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Funding R&D Cooperation between Firms and Universities

«The Effectiveness of the Innosuisse Model»

Hulfeld F., Spescha A., Wörter M.

Zurich, November 18, 2024

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Summary of the report

Source

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Disclaimer	This report is based on a research study with the same title: Hulfeld, F., Spescha, A., Wörter, M. (2024): Funding R&D Cooperation between Firms and Universities - The Effectiveness of the Innosuisse Model. KOF Working Paper, November 2024 This study was conducted by KOF Swiss Economic Institute and partly funded by Innosuisse.

Summary of the report

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Aim of the report	Innosuisse funds **joint innovation projects**, or R&D cooperation, between private firms and higher education institutions as research partners. The innovation projects are the **most important funding instruments** in terms of the share of Innosuisse's budget and aim to strengthen knowledge and technology transfer. The report investigates the **causal effect of this Innosuisse funding** on the employment and sales of firms.
Problem	We cannot make a simple mean comparison between the sales or employment of funded and non-funded firms, because firms **selectively apply** for funding and Innosuisse **selectively funds** only a subset of applicants. This twofold selection problem would **bias the results** of a mean comparison and the causal effects of the funding cannot be identified.
Applied method	To identify the causal effect, we rely on **difference-in-differences (DiD) estimators**, which compare funded and non-funded firms over time. The central assumption of a DiD is that after the funding **non-funded firms would develop in the same way as funded firms**. To make this assumption plausible, we use different firm characteristics to create a control group of non-funded firms that **closely resemble the funded firms**. We can then infer the causal effect of the Innosuisse funding on firm outcomes.
Results	The results of our DiD estimations show that the **funding increases firm sales by 21% and employment by 18% on average over the next 5 years** compared to similar but non-funded firms. The funding exerts dynamic effects that **increase over time**. This well-established way to pursue causal analysis confirms the positive impact of the funding of Innosuisse found in Innosuisse's impact monitoring, which is based on self-assessment of firms.

The rationale behind innovation support

The rationale behind innovation support

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Market failures

In a perfect market economy, private firms would invest in R&D to an appropriate level from a social point of view. Government intervention would only lead to misallocations. However, in an actual market economy, we observe several **market failures,** which may justify interventions**:**

1. Output from R&D is **partly a public good** that creates knowledge spillovers. Other firms can use the results without themselves having to pay the full R&D costs. This means that the **social returns to R&D are higher than private returns** and firms underinvest in R&D from a social perspective.

2. R&D projects are risky and their **outcomes are uncertain**. Public innovation support allows firms to pursue risky projects that they would not have executed otherwise. This creates social value because such projects can lead to **disproportionately high** social returns.

3. Firms often face difficulties in raising capital for R&D due to **imperfect financial markets**, because potential investors and creditors do not have access to all necessary information. They may therefore **refrain from** investing or lending credit. Governments can reduce this information gap by signaling – through their funding - which projects have a good chance of success.

Government support

These three types of market failures can make **support of R&D activities** of firms by the government **desirable**.

Innovation support in Switzerland

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The Swiss innovation support system

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The success of the Swiss innovation system rests on **several pillars, e.g.**:

- High quality universities
- Good infrastructure
- Competitive product and factor markets
- A technological/engineering focus supported by vocational education
- Political stability
- Effective KTT

The innovation system in Switzerland **builds on this strong foundation**.

The organization and implementation of the **innovation support in Switzerland is bottom-up**. Firms and higher education institutions have to take the initiative. There are only few and small-scale top-down programs.

Federal level

- SNF: Basic research at higher education institutions
- **Innosuisse**: supports innovation mainly through knowledge and technology transfer (**KTT**) between **private firms and public higher education institutions**. Other Innosuisse instruments are networking, coaching, and project set-up as well as direct support of start-ups.

Cantonal level

- R&D tax credits
- Patent boxes
- Corporate tax incentives, support for start-ups, and the creation of clusters and regional innovation networks

International level

- EU framework programs for research and innovation (i.e., Horizon 2020 / Horizon Europe)

We will **eliminate the effects of those alternative** innovation support instruments in our estimations of the casual effects.

The Innosuisse model

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Some facts about the Innosuisse Innovation support through **innovation projects:**

The main funding instrument of Innosuisse supports **R&D cooperation between private firms and public higher education institutions** in the form of joint innovation projects.

