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The Unintended Entrepreneurial Returns To University Grants

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Abstract

This paper asks whether university-wide public investments build entrepreneurial capacity. We link venture-capital (VC) deals to founders' education histories and track the financing raised by startups founded by graduates of universities competing for highly selective, multi-year institutional grants. We identify the grants' causal effects using the program's two-stage selection process: funded universities are compared with institutions also judged ex ante to be credible candidates for funding, and whose proposals advanced through the first stage but were not selected in the final round.

We document three main findings. First, winning a university-wide grant substantially increases the VC financing raised by alumni-founded startups, but the effect emerges only seven years after the award. Second, the delayed response and its concentration among cohorts exposed while studying at funded universities are inconsistent with an immediate prestige or labeling effect and instead point to the gradual accumulation of entrepreneurial capacity. Third, university-wide grants generate larger effects on venture-backed entrepreneurship than project-based research funding. The results are stable across alternative estimators, comparison groups, and timing definitions.

Keywords: Excellence Initiative; venture capital; academic entrepreneurship; science policy; difference-in-differences; universities.
JEL codes: I23, O38, G24, L26.

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1 Introduction

Governments invest heavily in universities because publicly funded research and training can generate benefits beyond the institution. A large empirical literature examines how research funding affects academic knowledge production, including researchers' and universities' publications and patents (e.g. Payne and Siow, 2003; Jacob and Lefgren, 2011; Ganguli, 2017; Myers, 2020). A related literature studies how university research and institutional presence affect technologically or geographically proximate private-sector activity (e.g. Azoulay et al., 2019; Kantor and Whalley, 2014; Hausman, 2022; Andrews, 2023; Bergeaud et al., 2022).[1]

Much less is known about whether university-wide funding builds entrepreneurial capacity among students and alumni, and whether the ventures they create subsequently attract external finance. The closest study is Babina et al. (2023), who exploit large, temporary cuts to federal funding within narrow research fields. They measure high-tech entrepreneurship as a researcher's employment at an age-zero high-tech firm. Consequently, their measure cannot distinguish founders from early employees or reveal the financing and subsequent performance of the new firm. This distinction matters because firm entry alone is a noisy measure of economic significance: approximately 48% of new U.S. private-sector establishments close within five years.[2]

At a more aggregate level, Bergeaud et al. (2022) study funding awarded to French academic research clusters and estimate its effects at the commuting-zone-by-industry level. They document increases in private R&D, patenting, and new-establishment creation—and show that the latter is driven primarily by new firms—but cannot link these entrants to university students or alumni or observe their external financing. We instead exploit university-wide funding shocks and follow alumni-founded ventures, allowing us to test whether institutional funding builds entrepreneurial capacity that is embodied in graduates and recognized by venture-capital investors.

This paper makes a step in filling this gap by studying the causal impact of university-wide grants on entrepreneurial capacity through Germany's Excellence Initiative, the largest university-funding programme Europe has run. Between 2006 and 2017 the federal government and the Länder spent about €4.6 billion on the *Exzellenzinitiative*, deliberately concentrating resources and prestige on a small number of universities. Its "Future Concepts" line gave winning universities between €7 and €14 million per year

[1] A separate literature examines public support for innovation within private firms, including direct R&D grants and related innovation policies (e.g. Bloom et al., 2019; Howell, 2017; Howell et al., 2021; Santoleri et al., 2022; Lerner, 1999).

[2] Among private-sector establishments born in the year ending March 2018, 51.9% remained active in March 2023, implying that 48.1% had closed within five years. See U.S. Bureau of Labor Statistics, Business Employment Dynamics, "Survival of private-sector establishments by opening year," https://www.bls.gov/bdm/us_age_naics_00_table7.txt. These statistics concern establishments rather than venture-backed startups.

for institution-wide strategies.

The Initiative was designed to promote scientific leadership, and evaluations of publications and citations find only modest effects.[3] However, in this paper we examine a downstream outcome that those evaluations do not observe: the VC raised by ventures founded by the universities' students and alumni. VC is not a fiscal return to the university, but it is a market-based measure of whether ideas and human capital produced there become financeable ventures. Whether funding universities does so through their graduates, and on what time scale, is largely unknown.

We explore these questions linking the universe of VC deals recorded by the commercial database PitchBook to the education histories of the founders of the financed companies, which lets us attribute each dollar of VC to the universities where the founders studied. We then follow the VC raised by graduates of every German university that competed for a Future Concept between 2006 and 2012, for the 28 years from 1998 to 2025. Our main comparison is between the 14 universities that were funded and the three that submitted a full proposal in the same rounds but were not, which is the sharpest control group the design of the competition permits: all of them had passed the first-stage screening of the same international panels, and all were judged strong enough to be invited to write a full institutional strategy. We estimate the dynamic effects of winning with the heterogeneity-robust event-study estimator of de Chaisemartin and D'Haultfœuille (2024), which accommodates the staggered timing of the three funding decisions, address the small number of universities with wild-cluster bootstrap and randomization inference, and show that the estimates are unchanged against two broader comparison groups, all 31 applicants and all 70 German institutions with VC-backed founders, and with the estimator of Callaway and Sant'Anna (2021).

The paper provides three main findings. First, the estimated effect is statistically significant, large, but delayed. For seven years after funding begins, VC flows to winners and unsuccessful full-proposal applicants evolve similarly. From the eighth year onward, winners' graduates raise between $7 million and $52 million more VC per year and close between three and ten more deals; the estimates continue to grow through year sixteen. A static difference-in-differences estimate averaging the whole post-treatment period is close to zero. The contrast shows how a conventional evaluation window can miss returns that operate through the formation of human capital and research capacity.

Second, the timing and cohort evidence point to capacity building rather than reputation effects. The program conferred to winners the public label "university of excellence", potentially creating a salient quality label independent on the actual quality of the projects undertaken by students and alumni. Yet we find that graduates who had left before the

[3] Winners publish about 7 per cent more but not more top-cited work, gains are larger in international and industry co-authorship, and part of the additional funding is offset by other funders (Carayol and Maublanc, 2025; Civera et al., 2020; Buenstorf and Koenig, 2020).

award show no detectable financing response. Post-grant cohorts account for a growing share of winners' deals just as the aggregate estimates begin to rise, and winning universities research standing—as proxied by university rankings—improves gradually over the same period. These patterns are difficult to reconcile with a label that immediately changes investor beliefs about all alumni.

Third, we find that university-wide grants are more effective than project-based financing at generating venture-backed entrepreneurship. The Excellence Initiative also funded Clusters of Excellence: thematic research consortia, typically joining several institutes of the host university with non-university partners, that received about €6.5 million per year for a defined research programme administered by the project rather than by the university. Among the 56 German institutions that never won a Future Concept, the fourteen that won at least one cluster show no detectable change in the VC raised by their graduates. The contrast fits the evidence of Aghion et al. (2010) that a given expenditure produces more university output where institutions are more autonomous and compete for high-stakes, merit-based funding: the Future Concepts grant was discretionary money won in exactly such a competition, whereas cluster money was tied to a project.

The paper's main contribution is to the economics of public science funding. Existing work measures returns in publications, patents, local invention and entrepreneurship by university personnel (Jacob and Lefgren, 2011; Azoulay et al., 2019; Kantor and Whalley, 2014; Hausman, 2022; Andrews, 2023; Babina et al., 2023). We add the financing of graduates' ventures and show why the evaluation horizon is part of programme design: a policy can look ineffective over its funding period yet generate downstream effects once exposed cohorts enter entrepreneurship. Second, we contribute to research on the organisation of innovation policy. The comparison between institution-wide and project-based funding, shifts attention from whether public science is funded to who controls the funds (Aghion et al., 2010; Carayol et al., 2024; Buenstorf and Koenig, 2020). Aghion et al. (2010) show that autonomy and competition raise the patents and publications a university produces from a given budget; we extend the comparison to the venture financing of its graduates.

Third, we contribute to work on universities, entrepreneurship and certification in venture finance (Audretsch and Lehmann, 2005; Samila and Sorenson, 2011; Åstebro et al., 2012; Hsu, 2004; Garfinkel et al., 2025). The delayed response and the null estimates for pre-grant graduates provide evidence against a pure labelling mechanism.

The remainder of the paper is organised as follows. Section 2 describes the Excellence Initiative and the Future Concepts competition. Section 3 presents the data and the sample. Section 4 sets out the empirical strategy. Section 5 reports the event-study and static estimates, including broader comparison groups and an alternative estimator. Section 6 examines timing and cohorts and compares institution-wide with cluster funding. Section 7 reports further robustness checks, and Section 8 concludes.

2 The Excellence Initiative and the Future Concepts competition

The Excellence Initiative was agreed by the federal government and the Länder in June 2005 as part of Germany's response to the Lisbon agenda and to the mid-2000s discovery that no German university appeared near the top of the new global rankings (Carayol and Maublanc, 2025). It was administered jointly by the German Research Foundation (DFG) and the German Council of Science and Humanities (Wissenschaftsrat), with funding split 75:25 between the federal government and the university's Land. Three funding lines were offered, and they differed in what they financed and in who controlled the money. *Graduate Schools* (about €1 million per year each) financed structured doctoral programmes in a defined field or set of fields: cohorts of doctoral students, their stipends, courses and supervision, run by a group of professors. *Clusters of Excellence* (about €6.5 million per year each) financed large, thematically focused research consortia on a single topic, such as regenerative therapies, ultrafast imaging or integrative production technology, typically bringing together several institutes of the host university with non-university partners such as Max Planck or Helmholtz institutes; the money was project money, tied to the cluster's research programme and administered by its spokespersons. *Future Concepts* (€7 to €14 million per year) were different in kind. They financed an institution-wide strategy "for the project-based expansion of top-level university research": the funds went to the university as a whole, were controlled by its leadership rather than by a research group, and were spent on structural measures, among them new professorships and research centres, tenure-track and international recruitment schemes, internal funding competitions open to the whole university, support structures for early-career researchers, and governance reforms (DFG and Wissenschaftsrat, 2015; IEKE, 2016). A Future Concept could only be funded if the university also held at least one funded Graduate School and one funded Cluster of Excellence (DFG and Wissenschaftsrat, 2015), so that the university-wide grant was by construction layered on top of demonstrated research capacity in at least one field. Winning a Future Concept also carried the public label "university of excellence"; winning clusters or graduate schools did not. Over the two phases, 2006–2012 and 2012–2017 (with bridging funds to 2019), the programme distributed about €4.6 billion, roughly 4 per cent of the research budget of German universities; the largest individual recipients obtained up to €350 million, or up to 14 per cent of their budgets (Buenstorf and Koenig, 2020; IEKE, 2016).

