** likely plays a role
... and **policies** that may be appropriate

- **The good news**: the impacts of digital transformation are likely still to come and some firms are already reaping the benefits – emerging skills shortages may accelerate the productivity gains

- **Policy can help** in several ways to strengthen these impacts, notably by:
  - Fostering **investment** in tangible and intangible capital
  - Strengthening **diffusion of technologies, practices and business models**
  - Improving **skills** of workers and management
  - Facilitating **structural change** and business dynamics – where certain sectors may require more policy attention
  - Ensuring **sound competition**.

- **Improving measurement** is important to improve the evidence base on productivity and the digital economy
Thank you

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