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Turning ideas into companies: the effect of a German (pre)-seed academic startup grant on the founding rate among supported ventures

Christoph E. Mueller[1]

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Abstract

Supporting academic spinoffs is a vital aspect of innovation and technology policy, as these ventures contribute to economic growth. The early stage – from idea development to company formation – is especially critical due to challenges in securing private financing. Public startup grants, such as the 'EXIST – Business Startup Grant' (EGS) in Germany, aim to bridge this gap. Despite previous evaluations, it remains unclear whether a grant such as the EGS effectively motivates recipients to establish a company formally and engage in economic activity. This study evaluates the effectiveness of the EGS program using register data on the outcome variable and a regression discontinuity design, a robust quasi-experimental research design that utilizes an intervention group and a comparison group to estimate causal program effects. The findings demonstrate that EGS funding at least doubles the likelihood of company formation, depending on model specification, with odds ratios ranging from 4.83 to 10.79. The statistically significant intervention effect remains robust across multiple model specifications, highlighting the program's impact on founding probability by reducing entrepreneurial risks, advancing business planning, and fostering product development. These results suggest that targeted early-stage support can effectively address barriers faced by high-risk academic startups. Policy implications include the importance of integrating financial resources with access to mentoring, coaching, education and institutional networks to enhance startup success. Future research should explore the transferability of these findings to other regional and institutional contexts.

Keywords Academic spinoff · Startup · Startup grant · Startup funding · Regression discontinuity design

✉ Christoph E. Mueller
chr.mueller@fz-juelich.de

[1] Project Management Jülich, Forschungszentrum Jülich GmbH, Berlin, Germany

Introduction

Academic spinoffs can contribute significantly to both local and national economic growth (e.g., Guerrero et al., 2015; Steenhuis & Bruijn, 2010; Shane, 2004). As a result, public interventions for academic spinoffs are often seen as a crucial element of technology and innovation policies (e.g., Vincett, 2010; Heirman & Clarysse, 2007). Governments and institutions offer a variety of support mechanisms for startups, including tax cuts, subsidies, credit guarantee schemes, regulatory exemptions, startup grants, and technical assistance or consulting services (e.g., Mueller & Eckardt, 2024a; Mueller, 2023a; Biancalani et al., 2022; Busu et al., 2021; Caliendo & Tübbicke, 2021; Audretsch et al., 2020; Goetz et al., 2010; Ayoub et al., 2017; Butler et al., 2016; Meager et al., 2003).

When supporting (academic) startups, it is important to distinguish between the different stages of their lifecycle, as each phase is associated with distinct goals and needs (e.g., Kazanjian & Drazin, 1990; Hanks et al., 1994). In the (pre-)foundation phase, the focus is often on activities such as further developing and validating ideas, creating prototypes, acquiring competencies, and building networks, with the primary goal of eventually establishing the company. By contrast, in the post-foundation phase, startups require different types of support, such as accelerators, financial incentives, and more funding to help them grow and scale. Tailoring support mechanisms to these different stages can significantly enhance the success and sustainability of startup ventures.

The present study focuses on the pre-foundation phase and aims to examine whether a startup grant can effectively encourage recipients to formally establish a company and become economically active. It is well known that many startup ideas never actually result in the formation of a business (e.g., Shane, 2009), especially due to the difficulties academic startups face in securing private financing during the early stages of their venture (e.g., Roche et al., 2020; Munari et al., 2018; Sørheim et al., 2011). Understanding the impact of public support of prospective startups on the likelihood of transitioning from idea to company is therefore important, particularly during the critical early stage of academic entrepreneurship.

The investigation focuses on one of the largest and most popular startup support programs in Germany, the 'EXIST – Business Startup Grant' (EGS), which specifically targets academic spinoffs. The program intervenes at an early stage, requiring that startup projects have neither established a company nor engaged in economic activities at the start of funding – although establishing a company during the funding period is permitted. Some studies have already explored various theoretically grounded mechanisms of impact (e.g., Mueller, 2023a, b; Baldauf et al., 2021) and potential microeconomic effects of the program years after the funding period ended (Ayoub et al., 2017). So far, the central effect of the program, and arguably the most important, has not been the subject of systematic or robust investigation – namely, whether the funding successfully transforms startup projects into economically active companies, effectively bridging the gap between idea generation and market entry. This is the specific aim of the present study. It contributes to the existing literature by demonstrating that early-stage public funding, in the form of a startup grant, can have significant impacts on prospective startups, particularly in their transition into fully operational companies.

Furthermore, this study plays an essential role from a program evaluation perspective (e.g., Stockmann, 2008) by providing oversight and legitimization for this particular startup support program. It provides transparency on whether the program's objectives are being met, and thus, whether the allocated funding is being used effectively to foster economic activity among nascent entrepreneurs. By demonstrating the program's ability to achieve its intended goals, this study not only provides evidence for legitimizing the use of public resources but also offers valuable insights for policymakers, enabling informed decisions to be made about the continuation or adaptation of such startup support initiatives.

The study is structured as follows: First, the conceptual background and the subject of investigation, the EGS, are introduced. Next, the research hypothesis is outlined. Before the results of the empirical analysis are introduced, the methodological approach employed is outlined. Finally, the results are discussed with regard to their implications and limitations.

Conceptual background

Academic spinoffs are defined as new ventures that are based in the transfer of key technologies from academic institutions, where the founding members may or may not include the academic inventor (Nosella & Grimaldi, 2009, p. 681). They are pivotal in entrepreneurship, transforming scientific discoveries into marketable products and services, driving innovation, and fostering economic growth (e.g., Guerrero et al., 2015; Steenhuis & Bruijn, 2010; Shane, 2004). Acting as a bridge between academia and industry, they commercialize research to address societal challenges (Rasmussen & Borch, 2010). Unlike traditional startups, spinoffs often operate in high-tech industries, focusing on pioneering, high-risk technologies requiring substantial development before market entry (Mustar et al., 2006). Their emphasis on innovation advances technological progress and creates entirely new industries (Van Looy et al., 2003), addressing market gaps with novel solutions (Perkmann et al., 2013).

Beyond innovation, academic spinoffs significantly impact the economy by creating high-quality jobs, stimulating regional development, and strengthening entrepreneurial ecosystems through collaborations with universities, industry, and government (e.g., Siegel & Wright, 2015). As opposed to traditional startups, academic spinoffs originate from universities and research institutions, prioritizing the commercialization of scientific discoveries (e.g., Nosella & Grimaldi, 2009). This gives them access to unique resources such as advanced technologies and intellectual property, but it also introduces challenges, such as the alignment of academic and commercial objectives. Moreover, their complex technologies often require longer development cycles, leading to higher capital intensity and reliance on public funding in the early stages (Mustar et al., 2006; Lockett & Wright, 2005).