Selection followed a two-stage procedure in each round. Universities first submitted outline proposals (*Antragsskizzen*), which international panels reviewed; only a subset was invited to submit full proposals (*Vollanträge*), on which the funding decision was taken by a joint commission of the DFG and the Wissenschaftsrat, together with a grants committee that included the federal and Land science ministers. The timeline of the first

round illustrates the pace: outlines were due on 30 September 2005, invitations to submit full proposals were issued on 20 January 2006, full proposals were due on 20 April 2006, the funding decision was announced on 13 October 2006, and funding started on 1 November 2006. The second round of the first phase followed one year later (decision 19 October 2007, funding from 1 November 2007) and the second phase was decided on 15 June 2012, with funding from 1 November 2012. A third phase, the Excellence Strategy, was decided in July 2019 under changed rules, in which eligibility for the university-level line required at least two funded clusters and applications no longer went through a separate outline stage. We restrict attention to the three decisions of 2006, 2007 and 2012, in which the university-level line was a stand-alone competition with an observable pool of unsuccessful applicants.

Table 1 lists the seventeen universities that reached the full-proposal stage in at least one of the three rounds. Three were funded in 2006 (LMU Munich, TU Munich and the University of Karlsruhe, which became the Karlsruhe Institute of Technology in 2009), six more in 2007 (RWTH Aachen, FU Berlin, Freiburg, Göttingen, Heidelberg and Konstanz), and in 2012 the eleven funded institutions comprised six renewals and five new winners (HU Berlin, Bremen, TU Dresden, Cologne and Tübingen), while Freiburg, Göttingen and Karlsruhe lost the status. Three universities submitted full proposals and were never funded: Bochum (full proposals in 2007 and 2012), Mainz (2012) and Würzburg (2006). A further eighteen universities submitted outline proposals in at least one round without being invited to the full-proposal stage; they enter our broader comparison samples.

Table 1: Universities that reached the full-proposal stage of the Future Concepts competition, 2006–2012

University	City	2006	2007	2012	First grant	Clusters 2010	ARWU 2005	VC 1998–2005	VC 2006–2025	Deals 2006–2025
KIT Karlsruhe	Karlsruhe	W	–	F	2006	1	13.8	0.0	145.1	38
LMU Munich	Muenchen	W	–	W	2006	3	30.5	2.0	815.8	193
TU Munich	Muenchen	W	–	W	2006	2	30.4	44.8	1634.1	419
FU Berlin	Berlin	F	W	W	2007	3	–	17.5	410.4	100
Freiburg	Freiburg	F	W	F	2007	1	24.2	0.0	107.4	39
Goettingen	Goettingen	S	W	F	2007	1	25.1	18.9	149.3	24
Heidelberg	Heidelberg	F	W	W	2007	2	27.3	0.0	413.2	57
Konstanz	Konstanz	S	W	W	2007	1	11.2	3.9	52.2	21
RWTH Aachen	Aachen	F	W	W	2007	3	13.2	76.4	411.8	139
Bremen	Bremen	F	S	W	2012	1	9.3	0.0	30.5	20
Cologne	Koeln	S	S	W	2012	1	17.2	19.9	408.0	78
HU Berlin	Berlin	S	F	W	2012	2	–	0.0	84.5	50
TU Dresden	Dresden	S	S	W	2012	1	11.2	0.0	31.7	16
Tuebingen	Tuebingen	F	S	W	2012	1	21.7	0.0	24.3	11
Full proposal, never funded										
Bochum	Bochum	S	F	F	–	0	14.9	0.0	58.7	16
Mainz	Mainz	S	S	F	–	0	17.0	0.0	65.6	12
Wuerzburg	Wuerzburg	F	S	S	–	0	21.9	0.0	22.6	8

Notes: Outcome codes by decision round: W = funded, F = full proposal not funded, S = outline proposal not invited to the full-proposal stage, – = did not apply. "First grant" is the year in which Future Concepts funding started. "Clusters 2010" is the number of Clusters of Excellence held in 2010. "ARWU 2005" is the Shanghai ranking total score in 2005 (FU and HU Berlin unranked). VC is the amount raised, in millions of US dollars, by ventures whose founders studied at the university, co-founder weighted, summed over the years shown. Karlsruhe: University of Karlsruhe (TH) until the 2009 merger into KIT. Source: Wissenschaftsrat lists of Future Concepts decisions; DFG lists of Clusters of Excellence; ARWU; PitchBook.

Two features of the programme matter for interpretation. First, the Future Concepts money was tied to organisational change and was spent at the discretion of the university leadership; the funded universities were granted unusual leeway in how to use it (DFG and Wissenschaftsrat, 2015). This leeway was a departure from the norm: in the survey of Aghion et al. (2010), every German university reported that its budget required government approval, against none in Denmark and 13 per cent in the United Kingdom.

One consequence, documented by the programme's own evaluation, was a large cohort of additional, mostly temporary, research positions at the postdoctoral level (IEKE, 2016). Because the grant was conditional on already holding a cluster and a graduate school, and because leaderships recruited into and built around their strongest departments, its effects should depend on the capacity it met. Second, the label was public and consequential. Winners were widely described as Germany's "elite universities," and the label changed the behaviour of outsiders quickly: winners attracted first-year students with better school grades for three admission cycles, an effect that faded after three years (Fischer and Kampkötter, 2017). Both features generate testable predictions about VC, to which we now turn.

3 Data

3.1 Venture capital flows attributed to universities

Our VC data come from the PitchBook platform, extracted in June 2026. PitchBook records venture deals worldwide with the deal date, the amount raised, the company, its founders and, through the education records of each person, the institutions the founders attended. We attribute each completed VC deal (excluding exits) to the founders' universities as follows. The deal amount is divided equally among the company's founders; each founder's share is attributed to the university, or universities, listed in their education record; the amounts are summed by university and deal year. Deal amounts are winsorised at the top of the deal-size distribution to limit the influence of a handful of mega-rounds; results with unwinsorised amounts are reported below. We also count the number of deals in which at least one founder studied at the university. A university-year without a recorded deal is a true zero, since PitchBook records a deal whenever one exists in its coverage. Amounts are in millions of US dollars. The attribution follows the approach of Garfinkel et al. (2025), who use the same PitchBook education records to link founders and investors to their alma mater.

Each of the 35 universities that ever applied to the Future Concepts line was matched by hand to its PitchBook institution string (34 matches; Hannover Medical School has no PitchBook institution entry and drops out of the VC analysis). Every other German higher-education institution present in PitchBook's education records (39 institutions,

including business schools and universities of applied sciences) enters the broadest comparison sample. The resulting panel runs from 1998, the first year with a recorded deal for the applicant universities, to 2025, the last complete year at extraction. For the founder-level analysis in Section 6 we use the underlying founder-by-year panel: 2,919 founders whose education records list one of the seventeen full-proposal universities, observed every year from 1998 to 2025, with their VC amounts, deal counts and, for 58 per cent of them, their graduation year.

3.2 Programme data

Application and funding status by round come from the Wissenschaftsrat's overview of the Future Concepts decisions, which lists every university that submitted an outline, every university invited to submit a full proposal, and every funded university, for the 2006, 2007 and 2012 decisions. We transcribed the lists and cross-checked them against the DFG and Wissenschaftsrat reports. The event year is the calendar year in which funding started (2006, 2007 or 2012), which coincides with the year of the decision. For universities funded in more than one round, the first funding start defines the event.

Because a Future Concept required a funded Cluster of Excellence and Graduate School, and because the cluster line is the one for which regional innovation effects have been found (Krieger, 2024), we also collected the complete lists of Clusters of Excellence and Graduate Schools funded in the 2006, 2007 and 2012 decisions (17 and 18, 20 and 21, and 43 and 45 projects respectively), with their host universities, from the DFG and Wissenschaftsrat lists. From these we construct the number of clusters and graduate schools each university holds in each year, counting joint projects once for each co-host and treating projects as held from their funding start to the year before the next decision. We use them as controls and to study the effect of cluster funding among universities that never won a Future Concept.

Research standing comes from the Academic Ranking of World Universities (ARWU, "Shanghai ranking"), 2003–2025, which we use both as a mechanism outcome and as a pre-treatment characteristic. ARWU ranks the world's top 500 universities (top 1000 from 2018) and publishes a total score for each; unranked universities have missing values. FU Berlin and HU Berlin are unranked from 2005 onwards in our source, because ARWU could not separate the two institutions' Nobel laureates, so the ranking analysis rests on twelve of the fourteen winners.

3.3 Sample and descriptive statistics

Table 1 shows the seventeen full-proposal universities with their application history, the year of their first grant, the number of clusters they held in 2010, their ARWU score in 2005, and the VC raised by their graduates before and after 2006. The funded group

is heterogeneous: it contains the two Munich universities, whose graduates raised $0.8 and $1.6 billion between 2006 and 2025, RWTH Aachen, Heidelberg, FU Berlin and Cologne with about $0.4 billion each, and small universities such as Konstanz, Bremen, TU Dresden and Tübingen with $25 to $50 million. The three unsuccessful full-proposal applicants raised between $23 and $66 million over the same period, a range that overlaps with the bottom half of the winners. Before 2006, VC to the graduates of German universities was rare everywhere: eleven of the seventeen universities had no recorded deal at all, and the total for the group was $184 million, three quarters of it at TU Munich and RWTH Aachen.