Extension of knowledge capacities

In contrast to other countries, the main instrument of Innosuisse does not just provide funding, but instead allows for an **extension of the knowledge capacities of the firms**. The support comes in the form of **access to qualified research personnel and an accompanying infrastructure**.

Shared costs

Innosuisse covers the costs arising at the higher education institutions, while the firms have to contribute **their own financial means**. Over the relevant time period, the split between public and private funds has been **50%-50%.**

Annual budget

The **annual budget** of Innosuisse for the funding of joint innovation projects ranged over the years 2019-2023 between **140 and 170 million CHF** annually. The average contribution of Innosuisse to the innovation projects has been about 360'000 CHF on average for those years.

Funding policy

Innosuisse aims to fund **risk-oriented and high quality projects** with a high market potential, but at the same time also tries funding those innovation projects that would **otherwise not have been pursued**.

Clientele

Innosuisse explicitly **targets small and medium-sized firms, but also start-ups and spin-offs (about 30%)**. Given this target clientele, the size of the average innovation project support is substantial

The mechanism behind the Innosuisse support

An alternating transfer of knowledge and technology

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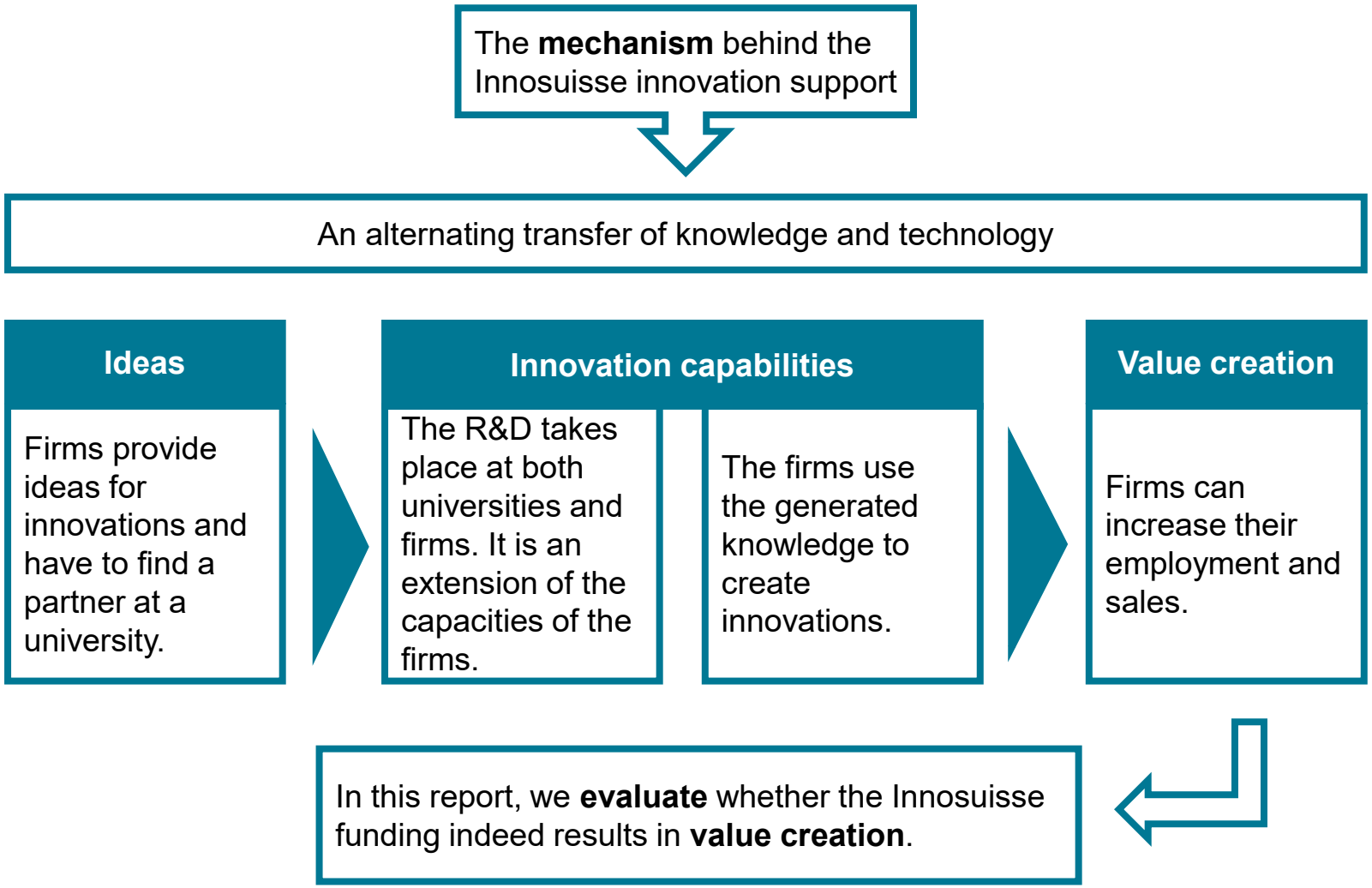