The creation and early-stage development of academic spinoffs is influenced by a variety of factors, which can be understood effectively through the conceptual model proposed by Fini et al. (2009). This model categorizes the factors influencing academics' decisions to establish a startup venture into three main groups: individual-level factors, university-level support mechanisms, and environmental influences (including local context factors and government support mechanisms). With regard to individual-level factors, the characteristics of founders play a crucial role, with aspects such as team composition, skill sets, intellectual capital, and prior experience being significant determinants (e.g., Hossinger et al., 2020; Mamabolo & Myres, 2020; Mitchelmore & Rowley, 2010; Colombo & Grilli, 2010). At university level, factors such as the presence of Technology Transfer Offices (TTOs), royalty regimes, infrastructure, networking opportunities, mentoring and coaching programs, and entrepreneurship education provide vital support for spin-off creation (e.g., Sansone et al., 2021; Hossinger et al., 2020; Fini et al., 2017; Muscio et al., 2015; Rothaermel et al., 2007). Local context factors further shape academics' decisions by influencing the availability of resources, structures, and capital, the integration of spin-offs into entrepreneurial ecosystems, and the prevailing market conditions (e.g., Hossinger et al., 2020; Franco-Leal et al., 2019; Iacobucci & Micozzi, 2015; Fini et al., 2011).

For this study, however, the most important factors are government support mechanisms, which can be broadly defined as "legislative changes in order to create the necessary conditions for an effective commercialization of research results" (Fini et al., 2009, p. 383). These governmental measures can take various forms, such as legal and structural reforms, financial incentives, and direct financial support. On the one hand, academic spinoffs can benefit from general government support mechanisms that are applicable to all startups (e.g., Pardo-del-Val et al., 2024; Audretsch et al., 2020). On the other hand, they can also benefit from policies specifically designed to support academic spin-offs. The focus of the present study falls into this category, making it worthwhile to examine studies that have explored the effects of policies targeting academic spinoffs in greater detail.

Government support for academic spinoffs can generally be provided in two main ways. Firstly, governments can promote academic spinoffs directly through targeted measures and programs. For example, Butler et al. (2016) used a regression discontinuity design (RDD) to estimate the causal effects of grants and cash transfers for startups in Argentina. Although academic founders represented only a certain portion of the target group, the analysis revealed significant effects on enterprise creation, survival, and employment. Fini et al. (2017) adopted a different approach by conducting a longitudinal, multilevel, cross-country study. Their findings showed that modifications in intellectual property rights legislation, aimed at enhancing the commercialization of academic research, positively influenced the creation of academic spinoffs. Further, Mueller and Eckardt (2024a), using a pipeline-based comparison group design, demonstrated that personal financial support – such as 18-month employment as a research associate at a university – combined with material resources, significantly advanced academic startups in areas such as business planning, product development, and securing external capital. Finally, Mustar and Wright (2010) highlighted that the impacts of government policies on academic spinoffs can also be analyzed at national level, beyond specific measures, through comparative case analysis. Secondly, government initiatives can support academic spinoffs indirectly by strengthening intermediaries such as universities. Numerous studies have emphasized the critical role of university support structures in the creation and development of academic spinoffs (e.g., Hossinger et al., 2020; Fini et al., 2017). When government programs enhance university support, they indirectly foster the emergence of academic spinoffs. Two recent evaluations provide evidence for this. Using difference-in-differences analyses Mueller (2023b) and Mueller and Eckardt (2024b) demonstrated that targeted government support measures can substantially improve universities' capacity to support academic spinoffs, thereby indirectly promoting their creation and development.

The EGS, the subject of this study, represents a direct form of public support for academic startups. Over time, several studies have investigated the program, offering various insights into its effectiveness and outcomes. For instance, Ayoub et al. (2017) conducted an ex-post analysis using a matched comparison group design and found that ventures previously funded by the EGS did not perform better economically – with regard to indicators such as number of employees, annual profit or total assets – than the comparison group. In contrast, Mueller (2023a) employed a pipeline-based comparison group design combined with a pre-post approach to examine changes during the funding phase. This study focused on the core objectives of the EGS and identified significant improvements in areas such as product development, business planning, networking, skill development, and the acquisition of external capital. Building on this, Mueller (2024) used a panel design to identify success factors for business planning and product development. The findings emphasized that team skills, networking activities, and collaboration with pilot customers were critical determinants of success. In addition to these endeavors, Baldauf et al. (2021) conducted a comprehensive evaluation of the EGS, including analyses of economic efficiency. Their findings indicate that the value generated by the program far exceeded that of public investments. Further, Mueller (2023c) used structural equation modeling to analyze factors influencing the product development stage of EGS-funded startups at the start of the funding phase. Although it is not a traditional program evaluation, this study provides insights into some of the initial conditions for EGS-funding and their underlying factors. Lastly, Lehmann et al. (2024) emphasize the evolving role of government funding programs in fostering impact-oriented entrepreneurship within academic spinoffs. It highlights how initiatives like the EXIST program – including the EGS – are integrating Environmental, Social, and Governance (ESG) principles into their frameworks.

Despite this substantial body of research on the EGS, the extent to which the program has actually achieved its primary goal – helping nascent academic entrepreneurs progress from ideas to actual company foundations – has not yet been analyzed systematically. This study aims to address that gap.

Subject of evaluation: the EXIST – Business Startup Grant (EGS)

The EGS is a funding line within the EXIST program, which is funded by the German Federal Ministry of Economic Affairs and Climate Action (BMWK). As what is arguably Germany's largest public support initiative for academic spinoffs, the EXIST program currently – as of the end of 2023 – operates on two core pillars (e.g., Mueller, 2023b). The first focuses on supporting university graduates, researchers, and students in developing technology-driven or knowledge-based startup projects rooted in scientific and research findings. The second aims to foster a vibrant and sustainable startup culture within universities while enhancing their startup support structures.

The EGS can be classified as part of the first pillar and was launched in 2007. Primarily funded by the BMWK with additional support from the European Social Fund (ESF), the EGS provides one year of financial assistance to students, graduates, and postdoctoral researchers, helping them transform their startup concepts into fully developed business plans. Graduates make up the largest group of grant recipients, followed by students and postdocs. In some exceptional cases, technical staff without a formal academic background are also eligible. The funded projects usually focus on technology-driven and/or knowledge-based innovations with significant market potential and strong economic prospects.

The main objective of the EGS, as outlined in its official funding directive, is to assist founders from universities and research institutions during the early stages of their entrepreneurial journey, particularly by helping them develop a viable business plan, create marketable products or innovative services, and formally establish a company. The program seeks to promote the creation of innovative, sustainable startups with high market relevance, based on ideas emerging from the academic environment. These projects typically leverage the expertise, knowledge, and possibly the research and development work generated in the university or research institution setting. Recently, the program has also increasingly emphasized ESG principles, as highlighted by Lehmann et al. (2024).

