Acquired firms and innovation: an empirical study

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Motivation

- Many firms have reached a concerning monopoly position (GAFAM, Nvidia).
  - *Google threaten to be dismantled for some of its markets*.
- In parallel, many acquisitions over the years that may have had a negative impact on innovation

Research question :

What is the impact of being acquired on innovation for acquired firms ?

Literature review

The evolution of the acquisition landscape :

- Acquisitions have become the easy-way to exit (Lemley, 2020), alleviate the innovator's dilemma (Christensen, 1997)
- Acquisition have became itself a goal for firms, and may serve as an ex ante incentive for start-ups (Eisfeld, 2024 ; Warg, 2021 ; Wang, 2018)

The concerning effect of acquisition on innovation :

- A relative consensus on a negative effect on innovation (Gügler et al., 2023 ; Fons-Rösen et al., 2022, etc)
- Possibly "**killer acquisition**" (Cunningham et al., 2021) and the end of capitalism (Schumpeter, 1942)

Contribution

1. A comprehensive database and methodology to investigate the acquisition landscape and its relationship with innovation

2. A causal estimate of the effect of being acquired on innovation for acquired firms

Data

Crunchbase

- Large firm repository, for firms characteristics (over 3 million records) and their description, founded year, closed year, or industry (defined by Crunchbase)
- Acquisitions (~ 150 000), IPOs (~ 45 000), Funding Rounds (~ 600 000)
- Limitations of data availability

Lens.org for Patents:

- All data on patents available from all jurisdiction.
- Around 130 millions patents (filings + granted)
- Counts, Weighted by Simple Family, Citation

Building a comprehensive panel

Matching Patent data to Crunchbase :

- Similar effort was made by OECD (2017)
- Combination of a manual and text-similarity methods to match Crunchbase firms to a patent applicant and/or owner.
- ~ 160 000 firms matched with a high level of confidence

Industry classification :

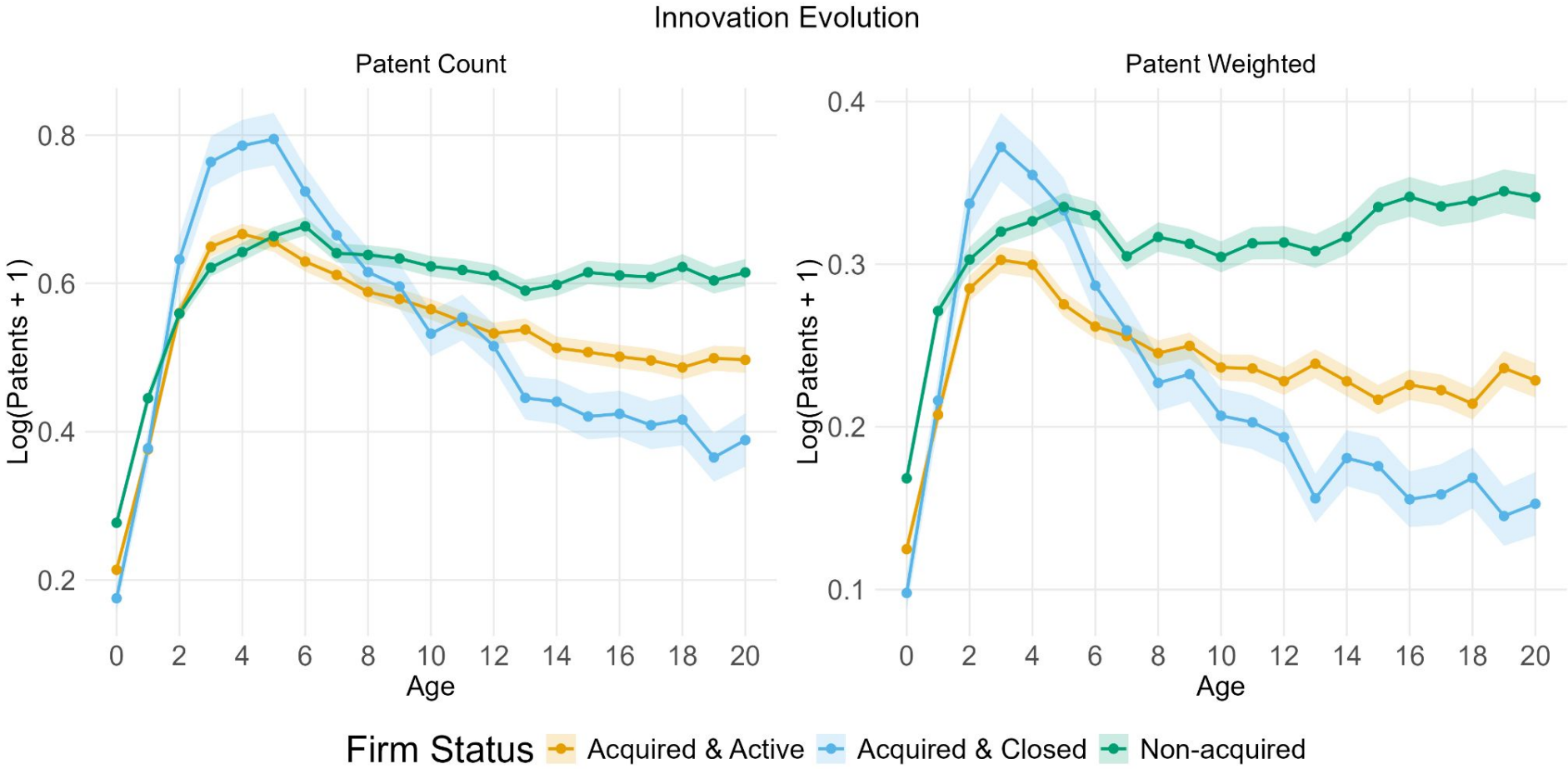
- Text-similarity between a company description and NAICS, using embeddings
- Allow to characterize the similarity between acquirers and acquired firms
- Approach could be extended