Table 2 compares winners and unsuccessful full-proposal applicants in the pre-period (1998–2005) and the post-period (2006–2025). Winners raised more VC before the programme, on average $1.6 million per university-year against zero for the three losers, and held a slightly higher ARWU score (19.4 against 17.9 points, a difference well within one standard deviation). Neither group held clusters before 2006 by construction. After 2006, winners hold on average one cluster and one graduate school per year, the losers 0.2 and 0.6. The level difference in VC before 2006 is why we work with a dynamic design: with university fixed effects and event-time coefficients, identification comes from changes around the grant within a university, not from the level.

Table 2: Summary statistics, full-proposal sample, by group and period

	1998–2005			2006–2025		
	Winners	Unsuccessful	Diff.	Winners	Unsuccessful	Diff.
VC received (USD mn)	1.64	0.00	1.64**	16.85	2.45	14.40**
VC deals	0.27	0.00	0.27**	4.30	0.60	3.70**
Any VC deal	0.19	0.00	0.19**	0.73	0.37	0.36***
ARWU score	19.43	17.89	1.54	20.24	16.70	3.54
Clusters of Excellence held	0.00	0.00	0.00	1.05	0.23	0.82***
Graduate Schools held	0.00	0.00	0.00	1.12	0.63	0.49**
University-years	112	24		280	60	
Universities	14	3		14	3	

Notes: Means over university-years. "Winners" are the 14 universities funded in 2006, 2007 or 2012; "Unsuccessful" are Bochum, Mainz and Würzburg. VC in millions of US dollars. ARWU score is missing for FU and HU Berlin from 2005 and for unranked university-years. The difference is from a regression on the group indicator with standard errors clustered by university; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 1 plots the yearly means of VC and deals for the two groups. Both series are close to zero until the mid-2000s and both rise with the German VC market thereafter, with the losers' series more volatile because it averages three universities. Winners and losers rise together from 2006 to about 2013, and the winners' series then accelerates. The event-study estimates below formalise this pattern and date it relative to each university's own grant.

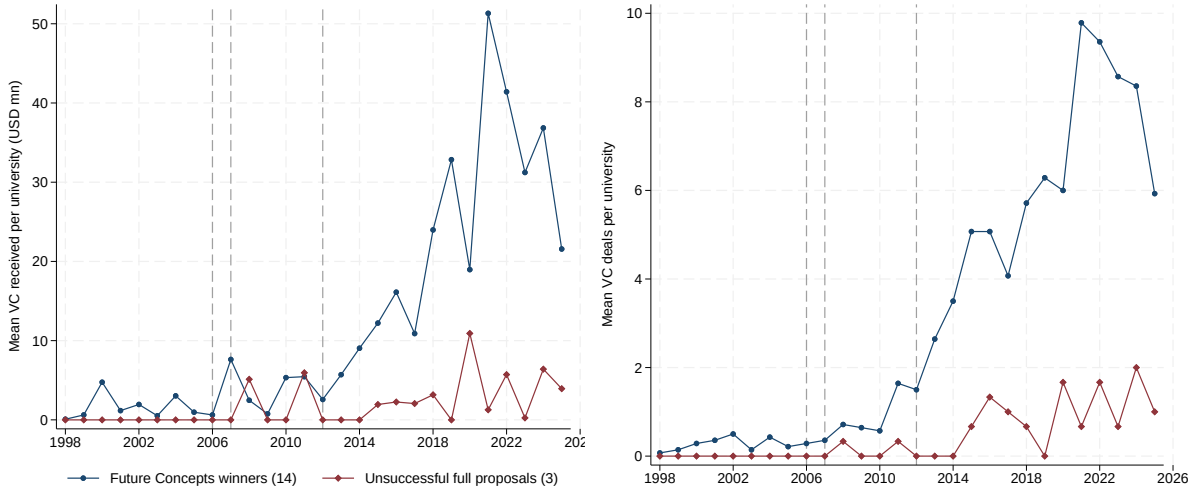


Figure 1: Venture capital raised by graduates: winners versus unsuccessful full-proposal applicants. *Notes:* Yearly means over universities of VC raised by the university's graduates (left, millions of US dollars) and of the number of deals (right) for the 14 Future Concepts winners and the three unsuccessful full-proposal applicants. Vertical lines mark the funding starts of 2006, 2007 and 2012.

4 Empirical strategy

4.1 Estimator

Let Y_{it} be an outcome for university i in year t, and let F_i be the year in which i's first Future Concepts funding started ($F_i = \infty$ for universities never funded). Treatment adoption is staggered across 2006, 2007 and 2012, treatment effects are likely to grow with time since the grant, and three universities lost the status in 2012. In this setting the conventional two-way fixed-effects event-study regression can put negative weights on some cohort-time effects and produce estimates that do not correspond to any average causal effect (de Chaisemartin and D'Haultfœuille, 2020; Roth et al., 2023). We therefore use the estimator of de Chaisemartin and D'Haultfœuille (2024), which compares the change in the outcome of universities whose treatment starts in year F, from $F-1$ to $F-1+\ell$, with the change over the same years among universities whose treatment has not yet started by $F-1+\ell$. The estimator for horizon ℓ, DID_ℓ, is an average over cohorts of these comparisons, weighted by cohort size, and is unbiased for the average effect of having been funded for ℓ years under parallel trends and no anticipation, whatever the pattern of effect heterogeneity. Placebo estimators DID^{pl}_ℓ apply the same comparison to the change from $F-1-\ell$ to $F-1$ and test parallel trends over ℓ pre-periods. We estimate 16 dynamic effects and 8 placebos; the long horizons rest on the 2006 and 2007 cohorts only, since the 2012 cohort is observed for 13 post years. Standard errors are clustered at the university level.

Our outcomes are the VC raised by the university's graduates in millions of US dollars,

the number of deals, and an indicator for at least one deal in the year; deal amounts are winsorised as described above, and the unwinsorised series is reported as a check. For static summaries we estimate the two-way fixed-effects regression

$$Y_{it} = \alpha_i + \lambda_t + \beta \, \text{Post}_{it} + \varepsilon_{it}, \tag{1}$$

where $\text{Post}_{it} = \mathbf{1}\{t \geq F_i\}$, and a version that splits Post_{it} into the first eight post years (0–7) and later years (8+).

4.2 Inference with seventeen universities

The main sample has 17 clusters and 14 treated units, and asymptotic cluster-robust inference is known to over-reject in such settings (Cameron et al., 2008; MacKinnon and Webb, 2017). We report three p-values for every static coefficient. The first is the cluster-robust p-value with $G - 1$ degrees of freedom. The second is from the wild-cluster bootstrap with the null imposed and Webb weights, 9,999 replications, which is the recommended procedure with few and unequal clusters (MacKinnon and Webb, 2017). The third is a randomization-inference p-value under the sharp null of no effect for any university-year: we hold fixed the observed vector of first funding years (three in 2006, six in 2007, five in 2012, three never), reassign it at random across the 17 universities 2,000 times, re-estimate the coefficient each time, and report the share of placebo coefficients at least as large in absolute value as the observed one. We apply the same permutation to the dynamic estimator's average cumulative effect.

4.3 Identification

The identifying assumption is that, absent funding, VC to the graduates of winners and of unsuccessful full-proposal applicants would have evolved in parallel from the year before the grant onwards. The comparison group is designed to make this plausible: the three losers had passed the same first-stage screening, held the same eligibility credentials, and were judged worthy of a full proposal by the same panels. The design does not require winners and losers to be alike in levels, which they are not, but it does require that they were not on different trajectories. We test this with eight placebo coefficients before each grant, with two broader comparison groups and an alternative estimator (Section 5.3), and with university-specific linear trends (Section 7). The remaining threat is selection on anticipated trajectories: the panels may have funded the universities whose graduates would have attracted VC anyway. We cannot rule this out with 17 units, but three features of the results weigh against it: the absence of pre-trends over eight years, the seven-year delay before any effect appears, and the fact that the effect is absent among the cohorts that had already left the university, which a selection-on-trajectory story does

not predict.

Two further issues concern the definition of treatment. First, three winners (Freiburg, Göttingen and KIT) lost the status in 2012 but continued to receive bridging funds until 2014, and KIT regained it in 2019; we treat the first grant as an absorbing event, which is the relevant definition for a capacity channel, and show that results are similar with an indicator for currently holding a funded Future Concept. Second, the Excellence Strategy of 2019 labelled Bonn, Hamburg and (through the Berlin alliance) TU Berlin as Excellence Universities; none of them is in the main sample, and we exclude them from the broader comparison groups. Finally, the three grants coincided with a growing German VC market, which is absorbed by the year effects; the effects we estimate are relative to the contemporaneous change at unsuccessful applicants.

5 Main results

5.1 Event studies

Figure 2 shows the estimated dynamic effects of the first Future Concepts grant on the VC raised by the university's graduates and on the number of deals, with 95 per cent confidence intervals, and Appendix Table A.2 reports the coefficients. Three features stand out. First, the eight placebo coefficients before the grant are small and individually insignificant for VC amounts, ranging from −\$0.7 to \$3.8 million with standard errors of similar size, and the joint test of parallel pre-trends does not reject ($p = 0.27$). For deal counts the placebos are within ±0.2 deals of zero for seven pre-periods; the single exception is the eighth pre-period, estimated on the seven universities with eight years of pre-data, which is negative (−0.48, s.e. 0.20) and drives the rejection of the joint test. This is not a differential pre-trend that continues into the post period; the coefficients from −7 to −1 average −0.06.