The grant offers financial support to cover the living expenses of up to three recipients, with up to €3,000 per person per month. Additionally, there is a separate budget for project-related materials (€30,000) and coaching (€5,000) for the startup teams. A key feature of the EGS is its close integration with universities and research institutions, which act as host institutions for the funded teams and play a crucial role in the process. They help the aspiring founders to develop their initial proposals, which are then submitted via the institutions to the project management organization responsible for administering the program on behalf of the BMWK. On approval, the host institutions manage the funding, which also involves providing the recipients with stipends through scholarship contracts. They also offer access to facilities, infrastructure, mentorship, and consulting services to support the development of the startups.

The selection process is two-staged. Applications for the EGS are initially assessed for formal eligibility by the project management organization – currently an innovation agency named 'Projektträger Jülich' (PtJ) – before being reviewed by experts. The expert evaluations, which include both qualitative feedback and an internal numerical score, determine the final decision on funding. As of October 2024, the overall funding rate since the program's inception stands at 55.6%. With 3,083 startup projects funded between 2007 and October 2024, the EGS is one of the largest public funding programs for academic startups in Germany. During this period, the EGS has disbursed more than €337 million to support academic startup projects. According to the latest monitoring report (Mueller & Eckardt, 2024c), the funded projects demonstrate a high rate of company formation and survival, employ an average of 14 people five years after funding, and generate significant revenues.

Research hypothesis

The objective of this study is to determine the magnitude of the effect of the EGS on the likelihood of founding a company. In this study, the terms ‘success probability’, ‘likelihood of company formation’, and ‘probability of company formation’ are used synonymously to refer to the probability that a startup will successfully progress from the planning phase to formal company establishment.

Several theoretical approaches are suitable for explaining the program’s effect on the likelihood of company foundation. For example, the resource-based view (e.g., Barney, 1991) explains how access to critical resources (i.e., capital, knowledge, and networks) can increase the likelihood of founding a company. The EGS reduces barriers caused by a lack of these resources, and that in turn increases founding probability. Additionally, risk theory (e.g., McMullen & Shepherd, 2006) suggests that entrepreneurial ventures are often associated with high levels of uncertainty and risk. The EGS mitigates financial risk and creates a ‘safe space’ for developing entrepreneurial endeavors, thereby increasing the probability of founding a company. Moreover, human capital theory (e.g., Unger et al., 2011) emphasizes the importance of knowledge, skills, and experience for entrepreneurial success. The EGS supports academic entrepreneurs in enhancing their human capital, which in turn increases the likelihood of their being able to found a company.

In order to understand the mechanisms of exactly how the EGS program supports entrepreneurs in founding their companies, it is also helpful to comprehend the conditions that are likely to increase the probability of a successful business launch and how the EGS influences those conditions. While the effects of the EGS on these presumed prerequisites are well documented, the relationship between the prerequisites and the likelihood of company formation, although theoretically plausible, has not yet been validated empirically. This would need to be addressed in a follow-up study and is not part of the present work, which focuses on a methodologically robust examination of the program’s effect on the likelihood of company formation. In the section that follows, the presumed central prerequisites for company formation are examined more closely.

A first key factor is the development stage of the product or service. The closer the product is to market readiness, the shorter the time to market (e.g., Heirman & Clarysse, 2007), enabling startups to operate commercially sooner, which is linked to their future success (Kalyanasundaram, 2018; Schoonhoven et al., 1990). Prior research indicates that the EGS program significantly enhances product development (Mueller, 2023a). This effect is presumably due to the material budget allocated to EGS teams, which supports further product development and access to tailored mentoring and coaching services. Furthermore, interaction with other founders, established companies, potential customers, and investors may also contribute to advancing the product (Mueller, 2023c, 2024).

Another critical factor is the progress of business planning, which encompasses activities such as financial planning, organizational development, logistics, market analysis, and marketing. In early-stage startups, business planning has been shown to play a crucial role in their overall development (Moro-Visconti, 2021; Krauss et al., 2021). It helps entrepreneurs identify viable ideas and abandon those that are less promising (Chwolka & Raith, 2012), while reducing the uncertainty in launching a business and the time required to do so (Hechavarría et al., 2017). According to Mueller (2023a), the EGS program has been shown to substantially advance business planning, as it provides founders with both financial and temporal freedom, along with coaching and training opportunities. The facilitated exchange with customers, investors, and other founders, fostered by the EGS program, probably plays a vital role in refining business plans. Indeed, another study by Mueller (2024) confirms that networking and interactions with these stakeholders significantly impact the stage of business planning.

In addition, acquired capital is of great importance for launching business operations. Numerous studies have shown that external funding can play a crucial role in the development of startups (e.g., Hossinger et al., 2020; Dziallas & Blind, 2019; Islam et al., 2018; Hechavarría et al., 2017; Lee & Zhang, 2011). If the EGS program enhances the ability of funded startups to secure external capital, it should also positively affect the likelihood of company formation. Indeed, Mueller (2023a) demonstrates that the EGS significantly increases the probability of acquiring external funding, which, in turn, improves the chances of successfully establishing a company.

Additional evidence exists in two other areas that probably have a more indirect but still positive impact on the likelihood of company formation. Mueller (2024) shows that networking with key stakeholders such as pilot customers, investors, and established companies significantly advances both product development and business planning during the funding phase. It has long been recognized that networks play a crucial role in acquiring essential resources such as knowledge and financing, as well as facilitating the successful launch of new products into the market. Several studies, including those by Spender et al. (2017), Soetanto and van Geenhuizen (2015), Lundberg (2013), and West and Gallagher (2006), underscore the importance of networking in achieving these objectives. Therefore, it is important to highlight that the EGS not only improves the aforementioned conditions for company formation but also enhances the degree of networking among the funded startups, as demonstrated by Mueller (2023a). This increase is probably driven by the regular interactions with mentors, coaches, and startup networks or TTOs associated with the parent institution, and through participation in networking events organized during the funding period. These interactions provide critical opportunities for knowledge exchange and relationship building, helping startups access essential resources and expand their professional networks.

