

Does the Technology Life-cycle Moderate the Innovation Impact of Demand-Pull Policies? – The Case of Wind Turbine Technology

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Work in progress



The motivation is to enhance understanding of demand-pull policies

- Demand-pull policies are a very prominent means under the mission-oriented policy paradigm
- This reflects the pressing need for transformation, in particular of the energy system
- Sustainable alternatives are at various stages of development
- Does it matter to switch from research funding to demand-pull policies?

Research question:



Does the effect of demand-pull policies on innovation differ across different technology life-cycle stages?

Theoretical perspective – main constructs

- **Demand-pull policies**

Policies that either directly subsidize clean technologies or address negative market externalities of competing alternatives; e.g. feed-in tariffs or taxes on carbon emissions

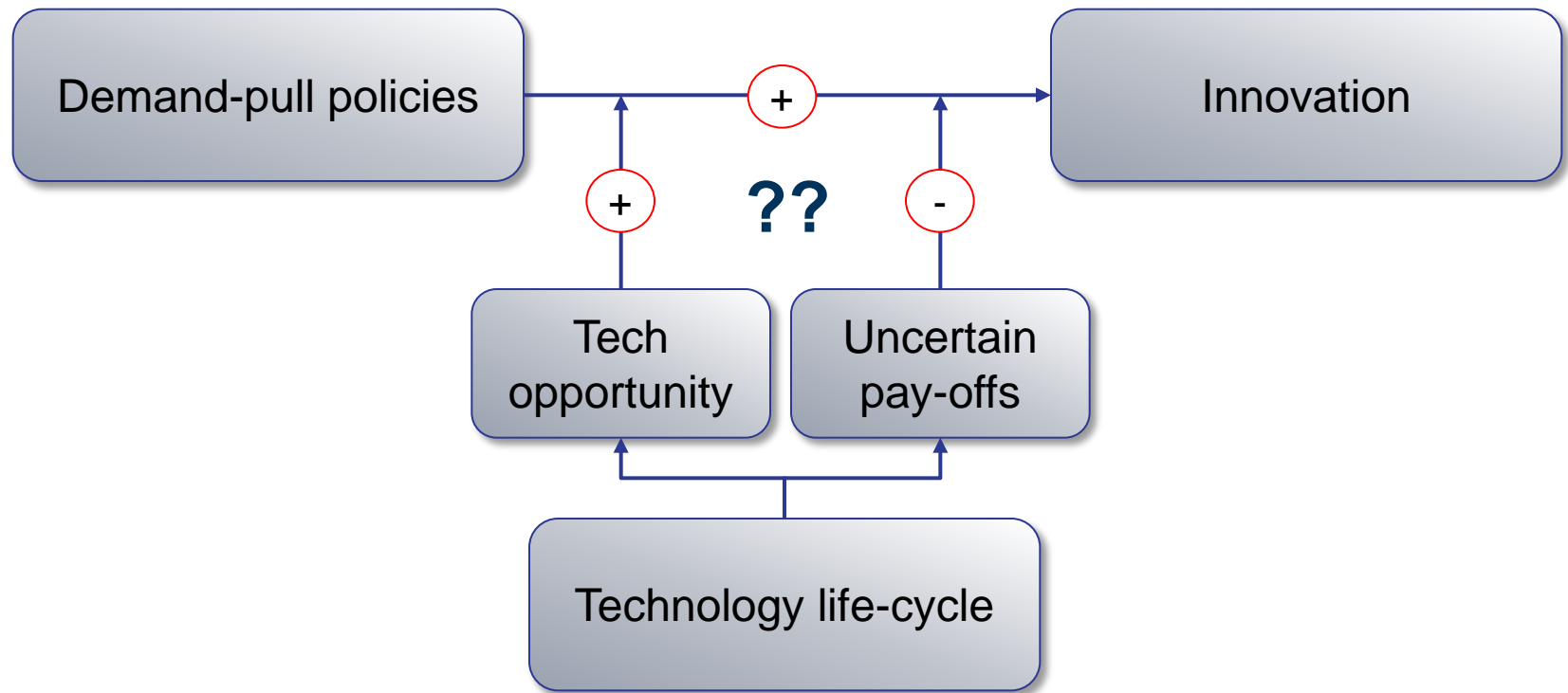
- **Technological paradigms**

Heuristics regarding the relevant technological problems, trade-offs, procedures and evaluation criteria that are *shared by communities of practitioners* – the ‘where do we go from here’