Measuring innovation through patents

- **Patent counts :**
  - Patents counts
  - Weighted by their family size

- **Filings** can be a good proxy for the innovation process :
  - Can correlate well with the ownership (Toner-Rodgers, 2024)
  - Measure the process of discovery and effort rather than the detention of rights of a given technology

A divergence between acquired and non-acquired firms



Evaluating the effect of an acquisition

Why is it difficult ?

- It is not a public policy, but a non unique event, non-comparable, staggered
- Log with zeros (Chen, Roth, 2024) makes difficult to interpret patent data, and distinguish intensive and extensive margin
- Non-acquired firms do not have “treatment date”

What is a good counterfactual and how can we find one ?

- A very similar firm, operating in a similar sector and created at the same time
- Having similar patent filing behavior

Matching Strategy

First Stage

12 000 patenting firms and acquired

Find the 20 most similar :

- Same NAICS (3 digits)
- Same Founded year
- Patent holding

Second stage

For each potential counterfactual :

- Define a treatment date using the age of the treated at the time of the acquisition
- Create 3 variables for patent filing for each pre-treatment year (-1 to -3)

Result

For each firm, find the closest firm in terms of pre-tend.

We verify if the standardized difference in pre-trends is not significant.

We obtain : 4, 244 pairs.

Methodology (1)

Our goal is to **estimate** :

$$\theta_{ATT\%} = \frac{E[Y_i t(1) | D_i = 1, \text{Post}_t = 1] - E[Y_i t(0) | D_i = 1, \text{Post}_t = 1]}{E[Y_i t(0) | D_i = 1, \text{Post}_t = 1]}$$

Using a Poisson QMLE event study regression (Chen and Roth, 2024; Wooldridge, 2023) :

$$Y_{it} = \exp\left(\lambda_t + D_i \beta_2 + \sum_{r \neq -1} D_i \times [\text{RelativeTime}_t = r] \beta_r^{ES}\right) \epsilon_{it}$$

Methodology (2)

Calibrating the log with a weight for the extensive margin :

m(y) = log(y) if y > 0 & -x if y = 0

$$m(Y_{it}) = \lambda_t + D_i \mathbf{B}_2 + \sum_{r \neq -1} D_i \times [\text{RelativeTime}_t = r] \mathbf{B}_r^{\text{ES}} + \epsilon_{it}$$

On a distributional level :