Finally, entrepreneurial competencies are critical to the process of starting a business. While these skills may not directly increase the likelihood of founding a company, they are essential drivers for both product development and business planning (Mueller, 2024). Extensive literature reviews by Mamabolo and Myres (2020) and Mitchelmore and Rowley (2010) have shown that entrepreneurial skills are a significant factor in startup success across all stages of early development. Possessing the relevant skill sets allows aspiring founders to prepare more effectively for the establishment of a company, including its organizational and operational challenges. There are two main reasons why these competencies are likely to improve during the program. First, entrepreneurship education plays a pivotal role (e.g., Von Graevenitz et al., 2010; Sansone et al., 2021). Funded startup teams frequently gain access to specialized training and qualifications through their parent institutions and the program management organization (PtJ). Second, the startup teams benefit from their interactions with network partners and external actors such as (potential) customers and investors, further enhancing their skills. Mueller (2023a) demonstrated that participation in the EGS program does lead to improved skills among the funded startup teams, albeit to a modest degree.

Building on the previous discussion, Fig. 1 provides an overview of the hypothesized mechanisms underlying the EGS program's impact. Taken together, these findings suggest that the EGS program and its components improve key prerequisites for company formation in various ways. It is therefore plausible to assume that EGS funding increases the likelihood of company creation. Hence, the central hypothesis guiding this research is as follows: *The probability of founding a company is higher for startup projects supported by the EGS than it would have been without the program's support.* How this hypothesis is empirically tested and whether it is supported by the available data will be presented in the sections that follow.

Method

Research design

To determine whether support from the EGS program increases the likelihood of formally starting a company, it is necessary to assess how likely a company founding would have been without such support. Unfortunately, this counterfactual scenario is unknown and not directly observable, which is why it needs to be estimated (e.g., Shadish et al., 2002). A common approach to estimating this is to use data from startup projects that did not receive the intervention as a proxy for the counterfactual and compare them with the data from the funded startup ventures. For the comparison

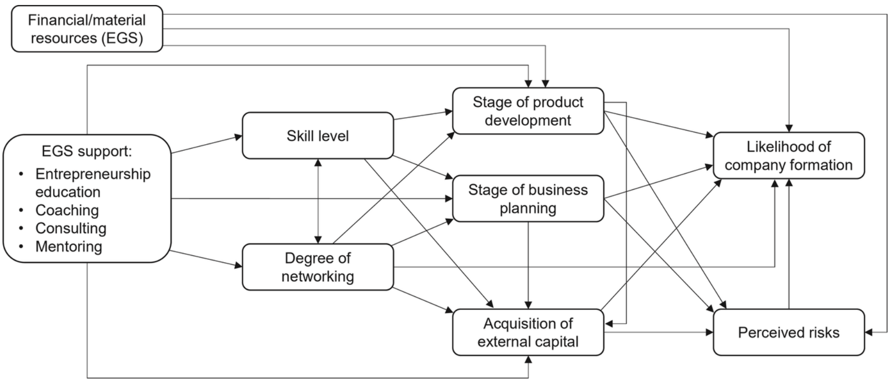

Fig. 1 Assumed mechanisms underlying the program's effect on the likelihood of company formation. Note. The graph illustrates the assumed causal mechanisms underlying the effect of the EGS on the likelihood of company formation. The arrows indicate the direction of the relationships (e.g., it is assumed that a more advanced level of product development increases the likelihood of company formation). Not all constructs in the model are assumed to directly affect the likelihood of company formation; some exert their influence indirectly

to be valid, the group of unsupported startup projects must not systematically differ from the intervention group in ways that could also influence the likelihood of company foundation.

Since EGS funding is awarded to a large extent based on the selection of the most promising projects, as is common in many startup support programs, random assignment – the most effective way of ensuring comparability between funded and non-funded startup projects – was not feasible in the present study. Consequently, identifying suitable unsupported spinoff projects for the comparison group posed a challenge, particularly because data on early-stage academic startups that have not yet launched a company are typically unavailable. One possible solution, however, was to form the comparison group from startup projects that applied for EGS funding but were not selected. This approach was implemented in the present study.

From a methodological perspective, this approach offers the advantage that the comparison group consists of academic startup projects similar in structure and motivation to the funded ones. However, the issue of systematic selection into the groups persists, as higher-quality and hence more promising projects were more likely to receive funding. To address this issue of selection bias, the criteria that formed the basis for the funding selection needed to be controlled for in the analysis to account for the quality of the startup projects at the time of their EGS application. In this study, this was achieved by incorporating the scores assigned by expert reviewers in the startup project selection process into the analysis. These were instrumental in the funding decision and they reflect how promising a prospective startup appears at the time of application from the perspective of an expert. To further minimize potential bias, additional control variables were considered.

Measures and data collection

The central outcome variable of the present study is whether a startup project has established a company or not. For this study, only 'Kapitalgesellschaften' – that is, companies with a specific legal form in which liability is limited to the corporate assets – were considered as companies. This is unlikely to lead to any notable distortions, as the latest monitoring report (Mueller & Eckardt, 2024c) indicates that nearly 90% of all founded businesses are of this type. In Germany, such entities include legal forms such as 'Gesellschaft mit beschränkter Haftung' (i.e., limited liability companies, GmbH; 75% of companies in the study sample) and 'Unternehmergesellschaft' (i.e., entrepreneurial companies, UG; 25% of companies the study sample). Partnerships such as 'Gesellschaft bürgerlichen Rechts' (i.e., civil law partnerships, GbR) were not included, as they are not required to be registered in the German Commercial Register ('Unternehmensregister'). To determine whether the startup projects that applied for EGS funding had established a company by the end of the observation period in September 2024, a search in the Commercial Register was conducted. The study included all of the startup projects that either began their EGS funding, or, in the case of rejected projects, planned to do so, between January 2021 at the earliest and June 2023 at the latest. A total of 452 funded startup projects and 332 projects rejected for EGS funding were reviewed for this analysis. The first step in the search involved looking for the project name in the Commercial Register as it appeared at the time of EGS application. If the name was found, further verification was conducted by comparing the information on the company's website with the application documents and cross-referencing the individuals listed in the Commercial Register with those who submitted the application. However, in most cases, this strategy was not successful because the names of the projects applying for funding usually differed from the names of the companies that were later established. Therefore, in the second step, the search was based on identifying the individuals who applied for EGS funding in the Commercial Register. If they were found in a company entry, the available information from PtJ – particularly the application documents – was used to verify whether the identified companies were the same startup projects that had applied for EGS funding. If no individuals were found in the Commercial Register, the conclusion was drawn that no company had been founded.

