

Discussion of *Evaluation of subsidies for commercialization of clean energy innovations*

Joacim Tåg

Tillväxtanalys, Stockholm September 25, 2026

IFN & Hanken School of Economics

Introduction

What I will cover

- **The study:**
 - The motivation and setting
 - The data
 - The findings
- **My five remarks and suggestions:**
 - Four identification concerns: selection, timing, age and survival
 - A dedicated financing-constraints mechanism section

Motivation and research question

- Between 2015 and 2022, the Swedish Energy Agency administered four competitive grant schemes as part of a business development and commercialization program
 - The grants support development and commercialization of clean-energy innovations
 - The rationale combines knowledge spillovers, environmental externalities, and financing constraints
- **Research Question:** Did the grants causally lead to recipients expanding employment, attracting VC, and developing commercial activities?
- Note: It excludes additional innovation and social benefits

- **Existing work:**
 - Howell (2017): US energy R&D grants, subsequent VC and commercialization
 - Santoleri et al. (2024): EU SME grants, firm performance and financing constraints
 - Reshid, Svensson and Steinbach (2025): long-term firm outcomes among Swedish Eurostars applicants
- **This study adds** evidence on Swedish clean-energy commercialization support across four development stages, linking financing to employment, sales and exports

Data

Four schemes at different stages

Scheme	Main activity	Grant ceiling
Concept development	Feasibility and early prototypes	SEK 0.5m
Verification	Validation with a customer	SEK 2m
Market introduction	Preparation for market launch	SEK 1m
International markets	Testing and adaptation abroad	SEK 1m

- The figures are ceilings, not typical amounts for every recipient.
- Verification accounts for about 73 percent of reported funding.
- Matters for both matching and the interpretation of co-financing requirements as the analysis pools schemes with different timing and developmental objectives.

Observed outcomes

- Total and S&T employment
- Recorded venture-capital receipt
- Total firm turnover
- Export participation and value

Not directly measured

- Private R&D expenditure
- Sales of the supported innovation
- All sources of external finance
- Emissions, spillovers, social returns

Administrative registers: Swedish Energy Agency, Statistics Sweden (FEK), SVCA, LOUISE, Tax Office Tax Registers

Empirical design

Matched difference-in-differences

- **Matched difference-in-differences using rejected applicants:**
 - Matching tries to make recipients and rejected firms comparable on recorded pre-application characteristics.
 - DiD then compares how outcomes change from the year before application.
- **Key details:**
 - Match on age, size, early commercialization, prior VC, patents, and scheme
 - Compare changes relative to the year before application
 - Include firm, calendar-year, and common application-relative-time effects
- **Key Identifying assumption:** absent an award, the adjusted groups would follow comparable outcome trends

From applicants to the matched sample

Stage	Funded	Rejected	Total
Unique applicant firms	227	215	442
After initial restrictions	180	169	349
After matching	131	133	264

- 74 firms lack pre-application observations
- Matching retains about 73% of the 180 funded firms after initial restrictions
- Main matched panel: 2,099 firm-years; observation windows vary

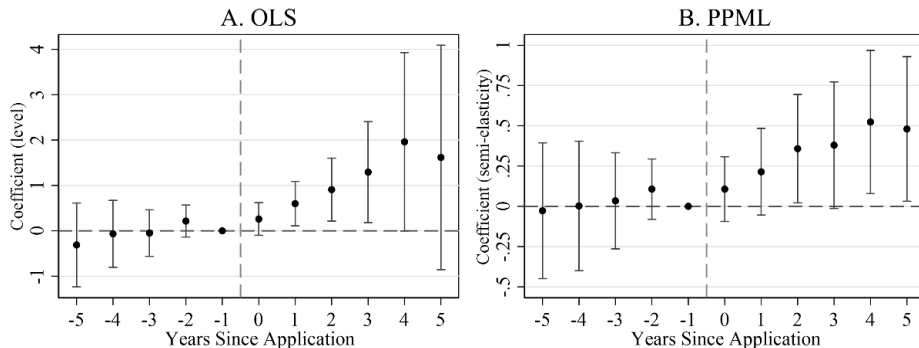
The reported event-study equation

$$Y_{it} = \sum_{\substack{k=-5 \\ k \neq -1}}^5 \beta_k D_i 1\{t - g_i = k\} + \sum_{\substack{k=-5 \\ k \neq -1}}^5 \gamma_k 1\{t - g_i = k\} + a_i + \mu_t + v_{it}.$$

- g_i : reference application year; D_i : subsidy indicator
- β_k : funded–rejected difference relative to $k = -1$
- γ_k : application-relative dynamics common to both groups
- a_i and μ_t : firm and calendar-year fixed effects
- Reference period: $k = -1$; firm-clustered inference
- Estimated with OLS and Poisson pseudo-maximum likelihood (PPML) due to many zeros