Research design

A twofold selection problem

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Problem

Innosuisse does not randomly distribute its funding among firms. We can therefore **not just make a simple mean comparison** between the performance of funded and non-funded firms. Such a comparison would suffer from a **twofold selection problem** and thus deliver biased estimates, which are likely overestimated.

1

Firms self-select into the application for Innosuisse funding. This means that applicants likely differ from all other firms in the economy. For example, if only small high-tech start-ups that grow fast apply for Innosuisse funding, we would overestimate the effect of the funding, since these particular firms would have grown faster than all other firms also without the funding.

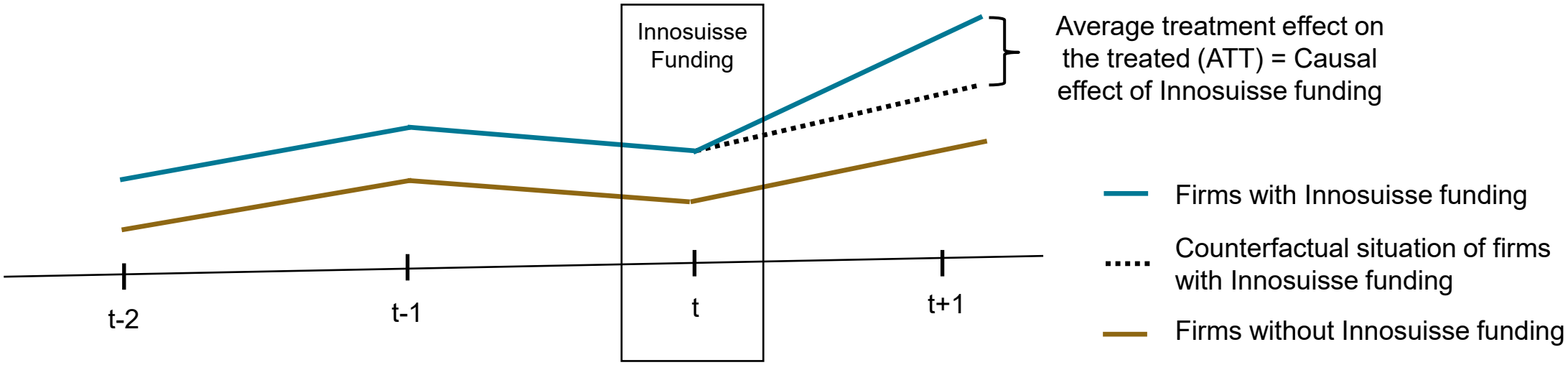
2

Innosuisse selects projects applications. It evaluates all applications and tries to fund projects that are of higher quality and thus have a higher market potential. These higher quality projects would have allowed the funded firms to perform better than the non-funded firms also without the funding. However, note that without the funding funding, these projects may not have been carried out or only to a limiting extent.

Solution

To address this twofold selection problem, we use a **difference-in-differences (DiD)** approach that compares over time the performance of firms funded by Innosuisse with the performance of a control group of non-funded firms that otherwise are very similar to the funded firms.

Difference-in-differences (DiD): the idea behind it



Central assumption	A valid control group	Identification	Pretrends
Without the Innosuisse funding, the funded firms would have developed in the same way as the non-funded firms (the counterfactual situation with the dotted line).	Hence, find a control group of non-funded firms that is very similar to the treatment group of funded firms.	Under the central assumption of a parallel development of funded and non-funded firms, the difference in the performance outcomes between the two groups is then the causal effect of the Innosuisse funding.	Important: One can provide some evidence for plausibility of the DiD if the performance before the funding is similar for both groups.

A valid control group

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To obtain a **valid control group** of firms that is similar to the funded firms, we rely on **a set of important firm characteristics:**

1. We take a **representative sample** of firms from the Swiss economy hat **did not apply for any Innosuisse funding** and randomly exclude firms that are **dissimilar** to the funded firms.