The central covariate of the study was the scores assigned by expert reviewers during the selection process for applications. The respective data were provided by PtJ. Until mid-2022, these scores ranged from 0 to 13, with a funding recommendation being given for scores of 9 or higher. The applications, which included a comprehensive project proposal, were evaluated based on three dimensions and several subdimensions: (1) *team* (i.e., scientific-technical expertise of team members; business/entrepreneurial expertise within the team; founding experience, freelance activities, industry knowledge; relevance to the university/research institution; team composition; visible network to support the project (advisors, mentors, etc.)); (2) *innovation potential* (i.e., level of innovation compared to the state of the art; unique selling points (short, medium, long-term); customer benefit; comprehensible product description; existing research and development background at the university/research institution; social value; project or work plan (implementation plan); intellectual property or strategy to secure uniqueness); and (3) *marketability* (i.e., business model; presentation of the market situation (market analysis: potential, volume, segmentation); market opportunities/market entry barriers; market access (marketing strategy, sales concept); presentation of the competitive situation; competitive advantages (direct/indirect); plausibility of the financial plan; (sales) partners, multipliers; pilot customers or users and letters of intent). For each of the three dimensions, a score was assigned, and the scores were then totaled to form the final assessment. Starting in mid-2022, the scoring range was expanded to include an additional dimension – *sustainability* – allowing total scores from 0 to 18, with a funding recommendation starting at 13 points. To make the two scoring scales comparable, the older scores were scaled up so that a score of 9 in the original system corresponded to 13 points after the transformation. Scores for individual projects were not available in all cases. While only two scores were missing from the intervention group based on the documents provided by PtJ, a total of 39 scores were missing from the comparison group. This discrepancy was due to several applications being ineligible for the EGS program and rejected for formal reasons without undergoing evaluation. Consequently, no reviewer scores were assigned in these cases.

Additional covariates that were available from the internal PtJ database included the technological field of the projects (information technology vs. other fields), the number of team members, their age and gender, and the type and the federal state of the institution through which the EGS funding application was submitted. This information was available for all projects included in the analysis.

Table 1 provides an overview of the descriptive statistics for the outcome variable and the covariates.

Data analysis

To estimate the intervention effect on the probability of establishing a company, an RDD (e.g., Imbens & Lemieux, 2008; Lee & Lemieux, 2010) was employed. This quasi-experimental approach optimally accounts for the selection process underlying the funding decision. The approach focuses on the selection criteria that lead to the grant approval, that is, the variable that determines assignment to the intervention and comparison groups, commonly referred to as the running variable. In this study, the expert reviewer scores described in the previous section served as the running variable. Based on the assumption that startup projects near the cutoff – set at 13 points, which determines whether a startup receives funding or not – are very similar in their

Table 1 Descriptive statistics

	Intervention Group	Comparison Group
Outcome	n (%)	n (%)
Company foundation		
Yes	336 (74.34)	108 (32.53)
No	116 (25.66)	224 (67.47)
Covariates (categorical)	n (%)	n (%)
Federal state of parent institution		
Other	139 (30.75)	110 (33.13)
Berlin	50 (11.06)	21 (6.33)
Baden-Wuerttemberg	81 (17.92)	68 (20.48)
Bavaria	110 (24.34)	61 (18.37)
North-Rhine Westphalia	72 (15.93)	72 (21.69)
Technology field of startup		
Information technology	187 (41.37)	133 (40.06)
Other technology	265 (58.63)	199 (59.94)
Type of parent institution		
Other	8 (1.77)	8 (2.41)
University of applied science	157 (34.73)	145 (43.67)
University (regular)	287 (63.50)	179 (53.92)
Covariates (continuous)	Mean (SD; n)	Mean (SD; n)
Reviewer scores	13.60 (0.75; 450)	8.55 (2.16; 293)
Number of team members	2.81 (0.47; 452)	2.62 (0.55; 332)
Age of team members	31.02 (4.04; 452)	30.43 (4.05; 332)
Number of women in team	0.63 (0.80; 452)	0.58 (0.76; 332)

This table presents descriptive statistics for the intervention and comparison groups. It includes the distributions of the outcome variable and categorical covariates, as well as key metrics for continuous covariates, including reviewer scores, which serve as the running variable in the regression discontinuity analysis. The information for the outcome variable is sourced from the German Commercial Register, while the data for the covariates come from the internal databases of the project management organization (PtJ) expected mean characteristics, the RDD simulates a randomized experiment around the cutoff. Consequently, the intervention effect is estimated specifically at the cutoff when using an RDD.

Frequently, the effect is estimated by exclusively using data points near the cutoff with a non-parametric polynomial approach, such as a local linear estimator. However, in this case, because the outcome is binary and relatively few cases are very close to the cutoff in the comparison group, a parametric estimation via logistic regression was employed to estimate the effects at the cutoff (e.g., Jacob et al., 2012). To estimate the intervention effect, two separate logistic regression models were used: one for observations below the cutoff (comparison group) and another for observations at or above the cutoff (intervention group). This approach enables the estimation of the local treatment effect by separately modeling the probability of the binary outcome for treated and untreated groups at the cutoff. Fitting logistic functions on either side of the cutoff accommodates potential nonlinearities in the relationship between the running variable and the binary outcome while respecting the binary nature of the dependent variable.

Given that the bandwidth – the range of cases included in the estimation above and below the cutoff – is crucial for balancing the variance and bias of the RDD estimator, three different bandwidths (one narrow, one moderate, and one somewhat wider) were selected for analysis. Since the distribution of data points around the cutoff differs significantly between the groups, asymmetric bandwidths were chosen by selecting a certain percentage of cases (i.e., 20%, 40%, and 60%) below and above the cutoff for the estimation. Narrower bandwidths (e.g., 20%) capture local effects closer to the cutoff, reducing bias, while wider bandwidths (e.g., 60%) improve precision by including more cases. This range also allows exploration of potential nonlinearities in the relationship between the running variable and the outcome. In addition to the analyses with specified bandwidths, the program effect was also estimated globally by including all data points in the RDD analysis. The control variables discussed in the previous section were incorporated as covariates in the model.

For all analyses, odds ratios (OR) and differences in adjusted success probabilities (i.e., the probability of formally founding a company) between the intervention and comparison groups were calculated to assess the effectiveness of the intervention. Additionally, the ratio of success probabilities was calculated to estimate how much more likely funded startup projects were to succeed in founding a company than non-funded ones.

Results

The results of the econometric analyses demonstrate a significant program effect. Regardless of the model specification, strong and statistically significant effects were observed (see Table 2). Across all model specifications, the odds of success – that is, the odds of establishing a company – were consistently higher for the intervention group than they were for the comparison group.