Second, for seven years after the grant the effect on VC amounts is indistinguishable from zero: the estimates at horizons 0 to 7 fluctuate between −\$1.2 and \$3.8 million with standard errors of \$3 to \$5 million. Deal counts show a small positive tendency in the early years, 0.5 additional deals at horizon 1 and 0.8 at horizon 4, that is marginally significant and does not build up. Third, from the eighth year on the effect rises and becomes statistically significant: winners' graduates raise \$7.4 million more in year 8 (s.e. 3.0), \$14.6 million in year 10 (3.9), \$15.3 million in year 12 (5.6), and \$47 and \$52 million in years 15 and 16 (13.0 and 23.0); they close 2.6 more deals in year 8 (s.e. 0.9), 3.9 in year 10 (1.3), 4.4 in year 12 (1.6), and 9.8 and 10.3 in years 15 and 16 (3.3 and 4.5). The last two horizons are identified only from the nine 2006 and 2007 winners. The average cumulative effect over all post-years is \$122 million per winner (s.e. 49) and 32 deals (s.e. 11), and the joint tests that all dynamic effects are zero reject at any conventional level

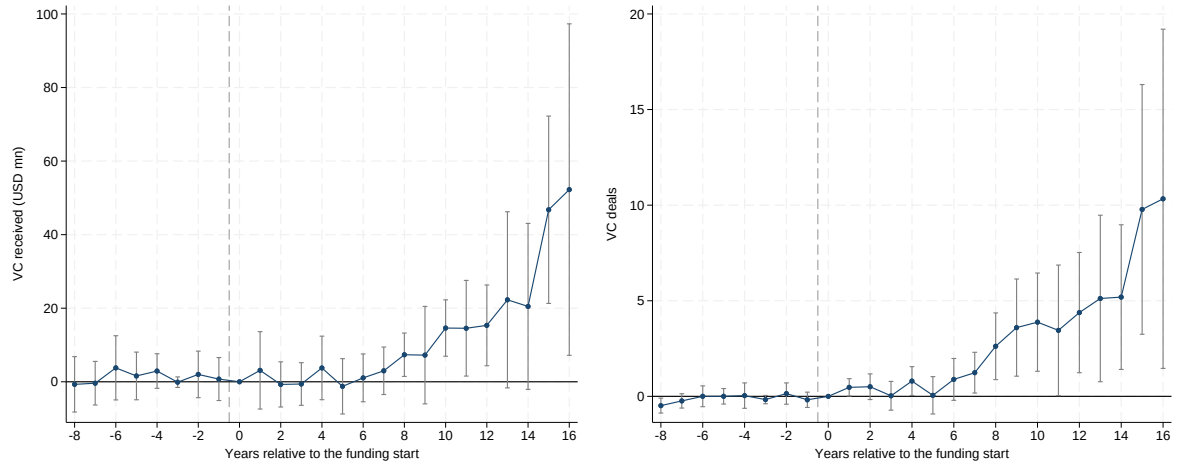


Figure 2: Dynamic effects of the first Future Concepts grant on venture capital raised by graduates. *Notes:* de Chaisemartin and D'Haultfœuille (2024) event-study estimates, full-proposal sample (17 universities, 1998–2025), with 95 per cent confidence intervals from standard errors clustered by university. Horizon 0 is the first year of funding; horizons −1 to −8 are placebos. Left: VC in millions of US dollars; right: number of deals.

for both outcomes. Against the post-2006 mean of $17 million and 4.3 deals per winner-year, the year-10 estimates imply that winners' graduates raised roughly twice the VC and closed twice the deals they would have without the grant.

Unwinsorised amounts (Appendix Figure A.1) give the same profile with wider intervals, and an average cumulative effect of $129 million (s.e. 98).

5.2 Static estimates and inference

Panel A of Table 3 reports the two-way fixed-effects coefficient on Post from equation (1) for the three outcomes, with the three p-values. Averaged over all post years, the effect on VC is −$0.8 million (s.e. 5.6), on deals 0.4 (s.e. 1.3), and on the probability of any deal 0.14 (s.e. 0.10); none is significant under any of the three procedures. Panel B splits the post period. In years 0–7 the coefficients are negative for VC (−$4.4 million, s.e. 4.0) and deals (−0.5, s.e. 0.9). In years 8 and later they are positive: $13.9 million (s.e. 7.4) and 3.9 deals (s.e. 1.7). The cluster-robust p-values are 0.08 and 0.03. The few-cluster procedures are less favourable: the wild-cluster bootstrap p-values are 0.15 for VC and 0.09 for deals, and the randomization-inference p-values 0.38 and 0.25. The static split is a blunt summary of a profile that rises steadily from year 8 to year 16, and the horizon-specific estimates in Appendix Table A.2 are individually significant with clustered standard errors from year 8 on for deals and from year 10 on for VC; but a reader who insists on the most conservative inference should treat the aggregate long-run effect on VC amounts as suggestive and the effect on deal counts as marginally significant. The randomization-inference p-value for the dynamic estimator's average cumulative effect on

VC, $122 million, is 0.51: under random reassignment of the grant years across the 17 universities, cumulative level differences of this size arise often, because any assignment that places TU Munich or LMU Munich among the never-funded produces placebo effects of either sign that are as large in absolute value.

Table 3: Static and split-period difference-in-differences estimates, full-proposal sample

Panel A. Whole post-grant period			
	(1) VC (USD mn)	(2) Deals	(3) Any deal
Post first grant	-0.810	0.363	0.142
	(5.606)	(1.293)	(0.104)
Cluster-robust p-value	0.887	0.783	0.193
Wild-cluster bootstrap p-value	0.877	0.767	0.193
Randomization inference p-value	0.924	0.857	0.170
Panel B. Years 0–7 and years 8 and later			
Post, years 0–7	-4.359	-0.493	0.134
	(3.990)	(0.908)	(0.110)
Post, years 8+	13.912*	3.912**	0.171
	(7.350)	(1.699)	(0.109)
Wild bootstrap p, years 0–7	0.297	0.628	0.232
RI p, years 0–7	0.653	0.823	0.214
Wild bootstrap p, years 8+	0.153	0.092	0.138
RI p, years 8+	0.384	0.252	0.134
University-years	476	476	476
Universities	17	17	17

Notes: Two-way fixed-effects regressions with university and year fixed effects; 17 universities, 1998–2025. Panel A: the regressor is an indicator equal to one from the year of the university's first Future Concepts grant onwards. Panel B: the indicator is split into years 0–7 and years 8 and later after the first grant. VC in millions of US dollars. Standard errors in parentheses are clustered by university. The wild-cluster bootstrap p-value imposes the null and uses Webb weights with 9,999 replications. The randomization-inference (RI) p-value reassigns the observed vector of first-grant years across the 17 universities 2,000 times and reports the share of placebo coefficients at least as large in absolute value as the estimate. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (cluster-robust).

The contrast between the static and dynamic estimates carries the paper's first message: an evaluation that averages over the first decade after funding, the horizon of most existing assessments of the Initiative, would conclude that the programme did nothing for VC. The estimated entrepreneurial response appears only over a longer horizon.

5.3 Broader comparison groups and an alternative estimator

The three unsuccessful full-proposal applicants are the most comparable controls the competition offers, but they are few. We therefore re-estimate the design against two broader comparison groups: the 31 universities that submitted at least an outline proposal in 2006, 2007 or 2012, and all 70 German higher-education institutions in the PitchBook education records. Figure 3 shows the event studies for the three groups side by side. The profiles are almost identical: placebo coefficients close to zero for eight pre-grant years, no effect for seven years after the grant, and a rise from the eighth year to about \$50 million and 10 deals by the sixteenth. The timing and size of the long-run effect are therefore not an artefact of the three full-proposal losers.

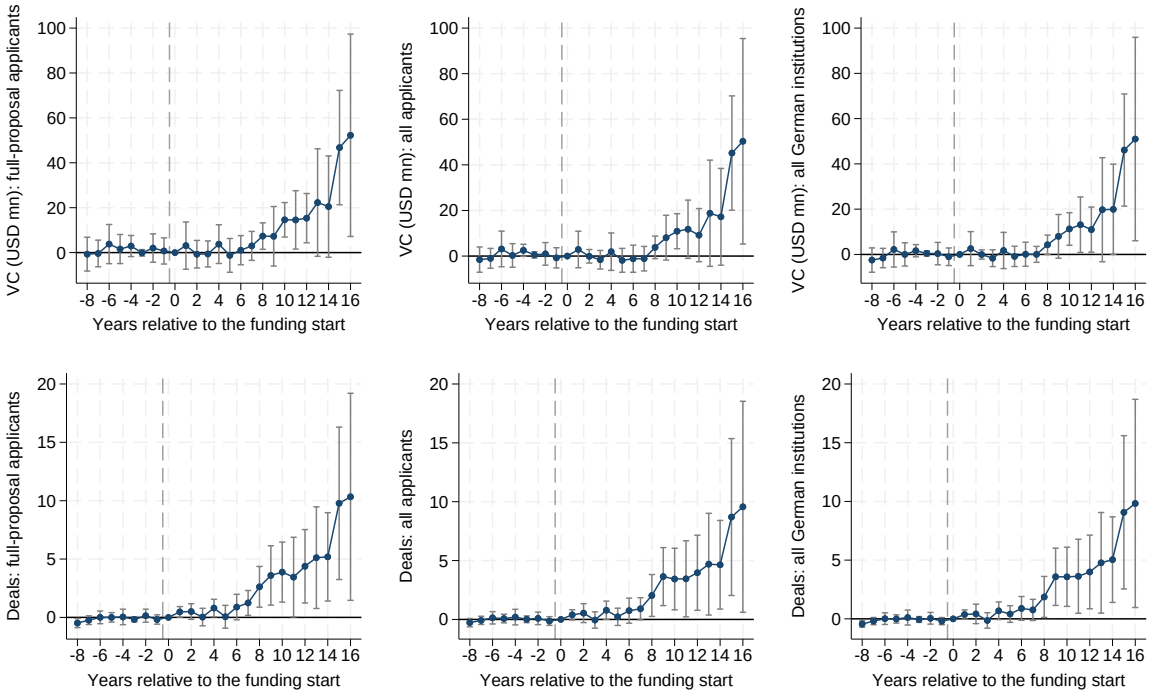


Figure 3: Dynamic effects with alternative comparison groups. *Notes:* As Figure 2. Left: full-proposal sample (17 universities). Centre: all 31 applicants. Right: all German higher-education institutions in PitchBook (70 institutions). Top row VC in millions of US dollars, bottom row deals. See notes to Table 4 for the exclusions.

