

Canadian Productivity, Secular Stagnation, and Technological Change

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Discussion by
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Contribution

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- Has it slowed?
- Why?
- Will it remain low?

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What is the past and future of Canadian productivity growth?

- Has it slowed? Yes. Slowdown also in other sources and other countries.
- Why? Direct measures of technical change also slowed.
- Will it remain low? Maybe not: there is suggestive evidence of a pickup in technical change in the US.

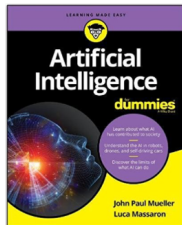
- **Measure of technical change:** counts of new books in Canadian libraries, by field.
 - Examples: Computer science, Electrical engineering and Electronics, Mining and Metallurgy...

Idea: when there's an innovation, books will be published about it.

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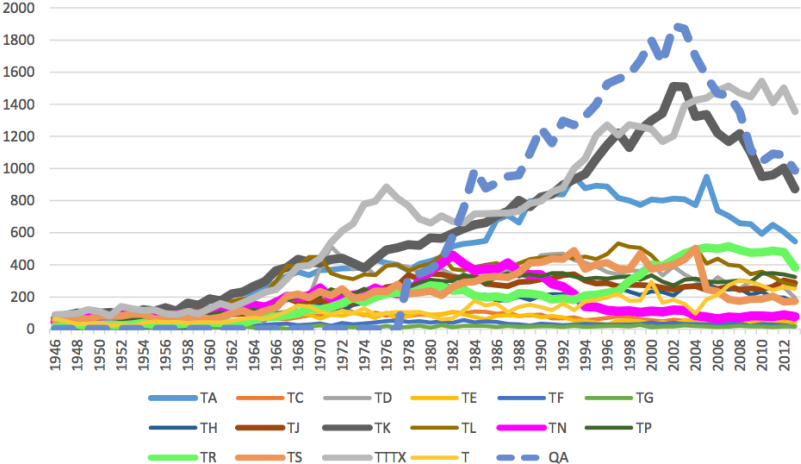


Methodology

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- Link these measures to TFP measures from Statscan.
- Particular strength: sector-level analysis.

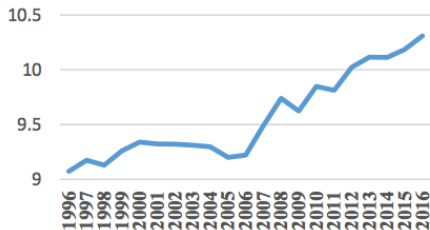
Main results

Waves of Innovation

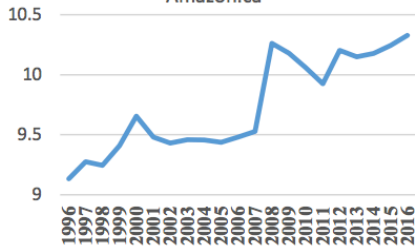


Recent pick-up

Panel A. $\ln(\text{Computer and Technology Titles in English})$ by release date-
Amazon.com



Panel B. $\ln(\text{Computer and Technology Titles- all languages})$ by release date-
Amazon.ca



- 1 Exploit the field/sector-level information more
- 2 Embodiment
 - Ignoring it can lead to understating the effects of technical change.
 - Did Canada underinvest in new technologies?

Comment 1: use sector/field-level information more

technical change_i →_{i,j} productivity growth_j

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- ① **Slowdown in TFP growth almost entirely due to a few goods industries**, in particular manufacturing and mining (incl. oil) (e.g. Conesa and Pujolas 2018).
 - How much of the Canadian slowdown is due to the importance of these two sectors?
 - Technical change in these industries: Are they particularly strongly affected by certain technologies? Did growth in those slow? Did adoption slow?

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 - How much of the Canadian slowdown is due to the importance of these two sectors?
 - Technical change in these industries: Are they particularly strongly affected by certain technologies? Did growth in those slow? Did adoption slow?
- 2 **Slowdown in technical change (book publishing) most pronounced in a few areas**, notably Computer science, and Electrical engineering and Electronics.
 - Which detailed industries rely on these technologies? (within goods/services)
 - Is slowdown in technical change by type similar in US and Canada?
 - Is strength of link (VAR evidence) different between Canada and US?

Comment 2: A conceptual issue

What is the relationship between technology and TFP?

- Analysis (both verbal and VAR) presumes that tech causes TFP.
- But a lot of tech that is measured is **embodied in capital goods**.
 - Robots, software...
- Consistent with this: Alexopoulos (AER 2011) shows that technology causes TFP *and* investment.

A conceptual issue: tech is embodied in capital

Why does embodiment matter?

- 1 Ignoring it can lead to understating the effects of technical change.
 - If all technical change is embodied, technical change promotes investment, but does not affect TFP.
 - If all K measures are constant quality, statistics capture this.
- ⇒ No effect of technical change on TFP – all effect on K .
- If not, K growth is understated and technical change will appear to affect TFP.
 - This and earlier papers find an effect of technical change on TFP. Possible reasons: not all technical change is embodied, and/or not all K measures are constant quality.
 - Which apply how much varies across sectors with different asset composition.
 - **Suggestion:** Could this explain lack of effect of technical change on services TFP in VARs?

A conceptual issue: tech is embodied in capital

Why does embodiment matter?

- 1 Ignoring it can lead to understating the effects of technical change.
- 2 Investment and productivity growth in Canada: Did Canada underinvest in new technologies?
 - Not in the aggregate: in 2002-14, K grew faster in Canada compared to the US (Conesa and Pujolas 2018).
 - Sector-level: investment in manufacturing, mining?

⇒ Different/inefficient allocation of investment, across or within sectors?

 - Why so few robots in Canada? Industrial composition? Probably not only.
 - Potential implications for **future technical change** and its **adoption**.

Concluding remarks

- Fascinating paper on very important topic.
- Looking forward to seeing more of this!