The analysis using RDD indicated a positive intervention effect across all bandwidth specifications. With a bandwidth of 20% of cases on either side of the cutoff,

Table 2 RDD estimates of intervention effect

	bw = 20%	bw = 40%	bw = 60%	global
Odds ratio	10.79	7.23	5.37	4.83
Ratio of success probabilities	3.40	2.66	2.29	2.00
Δ (difference in success probabilities)	53.29	45.77	39.71	36.95
p (Δ)	< 0.001	< 0.001	< 0.001	< 0.001
n	143	288	444	743

This table presents the effects of the EGS program on the likelihood of company formation, estimated by regression discontinuity analysis for several model specifications with different bandwidths. It shows odds ratios, ratios of success probabilities, and absolute differences (Δ) between success probabilities in percentage points

RDD = Regression discontinuity design. bw = Proportion of cases below and above the cutoff used for estimation. The raw values of all estimation models are provided in the supplementary information

the OR was 10.79, suggesting a substantial increase in the odds of success for the intervention group compared to the comparison group. Expanding the bandwidth to 40% lowered the OR to 7.23, and at a 60% bandwidth, the OR was estimated at 5.37, indicating a stable intervention effect across these bandwidths. The global RDD estimation, using the full sample, produced an OR of 4.83, further supporting the persistence of the effect across different bandwidth choices. In terms of absolute differences in success probabilities (Δ), the RDD estimates ranged from 39.71 percentage points (global RDD) to 53.29 percentage points (RDD with a 20% bandwidth), with all estimates being statistically significant. In all model specifications, the success probabilities of funded projects were at least twice as high as those of the comparison group.

The RDD estimations indicate a substantial increase in the likelihood of establishing a company in the intervention group, which becomes particularly evident when viewed graphically. Figure 2 below shows the predicted values from the global RDD estimation, as these are the ones that can best be visualized. As can be seen, there is a pronounced discontinuity at the cutoff.

Complete estimation details – i.e., the raw estimates of all models – are provided in the supplementary information. The model specific adjusted predictions – in case of the RDD estimations these reflect the success probabilities at the cutoff – and the respective 95% confidence intervals for the founding rates in the intervention and comparison groups are presented in Fig. 3.

Discussion

The findings of this study support the research hypothesis, aligning with previous research that expected this effect, based on different indicators (Mueller, 2023a, 2024). The robust and significant effect on the probability of company formation across all model specifications employed suggests that the program effectively achieves its core objective – that of enabling potential founders to transform their ideas into viable businesses. This suggests that the EGS program generates economic value. However, the question of whether or not the program's benefits outweigh the costs is not addressed by this study, although the latest program evaluation (Baldauf et al., 2021) hints that the economic returns clearly justify the resources invested.

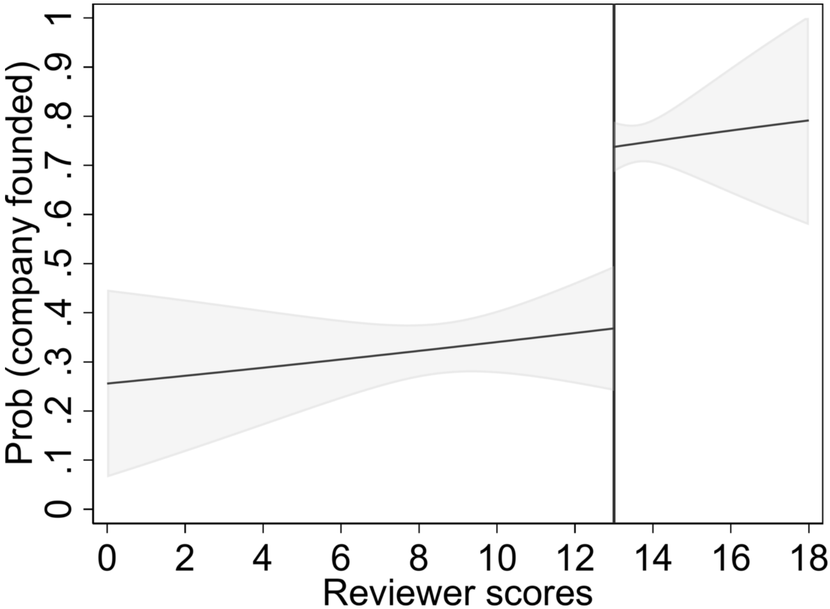

Fig. 2 Predicted probabilities and 95% confidence intervals from global RDD estimation across range of running variable. Note. The graph displays the estimated probabilities of company formation for the intervention and comparison groups, depending on the reviewer scores. The estimated probabilities at the cutoff (vertical line) are crucial, as the difference between these values represents the estimated intervention effect

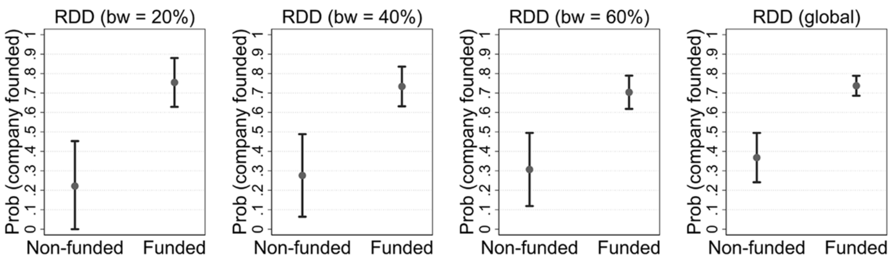

Fig. 3 Adjusted predictions at the cutoff and 95% confidence intervals. Note. The graph visualizes the estimated probabilities of founding a company for the intervention and comparison groups at the cutoff (i.e., the threshold at which an EGS grant is approved). The pronounced differences indicate that the funded projects exhibit a substantially higher probability of business formation across all model specifications. RDD = Regression discontinuity design. bw = Proportion of cases below and above the cutoff used for estimation

This raises important questions for policymakers about optimizing public funding allocation for entrepreneurial programs such as the EGS, ensuring both effectiveness and efficiency in fostering sustainable business creation.

Moreover, the fact that this intervention apparently leads to tangible outcomes in such a critical phase of the startup lifecycle highlights the value of targeted early-stage support in driving entrepreneurship. The findings of the study align with the growing body of literature that suggests that early-stage funding for academic spinoffs may be beneficial (e.g., Allioui & Mourdi, 2023; Berger & Hottenrott, 2021; Wojtowicz, 2013; Toole & Turvey, 2009), particularly because the risks faced by nascent entrepreneurs during this phase are considerable. Early-stage support mechanisms such as grants can mitigate these risks, enabling entrepreneurs to focus on product development and business planning without the immediate pressure of financial sustainability.

The study, however, also leaves some questions unanswered. While it demonstrates that EGS funding increases the likelihood of company formation, it does not empirically examine how this occurs. This study, therefore, is a classical impact evaluation, which empirically examines only whether the intervention produces the theoretically plausible and expected effects. Although various hypotheses and prior evidence (e.g., Mueller, 2023a, 2024) were presented to illustrate potential mechanisms underlying the expected effect (see also Fig. 1), further empirical research is necessary to confirm whether the proposed mechanisms are indeed responsible for the observed program impact. To address this gap, a theory-based evaluation (e.g., Astbury & Leeuw, 2010; Chen & Rossi, 1983) – i.e. an evaluation focused on understanding and testing the underlying theory of change or causal mechanisms that explain how and why a program achieves its outcomes – should be conducted in future studies. Such an evaluation would provide deeper insights into the causal pathways driving the observed program effect. Unfortunately, this was not able to be implemented in the present study, as a variety of different data would be required, some of which do not exist at this time.