2. We do this **based on** whether a firm has:
   1) exports
   2) employees with a tertiary degree
   3) R&D expenditures
   4) more than 5 competitors.

3. We **randomly exclude firms** until this control group is similar to the group of funded firms.

Whereas before this balancing the representative sample of firms from the Swiss economy is quite dissimilar to the funded firms, **after the balancing** the two groups show **very similar distributions** for all important firm characteristics.

The similarity of this matched control group to the group of funded firms makes the **parallel development** between this group and the group of funded firms **more plausible**.

Data sources

Data sources

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KOF Enterprise Panel

- Stratified random sample representative for the Swiss economy
- Only firms with more than 5 employees
- 9500 firms
- Stratified on geography, firm size, and industry
- Response rates between 25% and 40%

Basis for multiple survey waves

Population of Innosuisse applicants

Information recorded for all firms that have applied for Innosuisse funding

Basis for three survey waves (e.g., addresses)

Full data

Surveys conducted by KOF

- Swiss Innovation and Digitalisation Survey (2011, 2013, 2015, 2017, 2019, 2021, 2023)
- Swiss Digitalisation Survey (2016, 2020)
- Swiss Knowledge Transfer Survey (2011, 2018)

Innosuisse Survey (2019, 2021, 2023)

Detailed data on the innovation project level for all Innosuisse applicants

Final dataset

- Comprehensive firm-level dataset ranging from 2010-2022
- 3220 unique firm-year observations with 920 unique firms, of which 383 are funded firms and 537 are control firms
- Three cohorts of funded firms: 2017-2018, 2019-2020, and 2021-2022

Results

Firm employment outcome

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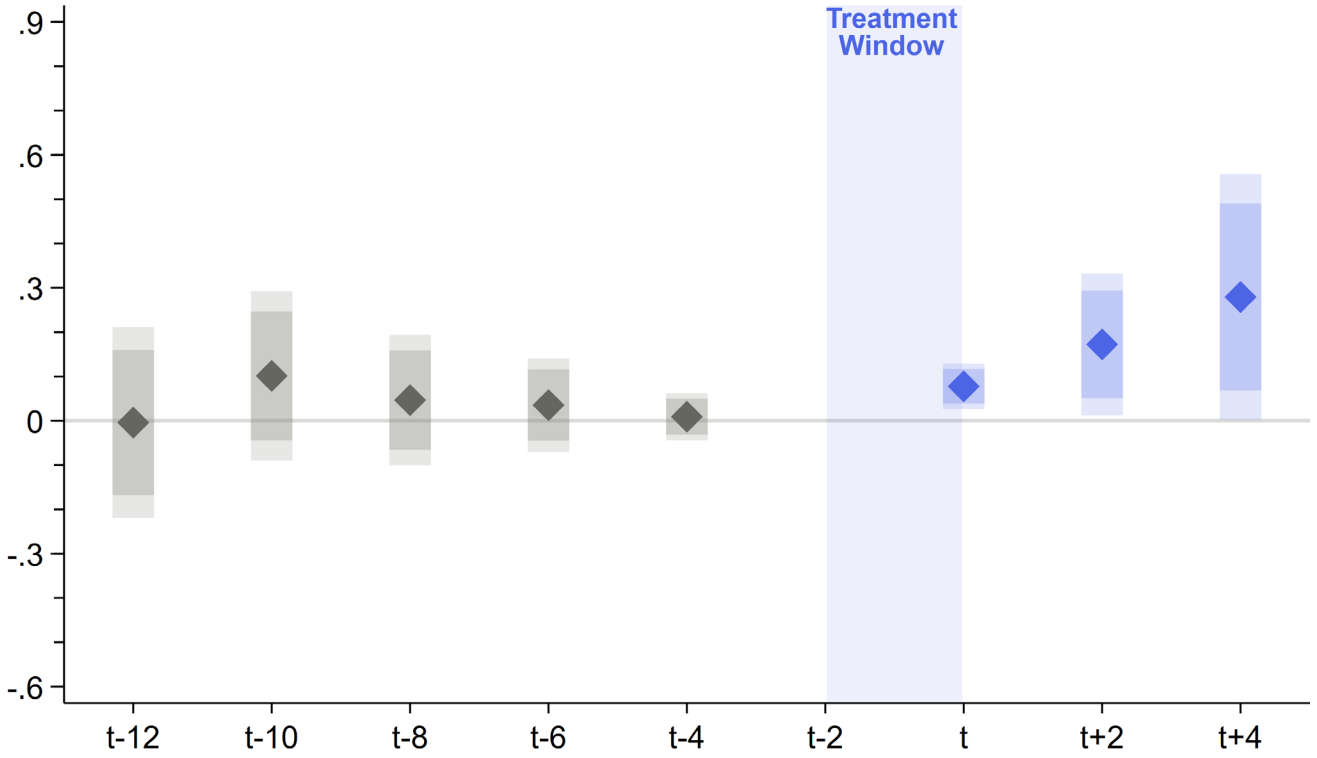

