

# Gaining Steam: Incumbent Lock-in and Entrant Leapfrogging

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2. Should we do anything about it?

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- Low fixed cost technologies: electric motor, artificial intelligence diffuse slowly

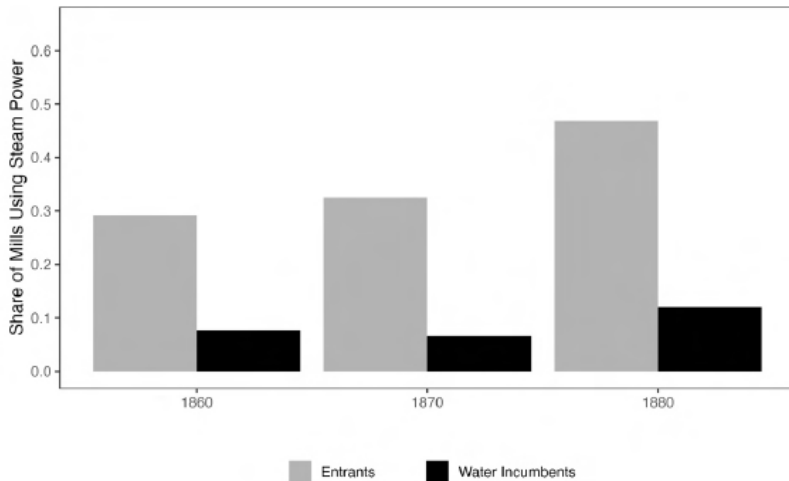
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- ▶ My view: possibly. Need to understand agglomeration effects clearly
  - Estimated agglomeration forces are small and local

# Entrants Do Not Always Embody New Technology



# Water is Cheaper to Adopt and Operate

		%	Target
Water	Adoption cost	18	E vs. I size + hand vs. water capital
	Operating cost	10	Exit rate, water
	Switching cost to S	1.4	Incumbent vs. entrant water share
Steam	Adoption cost, 1850	42	Steam adoption rate 1850
	Adoption cost, 1880	9	Steam adoption rate 1880
	Operating cost	30	Exit rate, steam
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Estimated costs as a percentage of median annual sales in 1850. Targets pool 1850-1880.

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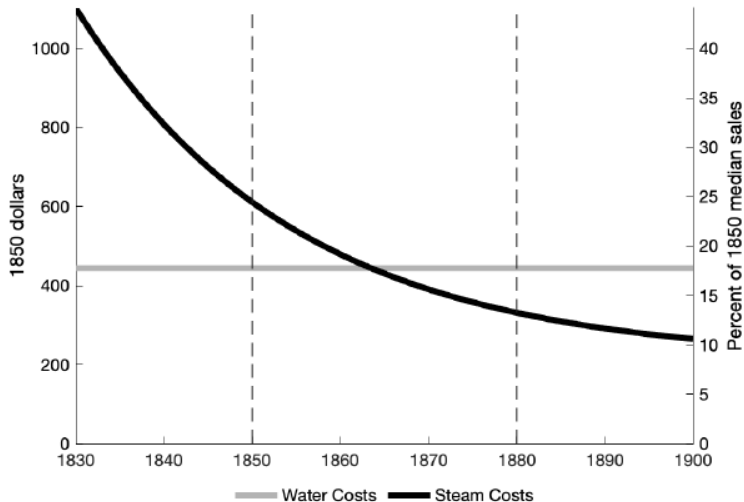


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# Adoption Cost of Steam Declines Slowly



## Steam $\downarrow$ Marginal Cost: Direct + Agglomeration Effects

$$y_{jct} = \exp(\varphi_{jct} + \mathbb{1}(R_{jct} = S)(\gamma + \alpha s_{ct}))x_{jct}$$

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1. **Direct:**  $\gamma$ : 9% lower marginal cost
  - target: sales differential, water vs. steam, 1850-1880
2. **Agglomeration:**  $\alpha$  from local share of adopters  $s_{ct}$ : 2.5% lower marginal cost

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- ▶  $\alpha$ : residual differences in rev. growth by waterpower potential after controls:
    - county-industry FE, industry-year FE, water/coal/market access
  - ▶ What if instead  $\gamma$  changes over time?