The study also leaves out other important dimensions, such as the speed and quality of company formation. While it examines whether or not a company was founded, it does not assess how quickly this happened or the quality of the startup, including factors such as sustainability, innovation output and economic development. These are crucial indicators – for example, there is a broad body of research on the consequences of startup time, i.e. how long it actually takes to found a company (e.g., Schoonhoven et al., 1990; Stayton & Mangematin, 2016; Capelleras et al., 2010) – and future research should address these aspects in depth to provide a more comprehensive understanding of the impact of EGS funding on academic startup ventures. With regard to economic development, future endeavors could build on the study by Ayoub et al. (2017), which compared the economic performance of formerly EGS-funded startups with non-funded companies in the years following the funding period. Yet despite being well executed in methodological terms, the study of Ayoub et al. suffers from neglecting the main effect of the EGS on the likelihood of starting a company in the first place. This caveat should be addressed in future research in order to avoid inaccurate or unjustified assessments of the program's effectiveness.

In essence, the relatively short observation period limits insights into the program's long-term effects, such as startup survival rates or scalability. This limitation could be addressed through longitudinal analyses, potentially utilizing data from the program monitoring system (Mueller, 2022), which surveys funded startups through a multi-wave panel. However, the current lack of comprehensive data – particularly for a suitable comparison group – poses a significant challenge. Addressing this issue would require merging diverse data sources, a time-intensive process beyond the scope of this study. Future research should focus on developing a robust data infrastructure to enable longitudinal analyses and provide deeper insights into the sustained impacts of the EGS program.

Some brief consideration must also be given to the absolute values of the outcome variable in this study, as these clearly differ from the company formation rate reported in the ongoing program monitoring in the case of EGS-funded projects. While the company formation rate among EGS-funded spinoffs in the present study is slightly above 74%, the current monitoring report indicates a rate of nearly 85% (Mueller & Eckardt, 2024c). This discrepancy is easily explained. First, the program monitoring includes partnerships ('Personengesellschaften'), which could not be considered in the present study because the relevant data were unavailable. Secondly, and more importantly, the present study examines projects that have only recently completed the funding period and had not yet founded a company by the time the data were collected. In contrast, the monitoring report only includes startups that had completed their funding at least 12 months previous to that, which gave them significantly more time to establish a company.

In addition to the content-related aspects, there are several methodological points that warrant discussion. To ensure the robustness of the RDD estimation results, sensitivity analyses were conducted using alternative bandwidths. Across these specifications, the effect remained substantively consistent, with no indications of a substantial decrease in replication. Additionally, data points were weighted based on their proximity to the cutoff using a kernel method, giving greater weight to cases closer to the cutoff. This approach closely approximates a local maximum likelihood estimator (Lee & Lee, 2023). Consistently, these replications did not indicate any compromise in the effect. Tests were also carried out to see whether the reviewer scores differed systemically after being scaled up from their previous value. However, the difference in reviewer assessments was minimal in both the intervention and the comparison group (Cohen's $d < 0.1$). This suggests that upscaling did not affect the RDD analysis.

Moreover, the variation in effect sizes across different model specifications warrants closer consideration. The observed decline in effect sizes as bandwidth increases could suggest a more localized impact of the intervention near the cutoff, with effect sizes appearing to diminish as cases further from the cutoff are included. This pattern may reflect an attenuation of the effect of the intervention as broader, less comparable groups are incorporated into the analysis. With increasing bandwidth, there is potential for greater variation in unobserved characteristics, which could influence the precision of the effect estimates. While the effects remain statistically significant across all specifications, this trend highlights the sensitivity of the estimates to bandwidth selection and underscores the fact that – in particular – caution is called for when interpreting effects estimated over a greater bandwidth, as these are more susceptible to bias.

Further, the direction of the relationship between the running variable and the outcome appears to vary depending on the bandwidth chosen for the RDD estimation (see supplementary information). In the global model, this relationship is positive; however, with narrower bandwidths, it can become negative. This pattern suggests that the relationship may shift locally near the cutoff, indicating that broader estimates based on larger bandwidths could mask these nuances. Future research could explore non-parametric methods to better capture local shifts in the relationship near the cutoff. However, as corresponding attempts in this analysis have revealed, limited cases near the cutoff – especially in the comparison group – can cause significant instability in such estimates, which is why they were not pursued further in this study. Larger samples or additional data could help address this limitation.

As with all empirical studies, this research is not without methodological limitations, which should be taken into account when interpreting its conclusions and addressed in future research endeavors. Firstly, there is a potential issue regarding the reliability and validity of the running variable, which could affect the overall validity of the RDD analysis. While the running variable is measured quantitatively on a scale, it remains, at least partially, a subjective measure that may not fully or objectively reflect the intended construct. No psychometric diagnostics were possible with the available data. There remains a possibility that subjective components – such as reviewer biases or differing interpretations of criteria – could introduce some measurement bias, which could affect the robustness and precision of RDD estimations. Future research should try to validate the running variable with psychometric diagnostics or more standardized measures to further support objectivity and precision.

Secondly, a potential limitation of this analysis lies in the relatively weak correlation between the running variable and the outcome (point-biserial bivariate correlation $=0.34$, $p<.001$), which may affect the precision of the estimates. The reason for this relatively weak correlation may be attributed to the broad selection criteria, which likely encompass multiple factors (e.g., sustainability, team characteristics, diversity, innovation degree, formal requirements for funding eligibility) that are not, or only minimally, correlated with the probability of founding a company. However, the weak correlation must not be interpreted as an indication that the selection process is inaccurate. The primary focus of the selection process is not to identify projects that will establish companies as quickly as possible, but rather to assess whether the applicants meet the diverse requirements and conditions of the program, which are broader in scope and include not only expectations of success but also other aspects. Importantly, the weak correlation is unlikely to compromise the validity of the estimated effects significantly, as intervention assignment at the cutoff is determined exclusively by the running variable. There is no reason to assume that characteristics affecting the outcome variable would differ systematically near the cutoff. In fact, several balance checks provide some reassurance, as no statistically significant or noteworthy differences in covariates (i.e., age, sex, size of team, federal state and type of parent institution, technology field) are observed between the intervention and comparison group among the 20% of cases above and below the cutoff. Nevertheless, future research could benefit from refining the selection criteria for the running variable to increase its correlation with the outcome, potentially improving the precision of estimates at the cutoff.