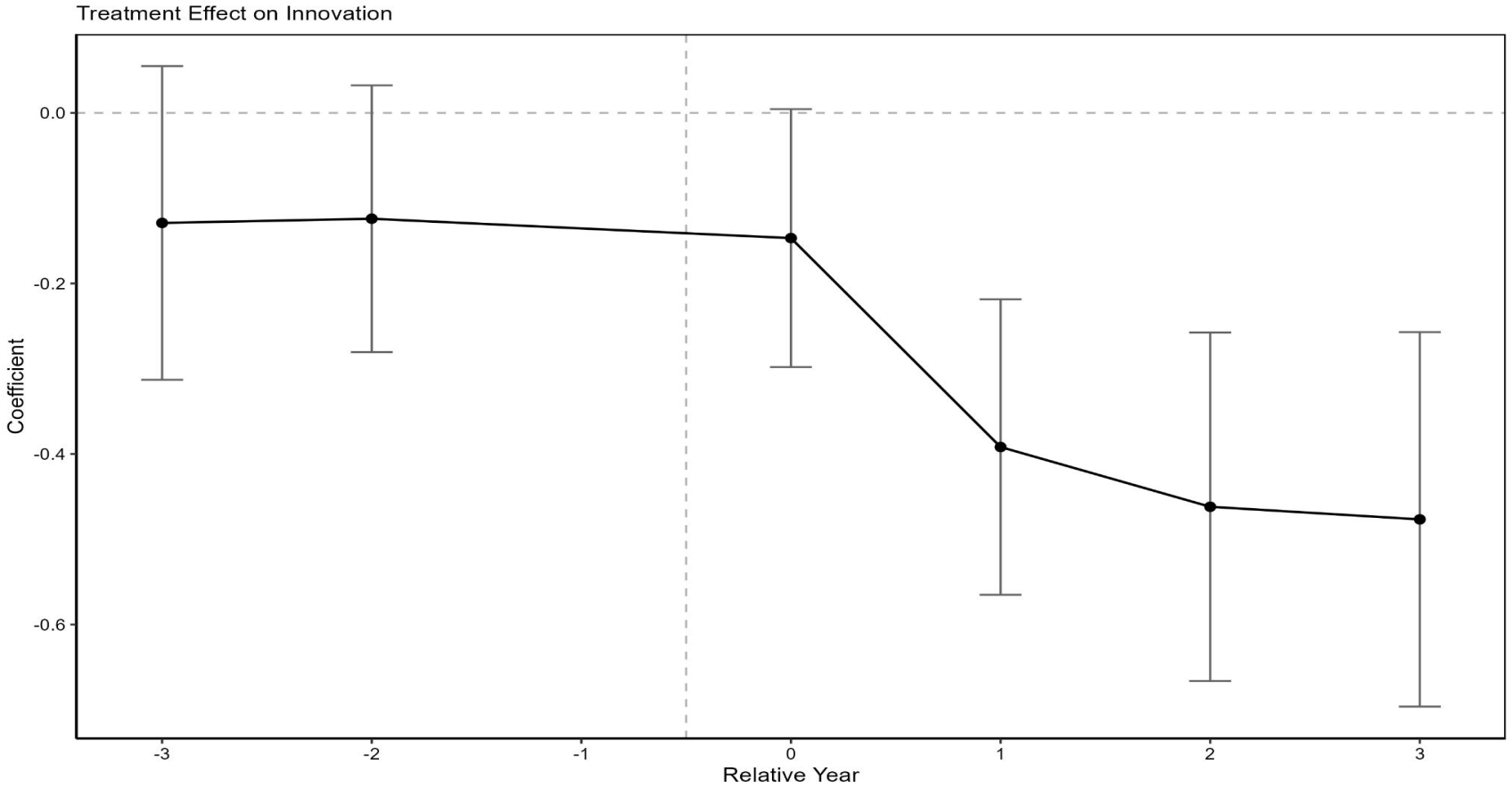
- *What is the effect of being acquired on the likeliness of stopping innovation?*