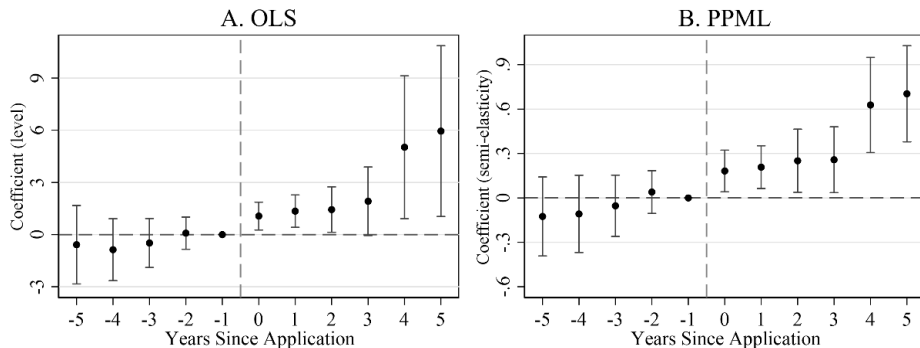
Results

S&T employment



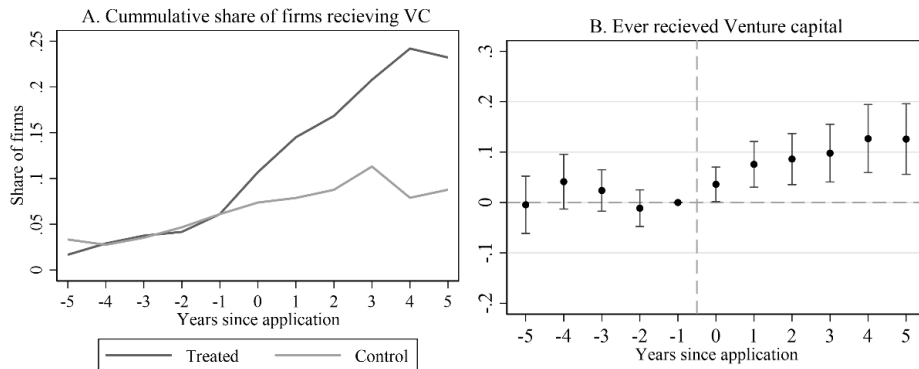
- Reported OLS gap: approximately 1–2 S&T workers at years 4–5

Total employment



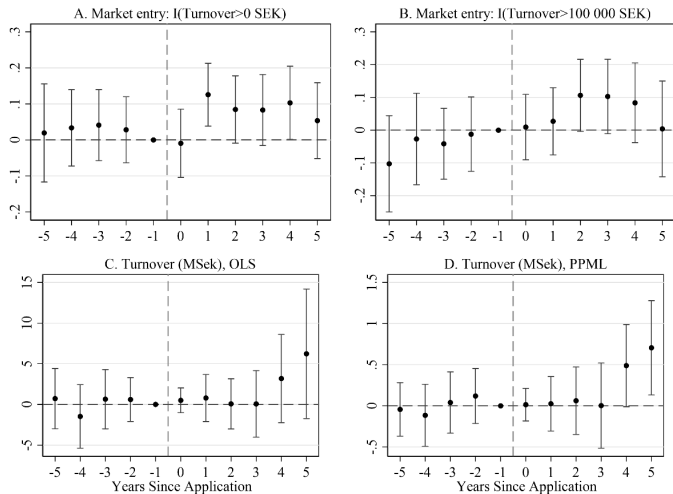
- Reported OLS gap: approximately 5–6 employees at years 4–5

Venture-capital receipt

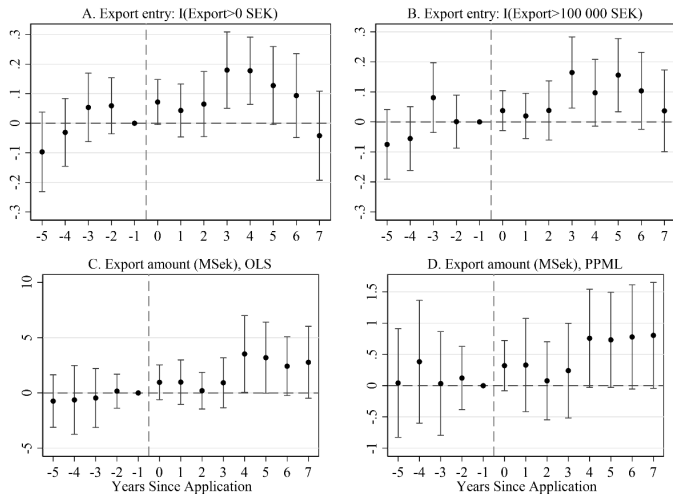


- Reported gap: roughly 10–12 percentage points at years 4–5

Turnover results



Export results



Robustness checks in the evaluation

Check	Reported finding
Population controls	Broadly similar outcome patterns
Concept + Verification	Results broadly consistent with the baseline
Single-grant recipients	Results broadly consistent with the baseline
Longer register series	Employment and commercial differences persist
Honest DiD	Total employment most robust; S&T employment and exports more sensitive