Thirdly, the differing density of the running variable around the cutoff warrants discussion. In this dataset, the density just below the cutoff is significantly lower than just above (confirmed by a McCrary density test), which could indicate manipulation and potential bias. However, this difference mainly comes from procedural factors: according to the specifications of the selection process, projects scoring only slightly below the threshold of funding in their initial application were allowed to revise their applications within a specified period, often exceeding the threshold upon re-application and thereby securing funding. These re-applicants were included in the analysis with their higher scores, as they ultimately received EGS funding, resulting in fewer projects directly below the cutoff. Yet by using a parametric estimator that extrapolates into this area, and given some cases in this range, the impact of density imbalances around the cutoff on the estimated program effect is considered limited. This is underpinned by the results of another sensitivity analysis in which those projects that were only awarded funding after revision were excluded from the analysis.

Fourthly, despite the use of RDD and various control variables, there remains the risk that key covariates correlated with the probability of success were not captured in this study, which could lead to bias in the results. This is particularly relevant for comparisons across different bandwidths, as differences in effects may partially reflect the influence of unmeasured factors. Future research could aim to incorporate additional covariates that are potentially correlated with the probability of success to further reduce the risk of omitted variable bias. At the end of the day, however, a randomized trial would be the most effective approach to estimating an unbiased intervention effect.

Fifthly, in terms of temporal generalizability, the results are specific to the period of time observed, although there is no reason to believe that the outcomes would have been markedly different in the past. Future research could enhance the generalizability of these findings by examining longer periods to determine if the observed effects are consistent over time. Analyzing multiple time frames would help identify any temporal variations in outcomes, clarifying whether the results are specific to the observed period or hold across different periods.

Lastly, while the study provides robust evidence for the effectiveness of the EGS, the findings are tied primarily to the unique context of the program. The EGS combines specific features, such as its integration with universities, targeted selection criteria, and comprehensive financial and institutional support, which may not be directly transposable to other startup support initiatives. Despite these specificities, the underlying mechanisms – such as mitigating entrepreneurial risks, fostering networks, providing education and coaching, enabling business planning, and advancing product development (Mueller, 2023a, 2024) – are widely applicable to early-stage startup support. Programs aimed at reducing early-stage barriers, particularly for high-risk academic ventures, are likely to see similar benefits, provided that they address local challenges and leverage comparable mechanisms. Future research could examine whether similar outcomes are observed in different regional or institutional settings and explore how adaptations in program design influence effectiveness. This would help to validate the transferability of these findings and refine strategies for fostering academic entrepreneurship globally.

Conclusion

Supporting academic spinoffs is a vital aspect of innovation and technology policy, as these ventures contribute to economic growth. The early stage – from idea development to company formation – is particularly critical due to challenges in securing private financing. Public startup grants, such as the EGS, aim to bridge this gap by providing targeted support during the pre-foundation phase. This study evaluates the effectiveness of the EGS using register data on the outcome variable and a regression discontinuity design, a robust quasi-experimental approach that utilizes an intervention group and a comparison group to estimate causal program effects. The findings demonstrate that EGS funding substantially increases the likelihood of company formation, depending on model specification, with odds ratios ranging from 4.83 to 10.79.

The results emphasize the importance of early-stage public support in facilitating the initial entrepreneurial process, a critical phase in moving academic innovations toward commercialization and long-term viability. By providing evidence that receiving the EGS grant at least doubles the likelihood of formally establishing a company, the findings imply that at least half of the companies founded with program support would probably not have been established otherwise. These findings not only legitimize the use of public funds but also provide essential transparency for stakeholders, including policymakers. This transparency is crucial for guiding future decisions on whether to continue or adapt the program to maximize its impact. Consistent with past evaluations (e.g., Baldauf et al., 2021; Mueller, 2023a), the study reinforces the evidence of the positive effects of the EGS on early-stage academic startup ventures. It also highlights the fact that the program's core effect does not lie primarily in fostering economic success (Ayoub et al., 2017), but in enabling aspiring academic entrepreneurs to progress from idea to company foundation.

From an academic perspective, this study makes several important contributions. First and foremost, it expands the literature on academic spinoffs in general and on (early-stage) support policies for academic startups in particular. It contributes methodologically by showcasing the integration of policy evaluation frameworks with entrepreneurial research. This interdisciplinary approach bridges the gap between theoretical insights on spinoff development and the practical implications of support mechanisms, offering a nuanced understanding of how (pre-)seed programs impact the entrepreneurial ecosystem. Moreover, by utilizing objective data and a robust research design, it provides reliable evidence on the effectiveness of a specific spinoff support measure – an aspect that has been less frequently addressed until now. The study also highlights the fact that, in the context of (pre-)seed programs, it is crucial to evaluate the primary intended effects rather than rely solely on outcome variables measured years later, as the latter approach can lead to conclusions that may unjustly undervalue the program's impact. Finally, the study demonstrates the value of the RDD for evaluating startup support programs, particularly in a field where randomized controlled trials (RCTs) are rarely feasible.

The findings of this study also suggest several practical implications for (pre-)seed support programs. In countries without such initiatives, introducing similar programs could foster academic entrepreneurship, while in Germany, the observed effect of the

EGS program supports its continuation and potential expansion. Future policy and research efforts should explore whether systematic variations in funding conditions could yield even greater effects. Standardizing evaluation criteria and providing additional training for external reviewers could further improve consistency in funding decisions, while refining the reviewer score to facilitate better prediction of outcomes such as company formation could enhance its utility. To improve data quality, future data collection should include all legal forms of startup, such as civil-law companies (GbR), for both funded and non-funded projects. Additionally, offering comprehensive guidance to applicants before submission could reduce discrepancies in evaluation scores due to varying knowledge levels, ensuring that the scores reflect actual proposal quality rather than familiarity with the application process. Moreover, these steps could enhance program effectiveness and impact.

From a broader policy perspective, this study highlights the critical role of public funding in bridging the challenging period between idea development during the student or postgraduate phase and the actual establishment of a business. Providing financial support through targeted grants has proved to be an effective strategy for mitigating risks and fostering the creation of innovative academic spinoffs. By integrating financial resources with education, coaching, mentoring and institutional networks, this approach enables these ventures to overcome early-stage challenges and develop into economically active enterprises. While there is always room for discussion regarding the optimal design of such programs, particularly in terms of targeting specific groups, the results of this study strongly indicate that such public support measures can be effective in stimulating entrepreneurial activity in academia. These findings contribute to the growing body of evidence suggesting that public investment in high-potential academic ventures – not just 'the average startup' (Shane, 2009) – can have far-reaching economic benefits, reinforcing the broader importance of government intervention in fostering innovation and entrepreneurship.

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