$$P(Y > 0 | D = 1)$$

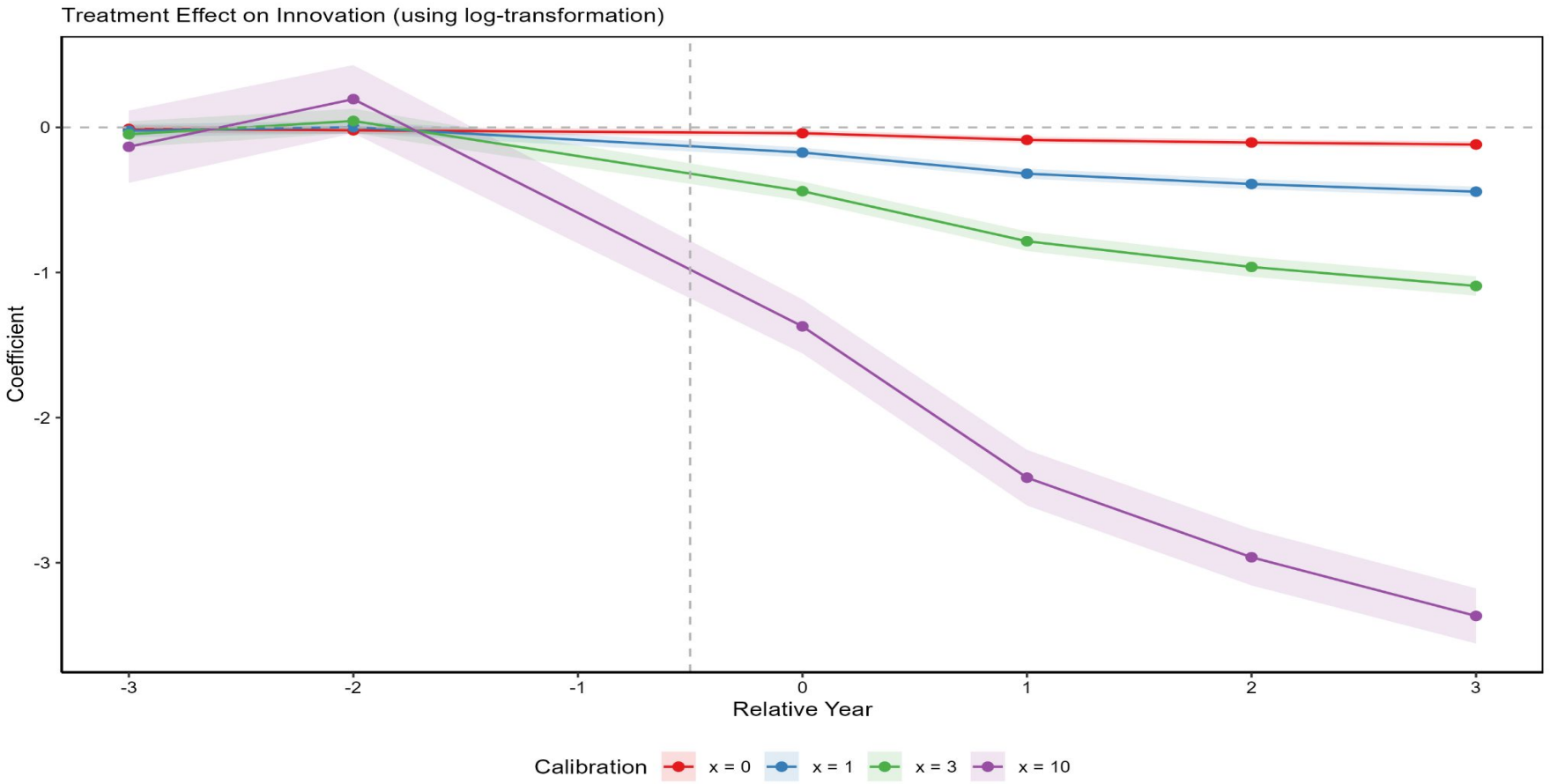
- *What is the effect on a distributional level ?*