Table 4 reports the corresponding static estimates. Against the broader groups the coefficient on Post averaged over the whole post-grant period becomes positive and statistically significant, \$6.7 million (s.e. 4.1; wild-bootstrap $p = 0.09$) against all applicants and \$10.2 million (s.e. 4.6; $p = 0.009$) against all German institutions for VC, and 2.2 and 2.9 deals ($p = 0.02$ and 0.002). With 31 and 70 clusters the few-cluster concern that weakens inference in the main sample is much less severe. The price is comparability: the additional controls were not shortlisted by the selection panels and are on average weaker in research standing than the winners, so we regard the full-proposal sample as

the cleaner counterfactual and the broader samples as evidence that the result does not hinge on it.

Table 4: Alternative comparison groups

	VC (USD mn)			Deals		
	(1) Full-proposal	(2) All applicants	(3) All German	(4) Full-proposal	(5) All applicants	(6) All German
Post first grant	-0.810	6.736	10.187**	0.363	2.172**	2.861**
	(5.606)	(4.059)	(4.590)	(1.293)	(1.010)	(1.168)
Wild bootstrap p-value	0.877	0.088	0.009	0.767	0.017	0.002
University-years	476	868	1,960	476	868	1,960
Universities	17	31	70	17	31	70

Notes: Two-way fixed-effects coefficient on the post-grant indicator, 1998–2025. "Full-proposal": the 17 universities of Table 1. "All applicants": the 31 universities that submitted at least an outline proposal in 2006, 2007 or 2012, excluding Hannover Medical School (no PitchBook record) and the three universities first labelled in 2019 (Bonn, Hamburg, TU Berlin). "All German": every German higher-education institution in the PitchBook education records, with the same exclusions. Standard errors clustered by university; wild-cluster bootstrap p-values with Webb weights. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 4 reports the doubly-robust estimator of Callaway and Sant'Anna (2021), which uses both not-yet-treated and never-treated universities as controls and aggregates cohort-time effects by event time. The average pre-treatment coefficient is \$0.05 million (s.e. 0.32) for VC and 0.04 deals (s.e. 0.03); the average post-treatment effect is \$15.5 million (s.e. 5.8) and 3.8 deals (s.e. 1.4), and the horizon-specific estimates coincide with those of the main estimator. The long-run effect is thus robust to the choice among the heterogeneity-robust estimators for staggered designs (Roth et al., 2023).

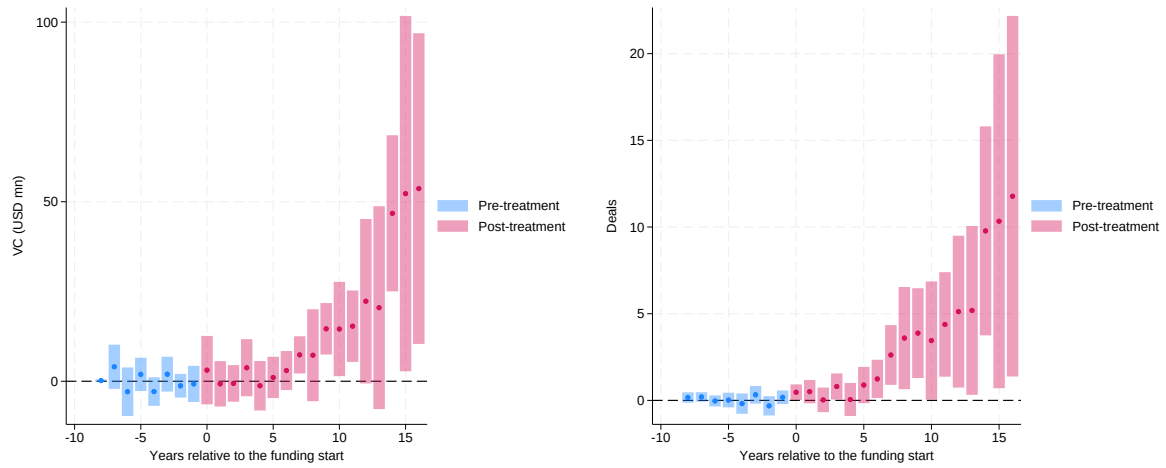


Figure 4: Callaway–Sant'Anna event study. *Notes:* Callaway and Sant'Anna (2021) doubly-robust estimates using not-yet-treated and never-treated universities as controls, full-proposal sample, aggregated by event time with 95 per cent confidence intervals. VC in millions of US dollars (left), deals (right).

6 Mechanisms and funding design

The event studies document the timing of the estimated response but do not by themselves identify why it occurs. This section uses cohort composition, research standing and differences across funding environments to assess whether the pattern is more consistent with capacity building or certification, and to examine how prior capacity and the organisation of funding mediate the response.

6.1 Timing and cohorts: capacity rather than certification

The dynamic profile is more consistent with capacity building than with immediate certification: the estimates rise only after eight years. Three further pieces of evidence reinforce that interpretation.

Research standing. If winners' graduates raise more VC because the universities became better places to do research and to train scientists, the winners' research standing should improve along a similar path. Figure 5 shows the event studies for the ARWU total score and the ARWU rank (sign reversed, so that positive values are positions gained). The pre-grant placebos are close to zero; the score then rises steadily, reaching 2.2 points in year 7 (s.e. 0.8) and 3.4 points in years 10 to 13 (s.e. about 1.0), and stays there; the rank improves by about 50 positions from year 7 and 60 to 70 positions from year 9. The cumulative effect of 23 score points (s.e. 7.8) is large against a within-university standard deviation of 1.6 points. This is consistent with Carayol and Maublanc (2025), who find that excellence funding helped the funded German universities maintain their scientific edge against European peers while the unfunded ones lost ground. For our purposes, the point is that measured research capacity moved slowly and in step with the VC outcome.

Founders who had already graduated. The certification channel predicts that any graduate of a labelled university benefits. We test this on the founder-by-year panel, restricted to founders whose graduation year is observed and precedes their alma mater's first grant (or 2012 for the graduates of the three unsuccessful applicants), observed from their graduation year onwards: 731 founders and 18,653 founder-years. These founders' human capital was formed before the grant; the only thing that changed for them is that their CV now carries the label. Table 5 reports two-way fixed-effects estimates with founder and year effects of the effect of the alma mater's grant on the probability of a VC deal, the amount raised and the number of deals, clustered by university with wild-cluster bootstrap p-values. The coefficient on Post for the probability of a deal is 0.009 (s.e. 0.006; bootstrap $p = 0.16$), against a sample mean of 0.044; for the amount it is −\$0.04 million (s.e. 0.11); for deals it is 0.010 (s.e. 0.006; bootstrap $p = 0.11$). Splitting the post period, the coefficients for years 8 and later are 0.019 for the probability of a deal, −\$0.15

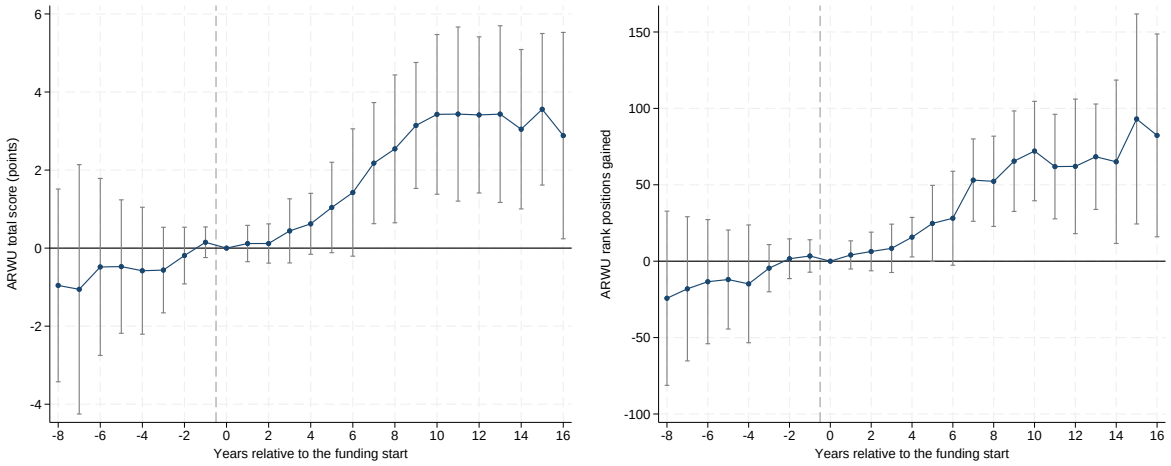


Figure 5: Dynamic effects on research standing (ARWU). *Notes:* As Figure 2, for the ARWU total score (left) and the ARWU world rank with the sign reversed (right), twelve winners and three unsuccessful applicants (FU and HU Berlin unranked).

million for the amount and 0.023 deals, none significant under the bootstrap ($p = 0.18$, 0.56 and 0.11). There is no evidence that the label alone raised the financing of founders who carried it without having been exposed to the funded university.