- **Simple model of the technology life-cycle:**

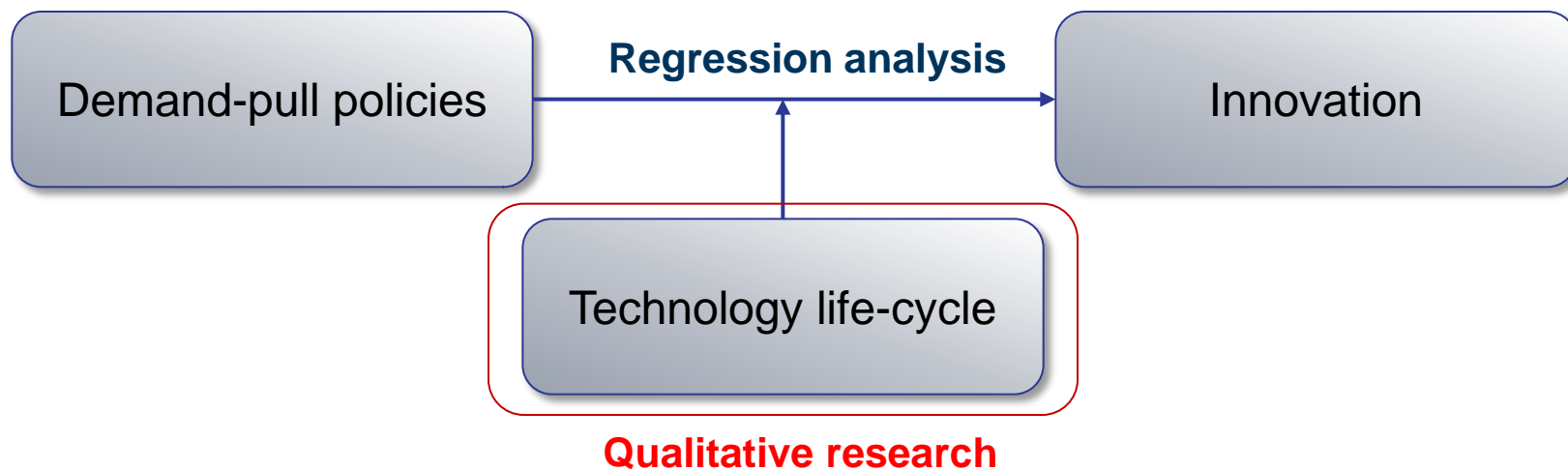
An era of high technological uncertainty and diversity (**era of competing paradigms**) followed by a selection process and a phase of high standardization (**era of a dominant paradigm**)

When investigating the impact of the technology life-cycle, we expect to contradictory effects in the era of competing paradigms



Data & methodology

- We used the case of the **wind turbine industry**:
 - the technology went through two distinct life-cycle stages,
 - has been developed in many countries across the globe, and
 - has been supported by demand-pull policies over an extended period of time
- We applied **mixed-method research** to understand the phenomenon