$$P(Y > x | D = 1))$$

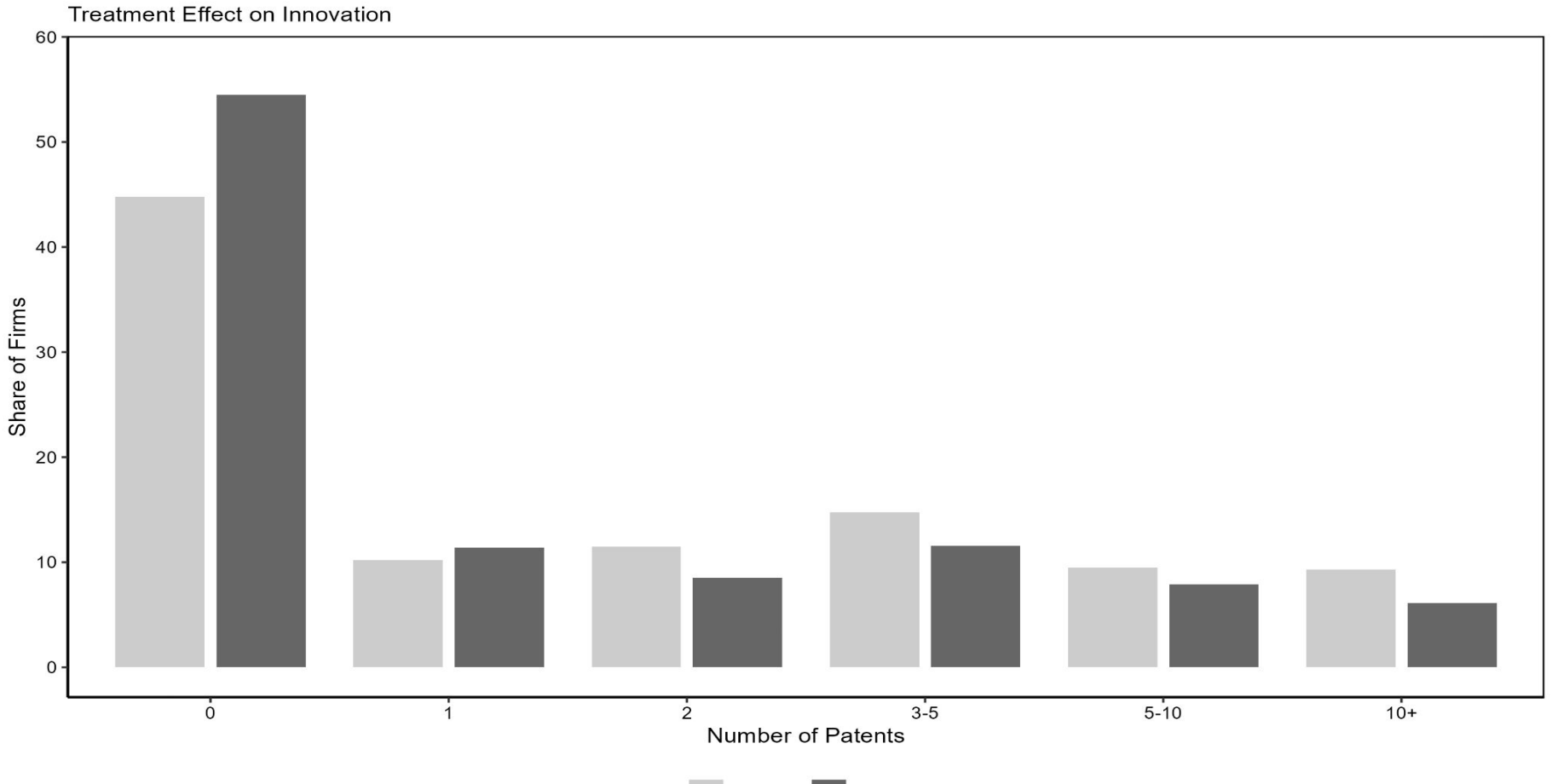
Results : Poisson QMLE event-study



Log calibration : sensitivity of the extensive margin



Distributional effect



Addressing an endogeneity concern

A potential endogeneity problem

- Acquired firms may know *ex ante* that they are not developing a high potential technology
- Given our assumptions, this was not taken into account in our matching

A solution :

- Including the overall number of citations of patents published pre acquisition
- Reduce our sample substantially (761 pairs), but does not affect the results

Finding the right scale for innovation

What is the impact of an acquisition :

- **At the inventor level ?**
  - Do they continue to innovate within an acquirer (*acqui-hire*) or elsewhere ? How does the acquisition has affected the incentive to pursue new innovations ?

- **At the acquirer level ?**
  - Do acquirers pursue the pipeline of the acquired firm, especially when it was closed or the innovation has stopped ? Does it increase the level of innovation of the acquirer

- **At the market level ?**
  - Did the acquisition had lead to any changes for rival firms or within the “innovation space” ?

Results at the inventor level

- **Similar effect, if not higher**

  ~2% of inventors are “mobile”,

  Less than a 1% join the acquirer

- **Role of the extensive margin**

  Reduces the likeliness of innovating

  by 10 percentage point

  Acqui-hire do not have a positive

  effect overall

	(1)	(2)
Post × Treatment	-1.556***	-1.535***
	(0.026)	(0.026)
Any Move		1.285***
		(0.077)
Post × Treatment × Any Move		-0.558***
		(0.113)
Proportional Effect	-0.789	-0.785
Controls	No	Yes
Number of Inventors (Treated, Control)	90223	71212
Treated Group Mean (Pre, Post)	8.92	14.0
Control Group Mean (Pre, Post)	7.03	52.4

Caveats

At the acquirer level:

- The inclusion of the acquirer patent filing is biased
- An appropriate estimate would require an other empirical strategy or data on citations (De Barsy and Gautier, 2024), not yet available

At the market level:

- The identification of rivals can be misleading
- Gügler et al. (2024) - does the estimation for GAFAM for markets
- Further research needed on this topic

Discussion and conclusion

1. Being acquired is associated with a **negative and significant effect** on innovation :
   - The effect is mainly due to the **extensive margin** (stopping effect on innovation, firm closure)
   - But there is also a moderate effect on the **intensive margin** (likeliness of producing a certain amount of patent)
   - The result holds with a more restrictive matching as well as at the inventor level

2. The result needs to be tempered:
   - The **existence of an ex ante incentive** to innovate in order to be acquired
   - The **potential benefit for the acquirer** in terms of innovation - can be difficult to measure, within the constraint of our data