Table 5: Founders who graduated before their alma mater's grant

	(1) Any deal	(2) Any deal	(3) VC (USD mn)	(4) VC (USD mn)	(5) Deals	(6) Deals
Post alma mater's first grant	0.009		-0.044		0.010*	
	(0.006)		(0.107)		(0.006)	
Post, years 0–7		0.010		-0.051		0.011*
		(0.006)		(0.114)		(0.006)
Post, years 8+		0.019		-0.148		0.023*
		(0.013)		(0.238)		(0.012)
Wild-cluster bootstrap p-value (Post / 8+)	0.162	0.180	0.707	0.562	0.111	0.108
Founder-years	18,653	18,653	18,653	18,653	18,653	18,653
Founders	731	731	731	731	731	731
Universities	17	17	17	17	17	17

Notes: Founder-by-year panel of founders whose education record lists one of the 17 full-proposal universities, whose graduation year is observed and precedes the alma mater's first grant (2012 for the graduates of Bochum, Mainz and Würzburg), observed from the graduation year to 2025. Founder and year fixed effects; standard errors clustered by university (17 clusters); wild-cluster bootstrap p-value for Post in odd columns and for years 8+ in even columns. Sample mean of "Any deal" is 0.044; VC in millions of US dollars. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A complementary cohort comparison uses one observation per founder: among the 1,473 founders with a graduation year between 1990 and 2020, we regress whether the founder was ever VC-backed, the total VC raised, and the total number of deals on an indicator for having graduated from a winner after its grant, with university and graduation-year fixed effects (Appendix Table A.3). Post-grant graduates of winners are no more likely to be VC-backed (-0.036, s.e. 0.064) and close no more deals (0.17, s.e. 0.22) than their peers; they do raise more in total, \$8.0 million per founder (s.e. 3.1;

bootstrap $p = 0.045$), an estimate that rests on a small number of large rounds, since per-founder amounts are heavily skewed. This design conditions on becoming a founder in PitchBook, which is itself an outcome, and compares cohorts with different lengths of time to raise capital. We therefore read it narrowly: conditional on appearing as a founder, post-grant graduates of winners were not financed more often than graduates of unsuccessful applicants, although a small number raised larger rounds. It does not by itself decompose the aggregate effect into the number of founders and the size of their rounds.

Who accounts for the winners' deals. Appendix Figure A.2 decomposes the VC deals of winners' graduates by the founders' graduation cohort. Until 2006, by construction, no deal involved a post-grant graduate. The share of deals with at least one founder who graduated after the alma mater's grant rises to 17 per cent in 2009, 26 per cent in 2012, 38 per cent in 2014 and 44 per cent in 2015, and fluctuates between 40 and 49 per cent from then on; the share of deals by pre-grant graduates falls from two thirds in 2006 to 15 per cent by 2023, with the remainder accounted for by founders whose graduation year is unknown. The transition happens between 2012 and 2015, that is, six to nine years after the first two rounds of grants, which is exactly when the aggregate event-study effect appears. The timing is what a pipeline mechanism implies: students who entered a funded university in the late 2000s graduated in the early 2010s and founded VC-backed companies from the mid-2010s.

6.2 Institution-wide funding versus cluster funding

Every applicant held at least one Cluster of Excellence, and cluster funding is the line for which regional innovation effects have been documented (Krieger, 2024). We use two exercises to ask whether clusters can account for the Future Concepts profile. First, adding the number of clusters and graduate schools held in each year as controls leaves the event-study estimates essentially unchanged (Appendix Figure A.3, right panels). Second, we estimate the event study of the first cluster award among the 56 German institutions in PitchBook that never won a Future Concept, fourteen of which won at least one cluster in 2006, 2007 or 2012 (Figure 6). We detect no corresponding break after the first cluster: the static coefficient on holding a cluster is \$0.5 million (s.e. 1.3) for VC and 0.13 deals (s.e. 0.26). The cluster confidence intervals rule out effects as large as the later Future Concepts estimates, but the exercise compares different institutions and does not isolate discretion from other differences between the funding lines.

The contrast is economically informative because Clusters of Excellence resemble the collaborative project funding through which much European research money is delivered: a consortium, a defined programme, a fixed term, and funds administered by the

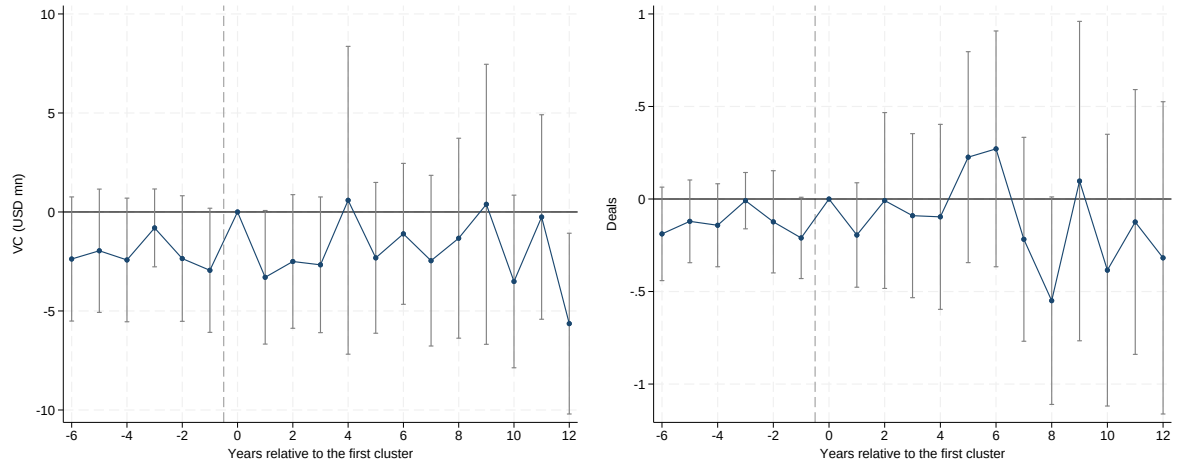


Figure 6: First Cluster of Excellence among institutions never funded in the Future Concepts line. *Notes:* de Chaisemartin and D'Haultfœuille (2024) event-study estimates around the first cluster award (2006, 2007 or 2012) among the 56 German institutions in PitchBook that never won a Future Concept, fourteen of which won a cluster. VC in millions of US dollars (left), deals (right). 95 per cent confidence intervals, standard errors clustered by institution.

project. Such projects can affect research output and partner-firm innovation (Krieger, 2024; Carayol et al., 2024); Audretsch et al. (2026) argue that their knowledge was absorbed by incumbents rather than new ventures. Our evidence adds that cluster-only recipients show no analogous increase in VC through graduates. This pattern is consistent with institution-level funding building broader recruitment, training and commercialisation capacity, and with the finding of Aghion et al. (2010) that university spending is more productive when the institution controls it and has competed for it, but a causal comparison of the instruments would require variation that assigns their organisational form independently of recipient characteristics.

7 Robustness

Specifications. Appendix Tables A.4 and A.5 re-estimate the static two-way fixed-effects regression under alternative specifications. Because the static coefficient averages the null early years with the positive late years, it is close to zero in the baseline and stays so throughout: measuring treatment as currently holding a funded Future Concept gives \$5.4 million (s.e. 4.6) and 1.7 deals (s.e. 1.1); adding the number of clusters and graduate schools held in each year gives \$3.0 million and 1.0 deals; dropping the two Munich universities, ending the panel in 2018 before the Excellence Strategy, or dropping the 2021–2022 boom years leaves the static coefficients within \$1.4 million and 0.7 deals of zero. University-specific linear trends turn the VC coefficient negative (−\$11.1 million, s.e. 6.2). This is the expected behaviour of unit trends when the treatment effect itself grows linearly with time since treatment: trends estimated over the full panel absorb the

post-2014 rise and attribute it to the university (Roth et al., 2023). The version of the de Chaisemartin and D'Haultfœuille (2024) estimator that extrapolates each university's pre-grant linear trend, which uses only pre-treatment periods to estimate the trend, gives the same rising profile as the baseline with much wider intervals (Appendix Figure A.3, left panels); controlling for clusters and graduate schools leaves the profile unchanged (right panels). Unwinsorised amounts give an average cumulative effect of $129 million (s.e. 98) with the same time profile (Figure A.1).

Influential universities. Appendix Figure A.4 re-estimates the years-8+ coefficient for VC dropping one university at a time. The estimate ranges from $9.7 million when TU Munich is dropped to $15.8 million when Tübingen is dropped, and is positive in every case; dropping TU Munich, the largest winner, is the only exclusion for which the cluster-robust confidence interval excludes zero, because TU Munich's volatile late-period amounts contribute most of the variance. Dropping any of the three controls gives $10.5 to $12.0 million.

Randomization inference. Appendix Figure A.5 shows the distribution of the static coefficient across 2,000 reassignments of the grant years; the observed static coefficients sit in the middle of the placebo distributions, as Table 3 reports. For the years-8+ coefficients, the randomization p-values are 0.38 for VC and 0.25 for deals (Table 3, Panel B); for the dynamic estimator's average cumulative effect on VC, 0.51. Randomization inference in this design asks whether a random subset of 14 of the 17 universities, assigned the observed grant years, would show a level difference as large as the winners do; with three small controls and two very large winners, it frequently does. The horizon-specific clustered inference, the wild-cluster bootstrap for deal counts, and the broader comparison groups of Section 5.3 support the long-run effect; randomization inference on the level of VC amounts does not, and we regard the effect on deal counts as better established than the effect on amounts.

8 Conclusion

The German Excellence Initiative was designed to promote scientific leadership, not entrepreneurship. Linking venture capital deals to the education histories of founders, we show that it nonetheless changed the financing of ventures created by the funded universities' graduates. The response is large but delayed: for seven years after the grant, winners and unsuccessful full-proposal applicants evolve alike, and from the eighth year winners' graduates raise between $7 and $52 million more per year and close three to ten more deals.

The evidence points to entrepreneurial capacity building rather than certification.

Graduates who had left before the award show no detectable response, cohorts trained after the grant account for a growing share of winners' deals as the aggregate effect emerges, and the winners' research standing improves over the same period. A label that shifted investors' beliefs about all alumni would have acted sooner and more broadly. The design of the funding also appears to matter: universities that won project-based Clusters of Excellence without the institution-wide grant show no comparable change, which is consistent with the view that university spending is more productive when the institution controls it and has competed for it (Aghion et al., 2010).

These conclusions carry caveats. The sample contains seventeen universities and three unsuccessful applicants, inference on VC amounts is weaker under few-cluster procedures than inference on deal counts, selection on anticipated trajectories cannot be excluded, and the comparison between funding lines involves different institutions. With these limits in mind, two implications follow. Evaluations of investments in university capacity should use a horizon matched to the mechanism, which for outcomes that run through training, graduation and firm formation is closer to a decade than to a funding period. And programmes that aim at venture creation should not expect labels or short-lived project consortia to substitute for funding that institutions can use to build capacity.