Note: The lighter shaded bands ( ) correspond to 99% and the darker shaded bands ( ) to 95% confidence intervals.
The Innosuisse funding happens for each funded firms somewhen in the treatment window between year "t-2" and year "t".

Year	ln(Employment$_{it}$)
Post-treatment effects	
t	0.078 (0.020)
t+2	0.172 (0.062)
t+4	0.279 (0.108)
Average	0.176 (0.049)
Pre-treatment effects	
t-4	0.009 (0.021)
t-6	0.035 (0.041)
t-8	0.046 (0.057)
t-10	0.101 (0.074)
t-12	-0.004 (0.084)
Average	0.038 (0.045)
Firm-years	3220
Treated	1144
Control	2076

- The figure and the table show the **differences in employment** between the firms in the treatment group and the firms in the control group. Before the treatment, both groups develop similarly, while **after the treatment** (i.e., the Innosuisse funding) **they diverge**
- In this baseline specification, the Innosuisse funding shows **statistically significant effects on employment** that increase over time, with an **average effect of 17.6% after five years**.

Firm sales outcome

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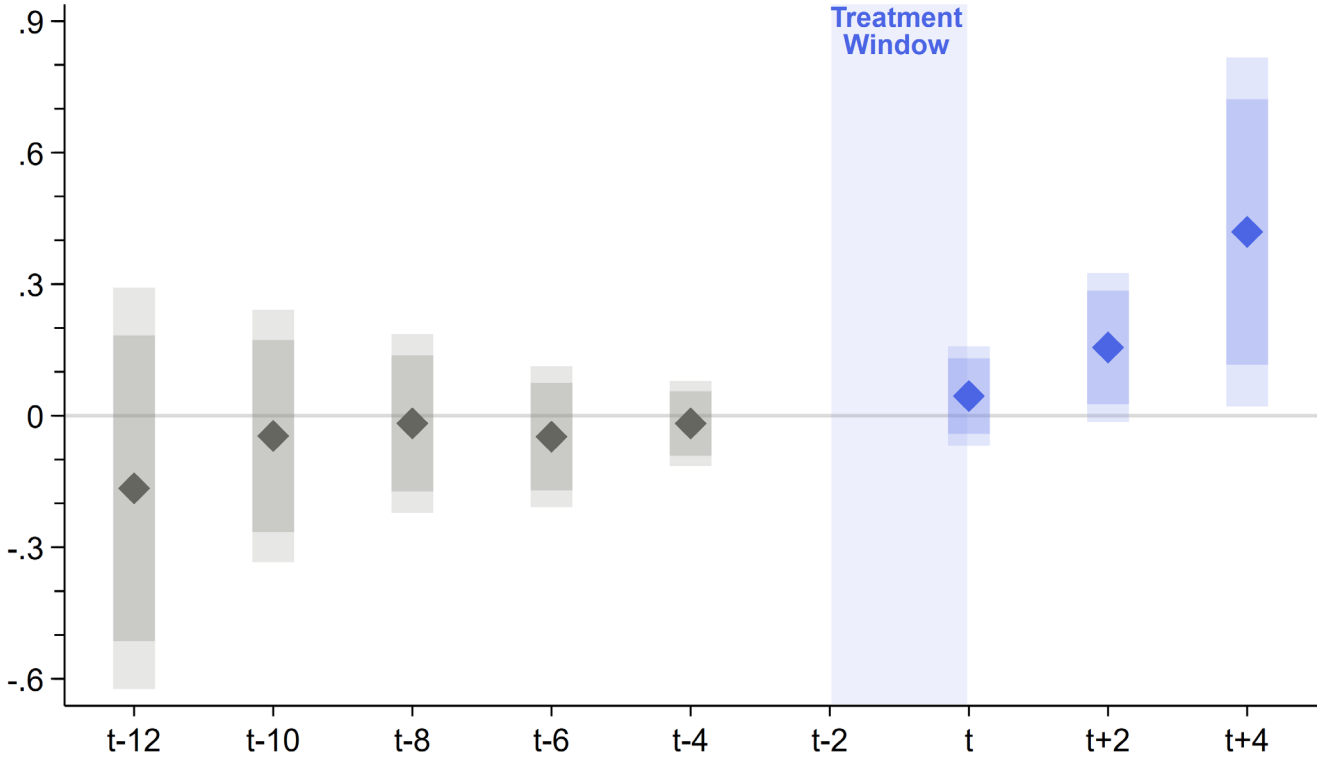