Takeaway

Takeaway

- Between 2015 and 2022, the Swedish Energy Agency administered four competitive grant schemes as part of a business development and commercialization program
 - The grants support development and commercialization of clean-energy innovations
 - The rationale combines knowledge spillovers, environmental externalities, and financing constraints
- **Research Question:** Did the grants causally lead to recipients expanding employment, attracting VC, and developing commercial activities? **Yes(?)**
- Note: It excludes additional innovation and social benefits

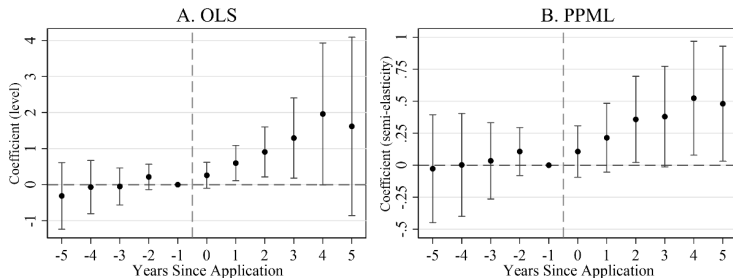
Comments

Overall assessment of internal validity

- **Strengths:** rejected applicants, linked registers and explicit sensitivity analysis
- **Main concern is selection:** new information about an innovation may drive both the award and later growth
- **Comments and suggestions:**
 - 1. Selection when an innovation becomes promising
 - 2. Application, decision and payment timing
 - 3. Firm age and available pre-application history
 - 4. Exit, censoring and changing composition
 - 5. Strengthening the financing-constraints mechanism argument

Comment 1: Selection when an innovation becomes promising

Comment 1: new information before the award



- **Key issue:**

- A commercial breakthrough may prompt an application for funding to exploit it
- Assessors may observe this development before it changes employment or sales
- The same information can predict an award and later growth
- Flat observed pre-trends can coexist with this selection process

Comment 1: new information before the award

- **Suggestions:**

- Less focus on observables, more information about unobservables in your current data
 - Describe assessors, decision rules and reasons for rejection
 - Recover call guidance and assessment forms, supplemented by interviews
 - Choose predetermined matching covariates that capture selection and growth prospects, not those that maximize balancing on observed covariates
 - Compare within scheme and call where feasible, using explicit pooling weights
-
- More granular description of the selection process can help inform the matching and increase the credibility of your control group and thus your internal validity

Comment 2: Application, decision and payment timing

Comment 2: several dates define exposure

- **Key issue:** Annual application time can combine very different exposures, leading to unclear treatment timing

Event	What it tells us
Call and deadline	When firms choose to apply
Decision and notification	When the firm learns it has support
Project start	When supported activity can begin
First and later payments	When cash arrives, possibly against milestones

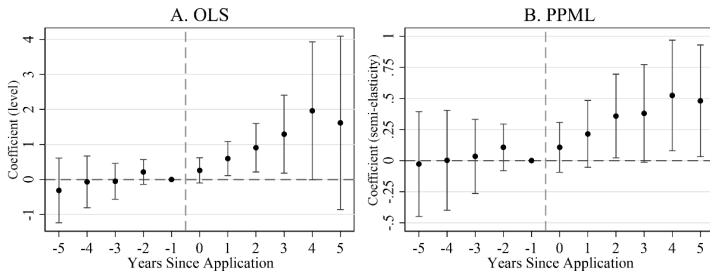
Comment 2: timing can distinguish explanations

- **Key issue:** Annual application time can combine very different exposures, leading to unclear treatment timing
- **Suggestion:** Use this to your advantage as timing can distinguish explanations since monthly VAT data and dated VC rounds data is available
 - **Before the decision:** selection or anticipation may already matter
 - **After notification:** certification or borrowing against the award may matter
 - **After payment:** a financial constraints explanation becomes plausible
- More granular timing can help increase the credibility of your causal claim

Comment 3. Firm age and available pre-application history

Comment 3: different firms can supply the leads

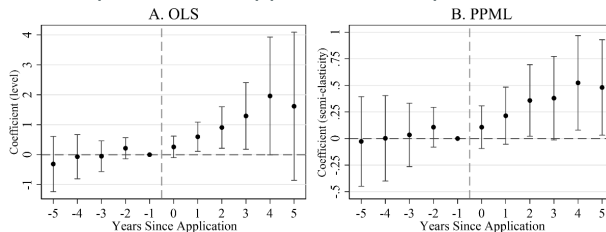
Key Issue: Whose pre-trends support the interpretation of whose growth?