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A Additional tables and figures

Table A.1: All applicants to the Future Concepts line, 2006–2012

University	City	2006	2007	2012	Clusters	Grad. schools	VC	Deals
KIT Karlsruhe	Karlsruhe	W	–	F	1	1	145.1	38
LMU Munich	Muenchen	W	–	W	3	1	815.8	193
TU Munich	Muenchen	W	–	W	2	1	1634.1	419
FU Berlin	Berlin	F	W	W	3	3	410.4	100
Freiburg	Freiburg	F	W	F	1	1	107.4	39
Goettingen	Goettingen	S	W	F	1	1	149.3	24
Heidelberg	Heidelberg	F	W	W	2	3	413.2	57
Konstanz	Konstanz	S	W	W	1	1	52.2	21
RWTH Aachen	Aachen	F	W	W	3	1	411.8	139
Bremen	Bremen	F	S	W	1	2	30.5	20
Cologne	Koeln	S	S	W	1	0	408.0	78
HU Berlin	Berlin	S	F	W	2	3	84.5	50
TU Dresden	Dresden	S	S	W	1	1	31.7	16
Tuebingen	Tuebingen	F	S	W	1	0	24.3	11
Bochum	Bochum	S	F	F	0	1	58.7	16
Mainz	Mainz	S	S	F	0	1	65.6	12
Wuerzburg	Wuerzburg	F	S	S	0	1	22.6	8
Outline proposal only (first stage)								
Bielefeld	Bielefeld	–	–	S	1	1	34.7	9
Bonn	Bonn	S	S	S	1	2	361.6	67
Erlangen-Nuremberg	Erlangen-Nuernberg	S	S	S	1	1	225.5	49
Frankfurt	Frankfurt/Main	–	S	S	2	0	15.5	7
Giessen	Giessen	–	S	S	1	1	84.7	14
Halle-Wittenberg	Halle-Wittenberg	S	–	–	0	0	0.6	2
Hamburg	Hamburg	–	S	S	1	0	425.8	96
Hannover	Hannover	–	S	–	1	0	31.9	5
Hannover Medical School	Hannover	S	S	–	1	1	0.0	0
Jena	Jena	–	S	S	0	1	9.1	9
Kiel	Kiel	–	–	S	2	1	4.5	7
Leipzig	Leipzig	S	S	S	0	1	21.7	12
Mannheim	Mannheim	S	–	–	0	1	346.8	73
Muenster	Muenster	S	S	S	1	0	125.0	27
Saarland	Saarbruecken	–	–	S	1	1	187.8	63
Stuttgart	Stuttgart	S	S	S	1	1	224.4	42
TU Berlin	Berlin	S	S	S	1	1	809.8	209
TU Darmstadt	Darmstadt	S	S	S	1	1	7.8	11

Notes: Outcome codes as in Table 1. Clusters and graduate schools held in 2010. VC and deals summed over 2006–2025; Hannover Medical School has no PitchBook institution record.

Table A.2: Event-study coefficients behind Figures 2 and 5

Horizon	VC (USD mn)	Deals	Any deal	ARWU score	Switchers
-8	-0.70 (3.84)	-0.48** (0.20)	-0.394** (0.177)	-0.96 (1.26)	11
-7	-0.39 (3.02)	-0.24 (0.19)	-0.167 (0.178)	-1.06 (1.63)	14
-6	3.79 (4.45)	0.00 (0.28)	-0.068 (0.202)	-0.48 (1.16)	14
-5	1.59 (3.31)	0.00 (0.21)	0.003 (0.168)	-0.47 (0.87)	14
-4	2.92 (2.40)	0.04 (0.34)	-0.122 (0.184)	-0.58 (0.83)	14
-3	-0.11 (0.73)	-0.17 (0.11)	-0.143 (0.124)	-0.56 (0.56)	14
-2	2.01 (3.23)	0.15 (0.28)	0.003 (0.210)	-0.19 (0.37)	14
-1	0.74 (2.98)	-0.18 (0.20)	-0.077 (0.197)	0.15 (0.20)	14
1	3.11 (5.36)	0.47** (0.23)	0.382* (0.211)	0.12 (0.24)	14
2	-0.72 (3.13)	0.50 (0.34)	0.012 (0.180)	0.12 (0.26)	14
3	-0.60 (2.96)	0.03 (0.38)	-0.104 (0.161)	0.44 (0.42)	14
4	3.77 (4.41)	0.80** (0.38)	0.113 (0.202)	0.62 (0.40)	14
5	-1.24 (3.84)	0.05 (0.50)	-0.155 (0.186)	1.04* (0.59)	14
6	1.06 (3.32)	0.89 (0.56)	0.033 (0.198)	1.42* (0.83)	14
7	2.98 (3.29)	1.24** (0.54)	0.286 (0.268)	2.18*** (0.79)	14
8	7.35** (3.01)	2.62*** (0.89)	0.333 (0.218)	2.54*** (0.97)	14
9	7.25 (6.76)	3.60*** (1.30)	0.167 (0.220)	3.14*** (0.82)	14
10	14.61*** (3.91)	3.88*** (1.31)	0.143 (0.143)	3.43*** (1.04)	14
11	14.55** (6.63)	3.45** (1.74)	-0.238 (0.219)	3.44*** (1.14)	14
12	15.34*** (5.60)	4.38*** (1.60)	0.024 (0.161)	3.41*** (1.02)	14
13	22.29* (12.21)	5.12** (2.22)	0.190 (0.195)	3.43*** (1.15)	14
14	20.50* (11.51)	5.19*** (1.93)	0.024 (0.270)	3.05*** (1.04)	14
15	46.77*** (12.99)	9.78*** (3.33)	0.444*** (0.157)	3.56*** (0.99)	9
16	52.25** (22.99)	10.33** (4.53)	0.111 (0.157)	2.88** (1.35)	9

Notes: Estimates of de Chaisemartin and D'Haultfœuille (2024) dynamic effects (horizons 1 to 16) and placebos (horizons −1 to −8), relative to the year before the first grant, full-proposal sample. VC in millions of US dollars. Standard errors clustered by university in parentheses. "Switchers" is the number of universities contributing to the estimate (twelve for the ARWU score, which is missing for FU and HU Berlin). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3: Cohort difference-in-differences at the founder level

	(1) Ever VC-backed	(2) Total VC (USD mn)	(3) Total deals
Winner × graduated after the grant	-0.036	7.970**	0.174
	(0.064)	(3.094)	(0.218)
Wild-cluster bootstrap p-value	0.589	0.045	0.482
Founders	1,473	1,473	1,473
Universities	17	17	17

Notes: One observation per founder with an observed graduation year between 1990 and 2020. The regressor is one for founders who graduated from a winner in or after the year of its first grant. Total VC in millions of US dollars over 1998–2025. University and graduation-year fixed effects; standard errors clustered by university. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.4: Specification checks, VC raised (USD million)

	(1) Baseline	(2) Funded now	(3) Cluster controls	(4) Excl. Munich	(5) To 2018	(6) Unit trends	(7) Excl. 2021–22
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post first grant	-0.810		3.038	1.346	-0.790	-11.095*	-1.068
	(5.606)		(5.809)	(2.451)	(2.919)	(6.156)	(4.514)
Currently funded		5.391					
		(4.602)					
Clusters held			-6.916**				
			(3.035)				
Graduate Schools held			2.183				
			(1.797)				
Wild-cluster bootstrap p-value	0.877	0.235	0.594	0.584	0.794	0.059	0.801
University-years	476	476	476	420	357	476	442

Notes: Two-way fixed-effects regressions with university and year effects, 17 universities; standard errors clustered by university. (1) Baseline as Table 3. (2) Treatment is an indicator for currently holding a funded Future Concept or Excellence University status. (3) Adds the number of Clusters of Excellence and Graduate Schools held in the year. (4) Drops LMU and TU Munich. (5) Ends the panel in 2018, before the Excellence Strategy. (6) Adds university-specific linear trends. (7) Drops the 2021–2022 boom years. Wild-cluster bootstrap p-values as in Table 3. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.5: Specification checks, number of deals

	(1) Baseline	(2) Funded now	(3) Cluster controls	(4) Excl. Munich	(5) To 2018	(6) Unit trends	(7) Excl. 2021–22
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post first grant	0.363		1.010	0.709	0.339	-1.947	0.342
	(1.293)		(1.332)	(0.570)	(0.684)	(1.317)	(1.097)
Currently funded		1.719					
		(1.100)					
Clusters held			-1.293				
			(0.777)				
Graduate Schools held			0.624				
			(0.397)				
Wild-cluster bootstrap p-value	0.767	0.109	0.443	0.265	0.608	0.119	0.741
University-years	476	476	476	420	357	476	442

Notes: As Table A.4, for the number of deals.

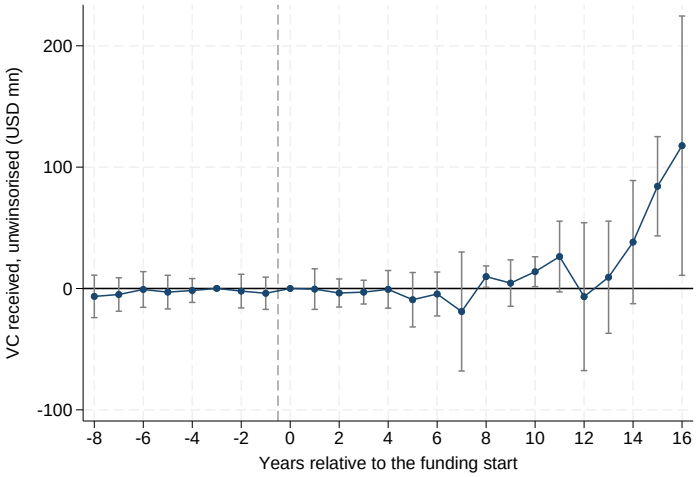


Figure A.1: Dynamic effects on unwinsorised VC amounts. *Notes:* As Figure 2, for VC amounts in millions of US dollars without winsorising deal sizes.