Note: The lighter shaded bands ( ) correspond to 99% and the darker shaded bands ( ) to 95% confidence intervals.
The Innosuisse funding happens for each funded firms somewhen in the treatment window between year "t-2" and year "t".

Year	ln(Sales$_{it}$)
Post-treatment effects	
t	0.045 (0.044)
t+2	0.156 (0.066)
t+4	0.419 (0.154)
Average	0.207 (0.063)
Pre-treatment effects	
t-4	-0.018 (0.038)
t-6	-0.048 (0.062)
t-8	-0.018 (0.079)
t-10	-0.046 (0.112)
t-12	-0.166 (0.178)
Average	-0.059 (0.077)
Firm-years	2866
Treated	944
Control	1922

- The figure and the table show the **differences in sales** between the firms in the treatment group and the firms in the control group. Before the treatment, both groups develop similarly, while **after the treatment** (i.e., the Innosuisse funding) **they diverge**
- In this baseline specification, the Innosuisse funding shows **statistically significant effects on sales** that increase over time, with an **average effect of 20.7% after five years**.

Heterogeneity of employment effects: Firm sizes

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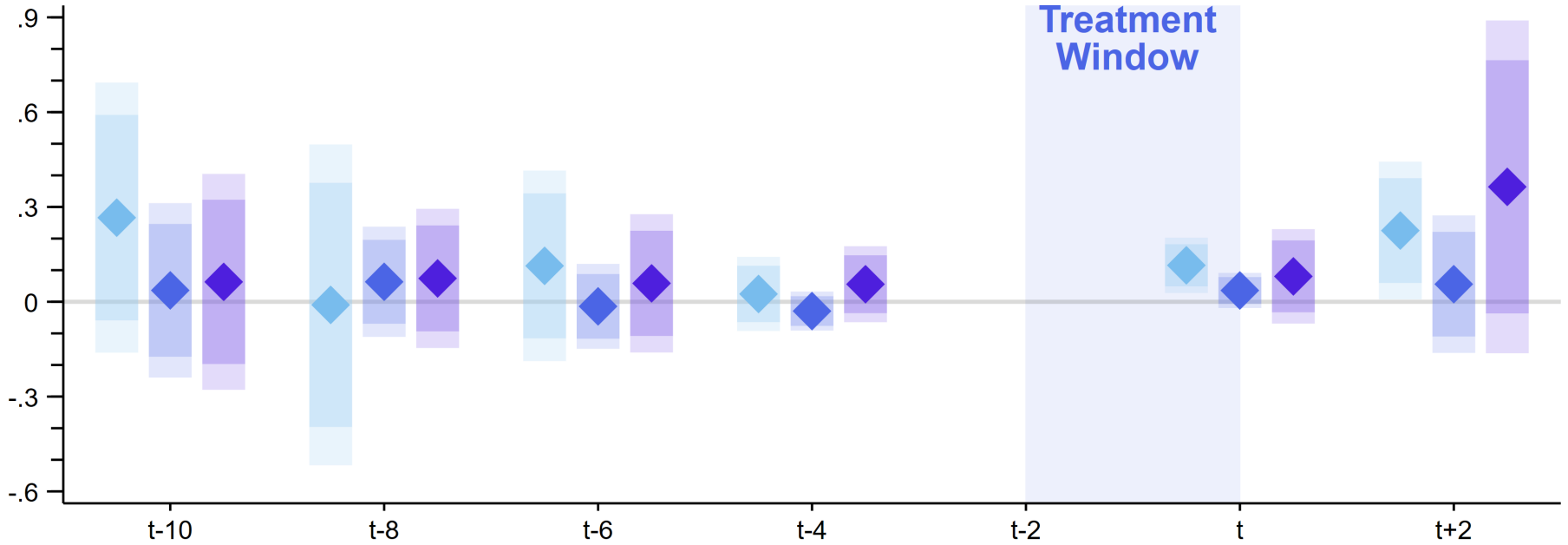

Note: The lighter shaded bands correspond to 99% and the darker shaded bands to 95% confidence intervals.