# Should Policy Speed Up The Transition?

- ▶ Policy: buy sunk capital of water incumbents
  - **More** entrants enter with water (option value of switching)
  - Relies on measuring agglomeration effects right

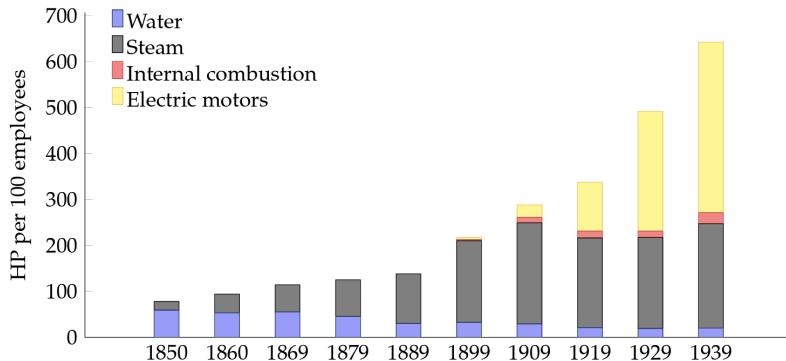


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- ▶ Policy: buy sunk capital of water incumbents
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  - Relies on measuring agglomeration effects right
- ▶ Alternative: where does fall in steam cost come from, why is it slow?  
Bresnahan and Trajtenberg (1995); Liu & Ma (2024)

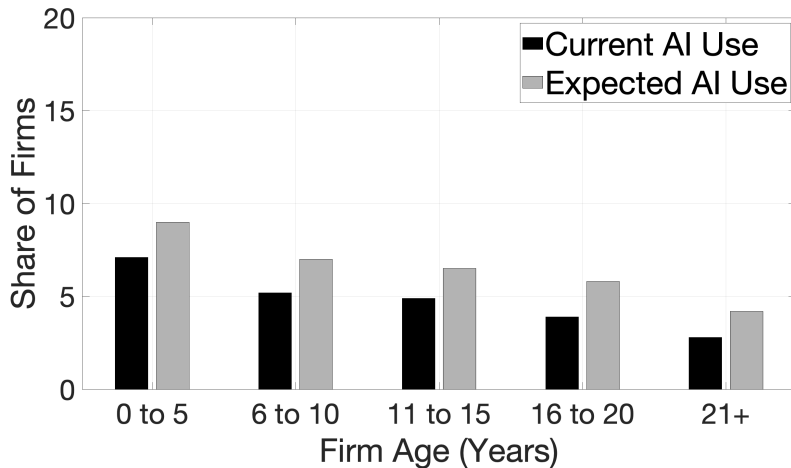
# Electric Motors (Low Fixed Cost) Also Diffused Slowly

FIGURE 3: Capacity of primary power by type in horsepower per 100 employees in manufacturing in the United States



**Source:** Reichardt (2024).

## AI (Low Fixed Cost?) Diffusing Slowly For All Firms



**Source:** Census Business Trends and Outlook Survey

# Why is AI Diffusing Slowly? Not Applicable Yet

Reasons for Not Planning to Use AI	Share resp. (%)
AI is not applicable to this business	80.9
Lack of knowledge on the capabilities of AI	7.3
Concerns about privacy/security	6.6
AI is not a mature enough technology yet	6.1
Other	4.5
Too expensive	4.1
Lack of skilled workforce	2.9
Concerns about bias	2.8
Lack of required data	2.2
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# Conclusion

- ▶ Interesting paper, immense data collection effort
- ▶ Spotlights key feature of slow adoption: entrants also slow to adopt
- ▶ Most GPTs diffuse slowly
- ▶ Open question: can/should policy speed up transition? If so, how?