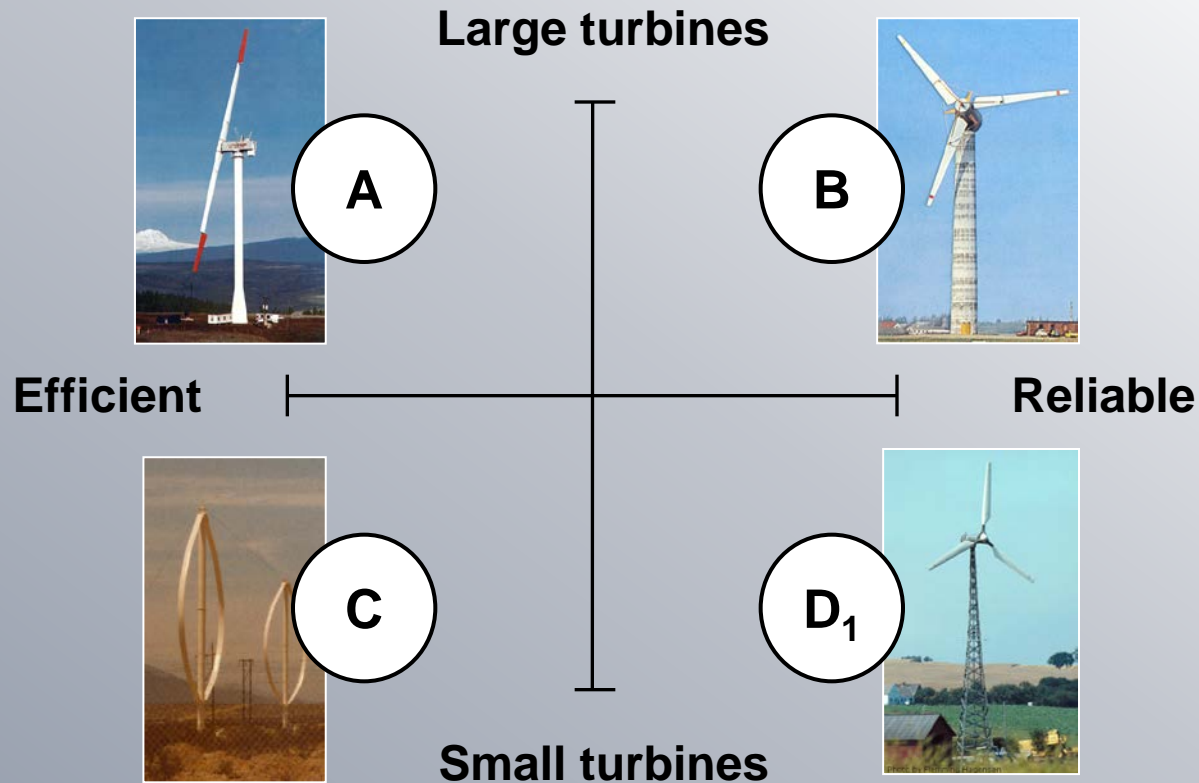


We use a panel of patent data for the quantitative analysis

- **Panel data regression** analysis: 15 countries, 25 years (1978-2002)
- Innovation is measured by **patent families**, weighted by value indicators
- **(Indirect) measures for demand-pull policies:**
 - Annual capacity installations (Dechezlepretre & Glachant, 2010) or
 - Electricity production from wind energy multiplied with the additional costs per unit of electricity
- Technological **life-cycle** is measured by **dummy variable** indicating the presence of several technological paradigms
- Its effect is modelled with interaction terms

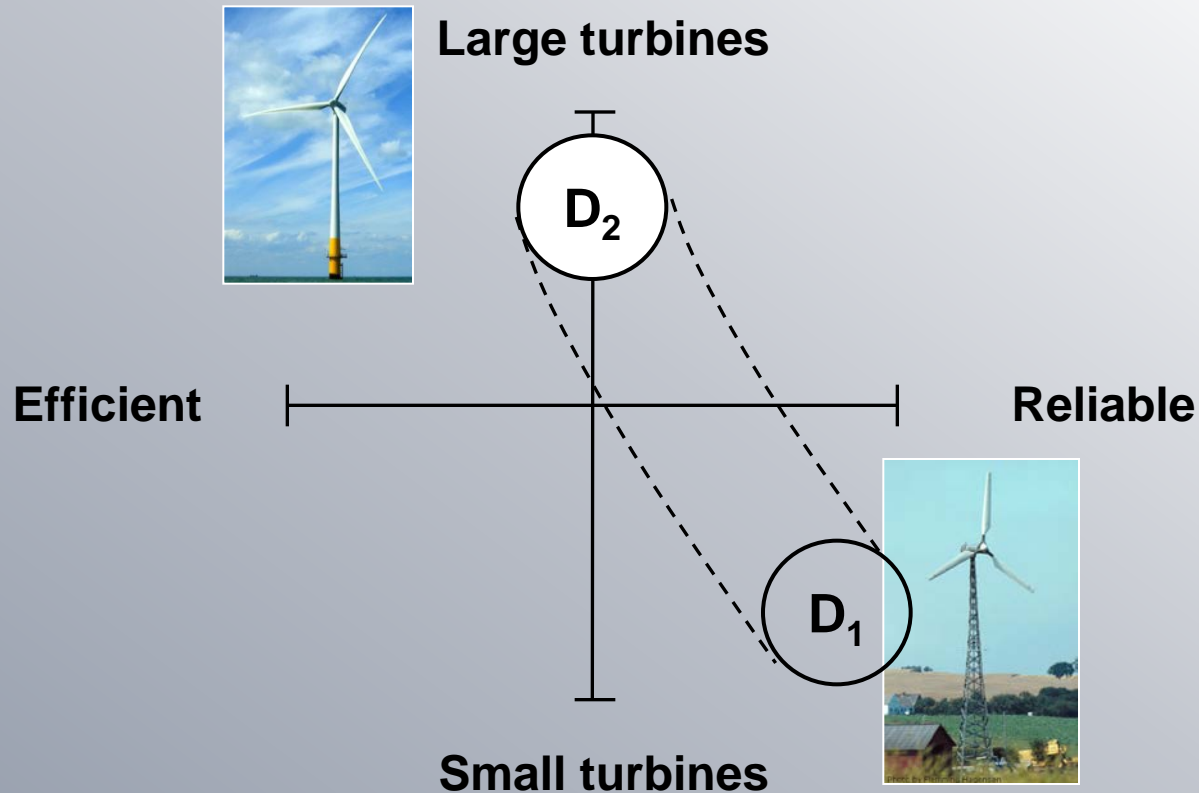
The emergence of wind energy technology after the oil crisis was marked by significantly different design approaches