Illustrative group	Before application	After application
Older firms	Long observable histories	Continue contributing
Young firms	One or two pre-periods	Can drive much of later growth

Comment 3: age and usable history

Key Issue: Whose pre-trends support the interpretation of whose growth?



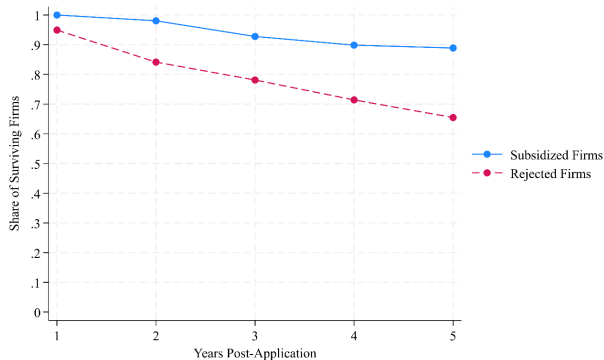
■ Suggestions:

- Show exact age, usable histories and weighted counts at each event time
- Try exact age matching and separate paths for ages 1–5 where support allows
- Compare estimates over a common pre-application window
- If rejected applicants offer too little support, use population matches for this exercise

Comment 4. Exit, censoring and changing composition

Comment 4: survival

Key Issue: Outcomes condition on survival, unclear what the bias is



- The report conditions outcomes on survival
- Survivors can differ in both groups
- Higher survival alone does not determine the bias

Comment 4: exit and follow-up are different

- **Key Issue:** Outcomes condition on survival, unclear what the bias is
- **Suggestions:** Get more data on outcomes and use imputation
 - Separate closure, acquisition, missing records and calendar censoring
 - Hold eligible cohort and scheme weights fixed across horizons
 - Vary required observed follow-up as a descriptive check: one, two, three or more years
 - Use zeros only after verified cessation where economically meaningful
- Allows you to sign the bias and provide indications on its magnitude and thus to improve your internal validity

Comment 5. Strengthening the financing-constraints mechanism argument

Comment 5: a dedicated mechanism section

- **Key issue:** Selection concerns remain, casting doubt on the findings
- **Suggestion:** Add a dedicated mechanism section
 - Bring VC evidence, co-financing rules and other finance into one section
 - Does the grant attract additional external private finance?
 - Does it replace spending financed from the firm's own resources?
 - Does it increase total investment?
- Allows you to provide more detailed evidence on crowding out/in of private investment
- Strong evidence on mechanisms increases internal validity

- **Issue 1:** What is the role of co-financing?
 - The report describes co-financing requirements in several schemes
 - When must commitments exist: application, decision or payment?
 - Which sources qualify, and do they include the observed VC rounds?
 - Separate required project finance from subsequent financing

Comment 5: private capital and total investment

- **Issue 2:** VC receipt alone leaves substitution unresolved
 - FEK has information on short and long term liabilities, interest expenses, cash, equity and dividends
 - Use this information to paint a more complete picture of financial conditions of firms before and after receiving grant payouts
 - Place grant payouts in relation to financing position: are the magnitudes reasonable in relation to the real effects?

Comment 5: when financing conditions matter

- **Issue 3:** Currently no extensive heterogeneity tests on mechanisms
 - Use pre-determined measures of financial position of firms to analyze effects of grants in subsamples
 - Use variation in private financing markets over time or across industries.
- Allows you to ask: Do constrained firms drive the positive financing and growth responses?

Summary of suggestions

Summary of suggestions

1. Document what assessors knew and use this in the matching
2. Document when firms received news and funding and use monthly data
3. Show who contributes to pre-trends and later outcomes
4. Separate exit from calendar follow-up and examine the composition of exits
5. Use a dedicated mechanism section to strengthen the interpretation of the effects

One more suggestion

Comment on designing future programmes for evaluation

- **Suggestion:** Add a short section on designing future calls for evaluation
 - A quality screen followed by a lottery can support credible evaluation when funding is scarce along the lines of British Academy small research grants.
 - Preserve applications, scores, ranking rules and exceptions for all applicants
 - Record notification, payment and later support from the start
 - Make data on above available freely on the web
- **Which of these features could be built into the next call?**

Thank you!
