New Approaches to Environmental Challenges

What do we learn from the long-run evolution of technological systems?

François Lafond
Key points

• There are increasing returns in technology investment
→ Do not wait to invest in climate mitigation technologies

• Technologies are interdependent
→ Support the knowledge base and technologies that fit well the current era

• Technologies are disruptive
→ Anticipate and mitigate negative consequences
There are increasing returns in technology investment

Do not wait to invest in climate mitigation technologies
Trends are persistent

Experience curves for *conditional* prediction

What will be the price of solar energy *if* we decide to produce $x$ more?

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But is this really a causal relationship?

“Experience causes cost improvement”

“Lower prices cause increased demand”
World War II as a natural experiment

- Cheaper solar panels
- More demand for solar panels
- Cheaper bombers
- More demand for bombers

Lafond, Greenwald and Farmer, Does stimulating demand drive costs down? WWII as a natural experiment, in progress
Energy portfolio

- Technologies follow uncertain experience curves
- Applied to energy transition: costs may be lower than business as usual.

Farmer et al. (2019), Sensitive Intervention points in the post-carbon transition, Science.
Technologies are interdependent

Support the knowledge base and technologies that fit well the current era
Technological eras

• Some groups of technologies reinforce each other

• Groups of technologies have their golden age where they concentrate most of the activity

• Technological eras: groups of technologies are central at the same time

Asano, Wary, Lafond, Farmer and Beguerrise Díaz, Uncovering technological eras, in progress
Knowledge base of green technologies

- There are clusters of interrelated technologies
- Some technology clusters are overall more isolated than others
- PV, and to some extend wind, rely on digital and semiconductor technologies.
- Green technologies are often found to produce higher spillovers

Schematic depiction of a subset of the technological ecosystem, based on Pichler, Lafond and Farmer, Predicting innovation dynamics in the technological ecosystem, in progress
On spillovers, see Barbieri et al, Dechezlepretre et al
Technologies are **disruptive**

- Anticipate and **mitigate negative consequences**
Challenges to labor markets

• Sustainability transition requires the decline of some industries and the rise of others
• But other forces can balance or accentuates this
  • Automation
  • Demography

Challenges to measurement systems

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  e.g. Corrado, Hulten and Sichel (2009)

  e.g. https://seea.un.org/

  e.g. Fitoussi, Sen, Stiglitz (2009)
Thanks

Thanks to all my co-authors and the Complexity Economics team (J. Doyne Farmer) at INET Oxford

https://www.inet.ox.ac.uk/research/programmes/complexity-economics/

Bibliography


Pichler, A., Lafond,F. and Farmer, J.D. (2019), Predicting innovation dynamics in the technological ecosystem, *in progress*


*Science Museum* refers to the Science Museum in London (visited 2018)

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