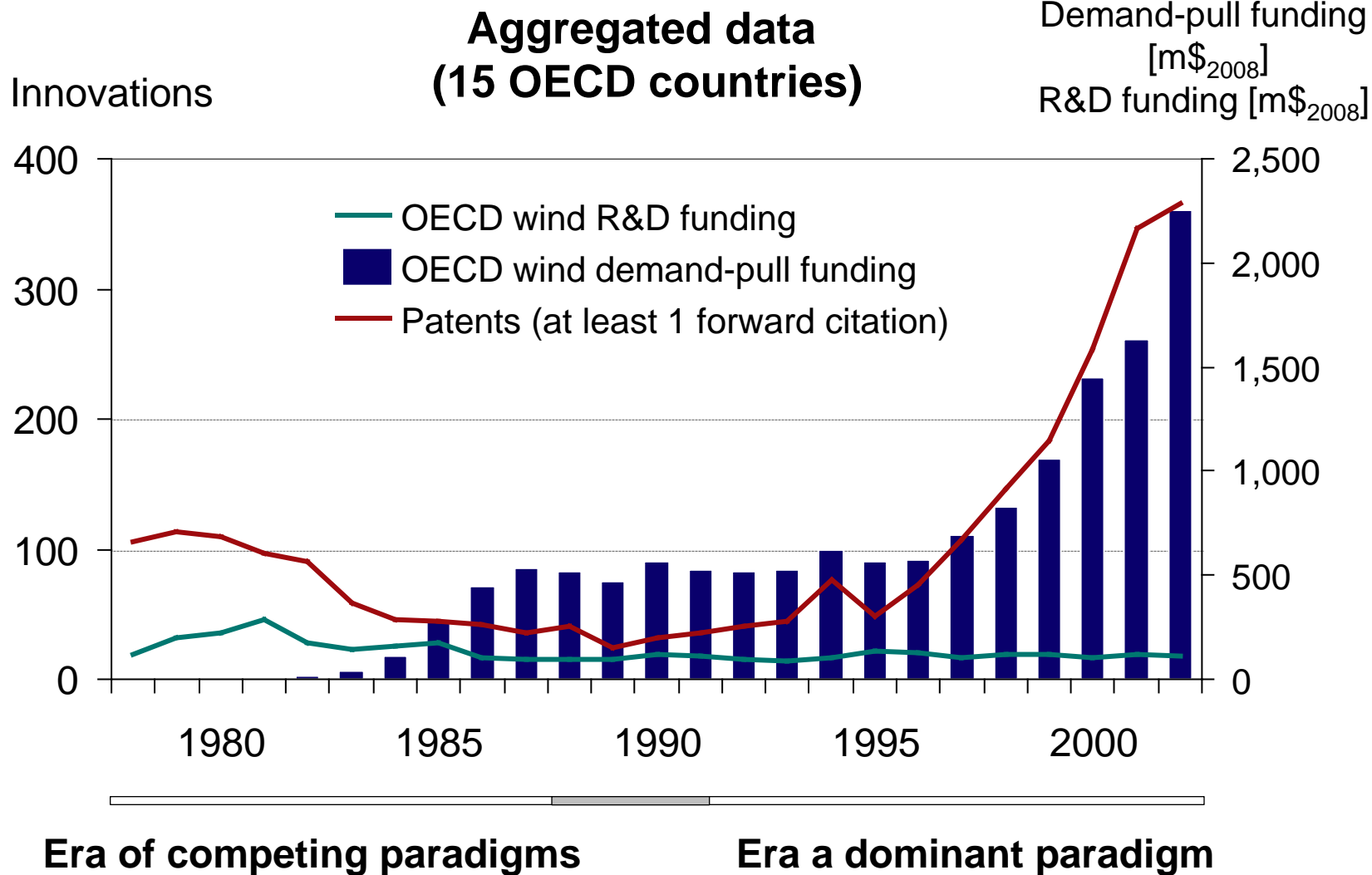
Era of competing paradigms (1970s–1980s)



~ 1990 the ‚Danish approach‘ emerged as dominant paradigm, when firms globally adopted their small, reliable designs

Era of one dominant paradigm (1990s–present)






The life cycle stage of a technology matters for policymakers: 2 key quantitative results and their implications

(work in progress)

Key Findings

- 1 Under dominant paradigm: demand-pull policies had a stronger impact on innovation
 - 2 Some models: negative impact before dominant paradigm had emerged
-  We explain this with **high investment uncertainty in era of competing paradigms**, particularly for formalized, long-term R&D that might result in patents
Firms chose to exploit existing designs

Policy implications

- After a dominant design has emerged, demand-pull policies are a useful tool to foster both diffusion and innovation
- Early demand-pull policies might still be beneficial, but should be designed stable, predictable, and indiscriminative
- But: Results have to be taken with a grain of salt: small but successful firms filed few patents in early years

Thank you for your attention!