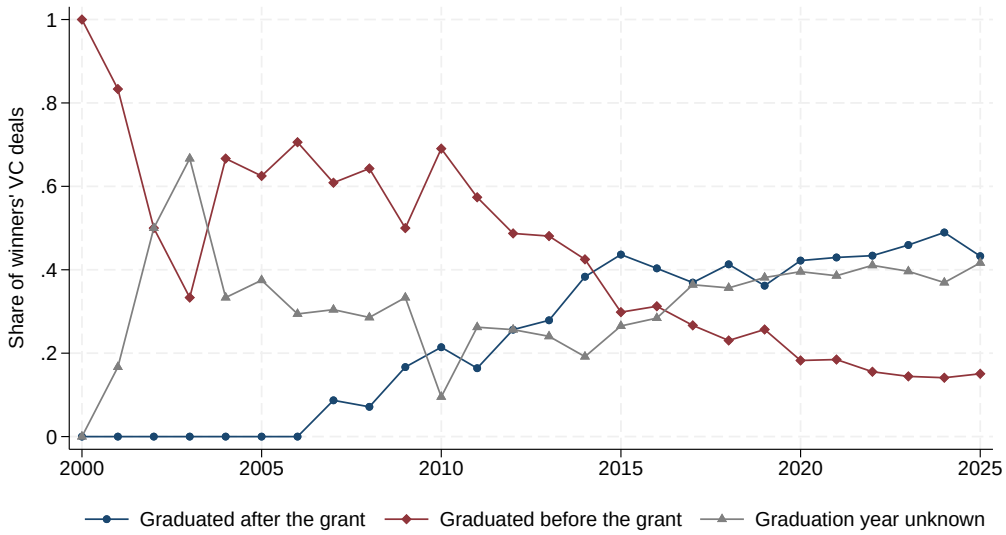


Figure A.2: Share of winners' VC deals by the founders' graduation cohort. *Notes:* Deals in each year involving at least one founder from a winning university, split by whether the founder graduated in or after the year of the alma mater's first grant, before it, or has no recorded graduation year.

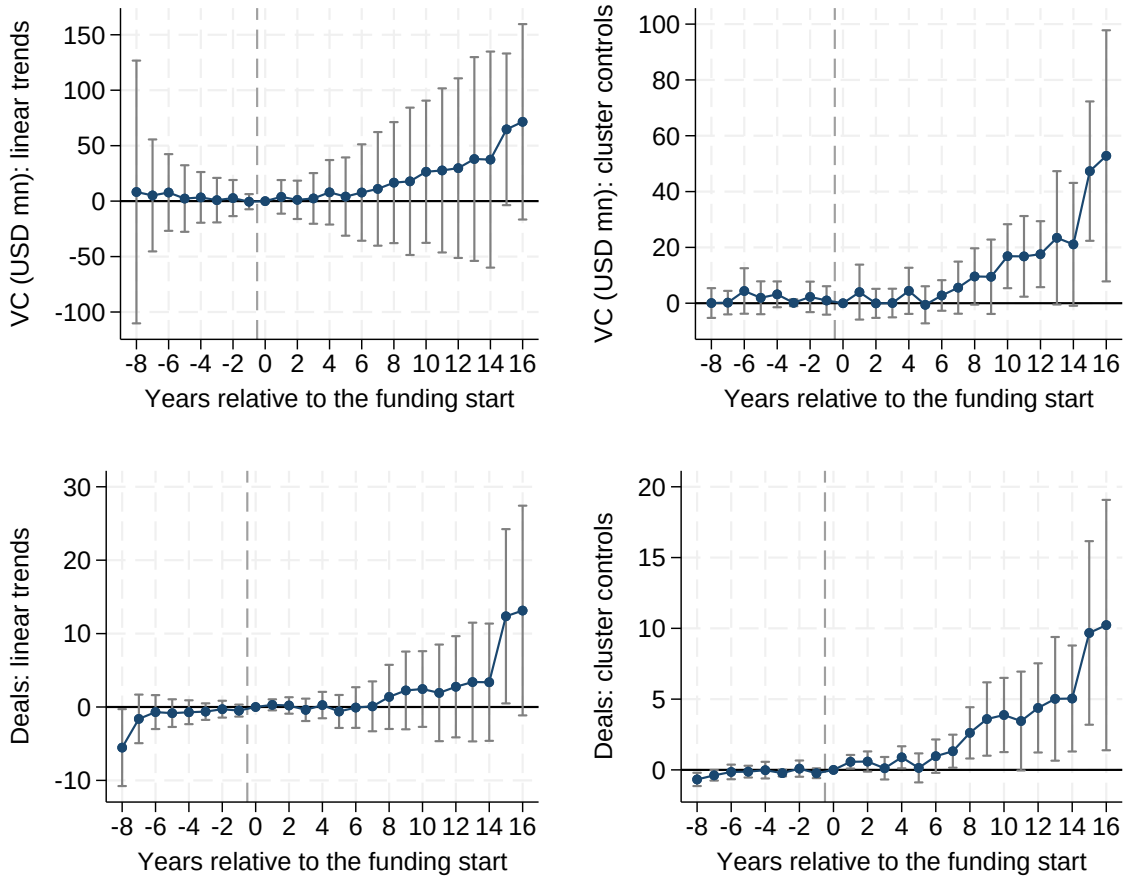


Figure A.3: Dynamic effects with university-specific linear trends and with cluster controls. *Notes:* As Figure 2. Left column: estimator allowing for university-specific linear trends. Right column: controlling for the number of Clusters of Excellence and Graduate Schools held in each year. Top row VC in millions of US dollars, bottom row deals.

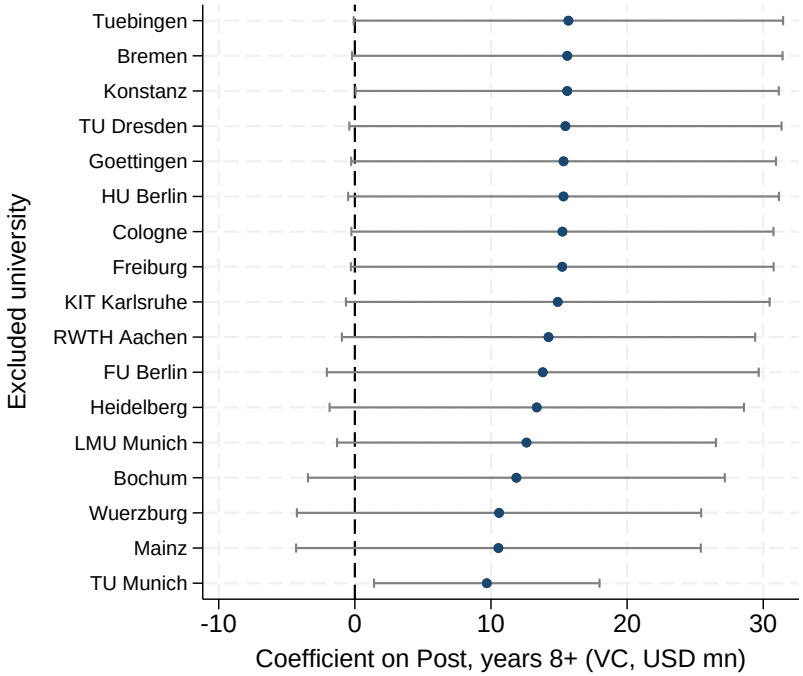


Figure A.4: Leave-one-university-out estimates. *Notes:* Two-way fixed-effects coefficient on the post-grant indicator for years 8 and later, VC in millions of US dollars, re-estimated dropping one of the 17 universities at a time, with 95 per cent confidence intervals from standard errors clustered by university.

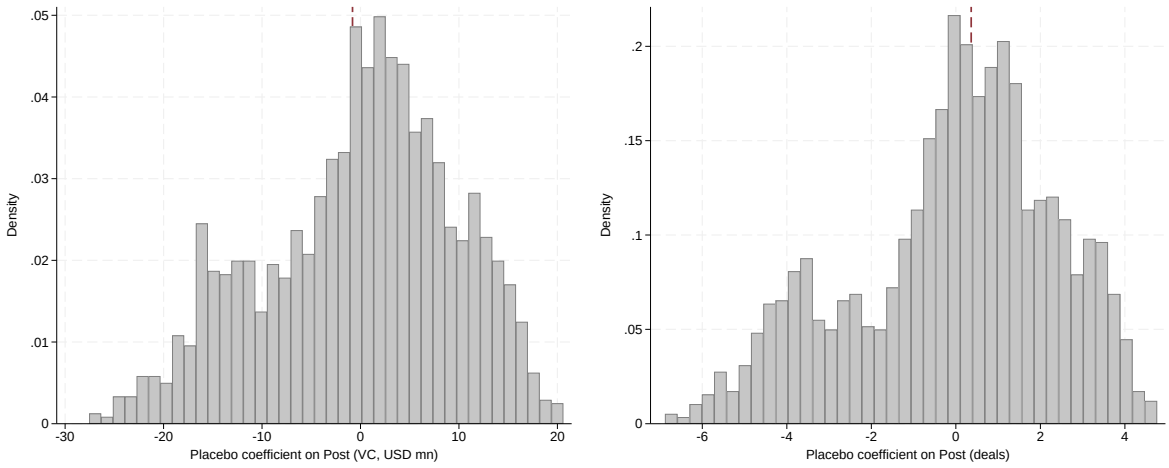


Figure A.5: Randomization inference. *Notes:* Distribution of the two-way fixed-effects coefficient on the post-grant indicator across 2,000 random reassignments of the observed vector of first-grant years to the 17 universities; the vertical line is the estimate with the actual assignment. Left VC in millions of US dollars, right deals.

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