Small firms with between 5 and 50 employees (◆) and large firms with more than 250 employees (◆) show **positive and increasing effect sizes**. Medium-sized firms with between 50 and 250 employees (◆) show comparatively smaller increases in effect sizes. Importantly, the effects on employment are **statistically significant only for the small firms**. This is because they can rely on larger sample sizes than the medium or large firms, which increases the precision of the estimates.

Heterogeneity of employment effects: Higher education institutions

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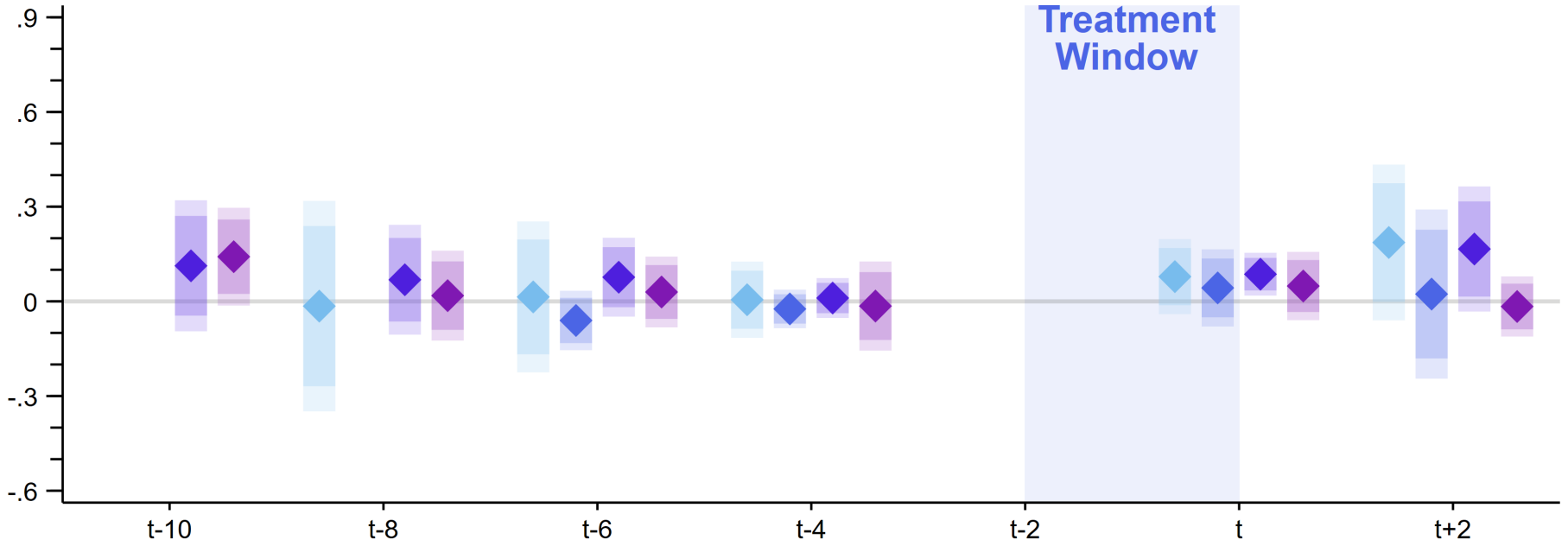

Note: The lighter shaded bands correspond to 99% and the darker shaded bands to 95% confidence intervals.

When the funded firms are split by their research partner, we see **small positive but statistically significant effects** of the Innosuisse funding on employment in year "t" for the ETH domain (◆) and for the universities of applied sciences (◆). The universities (◆) and the research institutions and government agencies (◆) show statistically insignificant effects. We see the same pattern two years after the treatment in "t+2", whereby the effects for the ETH domain and the universities of applied sciences **have increased by even more**.

Heterogeneity of employment effects: Scientific fields

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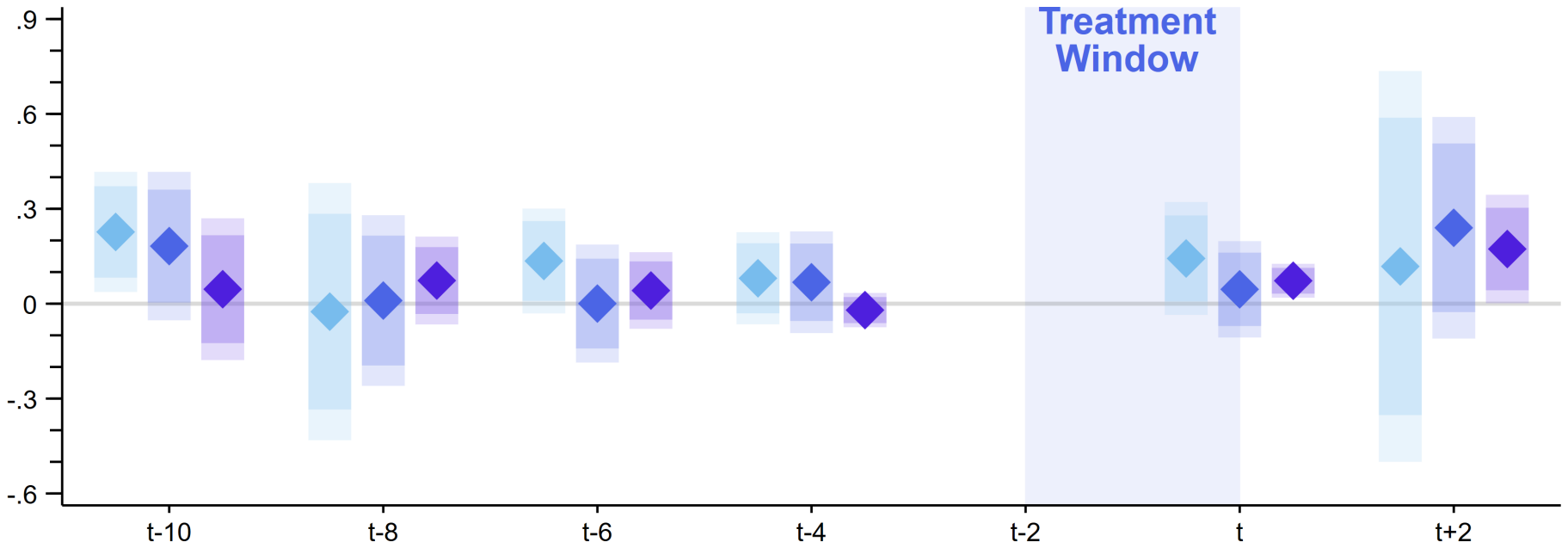

Note: The lighter shaded bands correspond to 99% and the darker shaded bands to 95% confidence intervals.

When the funded firms are split by the scientific field of their research partner, we see **positive and increasing effects** of the Innosuisse funding on employment for information and communication technologies (◆) and for the engineering sciences (◆). However, the effects are **statistically significant only for the engineering sciences**. Other scientific field (social, health, life sciences, etc. ◆) show a strong initial increase that does not carry on to the next period. It may be that these projects are of a very short (social sciences) or very long duration (life sciences), in which case only the effects of short-term projects are captured.

Discussion of the results & outlook

Comparison of results with Innosuisse Impact Monitoring

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Differences between Innosuisse and KOF Monitoring	
Innosuisse	**KOF**
• Self-assessment of firms • Simple but intuitive methods • For each project, survey takes place after project completion and three years after • Balanced data, but only two time periods • Mandatory survey (higher response rate)	• Effectively realized data • State-of-the-art econometric methods • Ongoing, biannual tracking of firms • Unbalanced data, but many time periods • Voluntary survey (lower response rate)
Key result	**Key result**
2.5 additional employees (FTE) three years after completion on average for each project	Average increase in employment of about 18% over the next 5 years

Summary of the report

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Contribution	This report provides a causal estimate of the impact of the Innosuisse funding on both firm sales and employment.
Results	Public funding from Innosuisse has a positive effect on both firms sales and employment. A joint innovation project funded by Innosuisse increases firm sales by about 21% and employment by about 18% on average over the next five years. The funding effects thereby increase over time.
Heterogeneity	The funding effects are particularly strong for small firms, innovation projects with the ETH domain and the universities of applied sciences, and in the field of the engineering sciences.
The future	To validate these results, a further wave of the Innosuisse survey would provide more statistical power and thus more precisely estimated effects and also make it possible to estimate effects further into the past (t-14 years) and the future (t+6 years). It would allow a long-term, quantitative monitoring of the Innosuisse funding. Moreover, one could also compare the different funding cohorts to see whether the impact of the Innosuisse funding improves over time or not.

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