

Venture Capital Constraints and the Growth of Academic Spin-offs: Evidence from the Czech Republic

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Abstract: Academic spin-offs play an important role in transferring university research into economic and societal value, yet their development often depends on access to external financing, particularly venture capital. This study examines how limited access to venture capital affects the growth and sustainability of academic spin-offs in the Czech Republic. The research combines semi-structured interviews with founders of academic spin-offs, technology transfer representatives, and innovation financing experts with secondary data on venture capital markets and innovation policy. The findings suggest that limited venture capital availability represents a structural barrier within the Czech academic entrepreneurship ecosystem. As a result, many spin-offs rely primarily on public grants, which support early technological development but rarely enable rapid scaling. This leads to delayed commercialization, slower internationalization, and limited managerial development. The study highlights the need to strengthen science-oriented venture capital instruments and improve investor–university linkages to enhance the commercialization potential of academic research.

Keywords: academic spin-offs; technology transfer; innovation ecosystem; Czech Republic; university entrepreneurship

JEL Classification: O31; O38; L26

1. Introduction

Academic spin-offs are widely recognized as a central mechanism of knowledge transfer within innovation-driven economies. By commercializing research results originating from universities and public research organizations, spin-offs contribute to technological advancement, regional development, and long-term economic competitiveness (Etzkowitz & Leydesdorff, 2000; Rothaermel et al., 2007). In the European context, academic entrepreneurship has become a strategic policy priority, particularly within the framework of smart specialization and innovation ecosystems (European Commission, 2020; OECD, 2019).

Despite increasing institutional support structures such as technology transfer offices, incubators, and public grant schemes, academic spin-offs frequently face structural disadvantages compared to commercially founded start-ups. One of the most frequently identified barriers is constrained access to private risk capital, particularly venture capital

(VC) (Lockett et al., 2003; Wright et al., 2004). Academic spin-offs often operate in high-uncertainty environments characterized by longer development cycles, complex intellectual property arrangements, and limited immediate market validation. These characteristics may reduce their attractiveness to venture capital investors who typically prioritize scalability, rapid commercialization, and clear exit strategies.

Access to venture capital plays a crucial role in firm growth and survival. Financial constraints limit the ability of young firms to hire managerial talent, invest in business development, expand internationally, and accelerate product-market fit (Clarysse et al., 2005). From the perspective of financial theory, information asymmetry and risk perception can significantly affect investment decisions, particularly in technology-intensive ventures with strong scientific origins (Akerlof, 1970; Harrison & Leitch, 2010). Academic founders often possess strong technical expertise but limited entrepreneurial experience, which may further amplify perceived investment risk.

In post-transition economies such as the Czech Republic, the challenge of financing academic spin-offs is further intensified by structural characteristics of the national innovation system. Venture capital markets remain relatively shallow compared to Western European countries, and risk aversion among private investors persists (OECD, 2023). As a result, academic spin-offs frequently rely on public grants as their primary source of early-stage financing. While public funding can support research and prototype development, it may not provide sufficient resources for scaling activities or market expansion. This creates what can be described as a “financing gap” between research commercialization and sustainable market growth.

The consequences of constrained access to venture capital extend beyond individual firms. From a macroeconomic perspective, limited scaling of university-based innovations may weaken the overall efficiency of the national innovation system and reduce the return on public investment in research and development (Bercovitz & Feldman, 2006; Siegel et al., 2007). If academic spin-offs fail to transition successfully from laboratory to market, the knowledge transfer function of universities remains underutilized, diminishing their contribution to economic growth.

Against this background, this article addresses the following research question: How does constrained access to venture capital affect the growth and survival prospects of Czech academic spin-offs?

2. Methodology

2.1. Study Design

This study adopts a qualitative-quantitative exploratory research design focused on identifying the mechanisms through which constrained access to venture capital affects the growth and survival prospects of Czech academic spin-offs. An exploratory design is appropriate given the limited empirical evidence on financing constraints in academic spin-offs within post-transition innovation systems such as the Czech Republic. Given the structural and institutional nature of the research problem, the study does not aim to

construct a causal econometric model. Instead, it applies a structured analytical framework combining: qualitative evidence from semi-structured interviews and secondary macro-level data on venture capital markets and innovation systems. This approach enables triangulation between micro-level entrepreneurial experience and macro-level characteristics of the national innovation ecosystem.

2.2. Research Question

The study addresses the following primary research question: How does constrained access to venture capital affect the growth and survival prospects of Czech academic spin-offs?

This question is operationalized through three analytical sub-dimensions:

- Does limited access to venture capital delay commercialization and revenue generation?
- Does financial constraint reduce the ability of spin-offs to scale operations (e.g., hiring, internationalization)?
- Does dependence on public grant financing substitute or structurally limit private capital-driven growth?

The analytical framework assumes that venture capital is not only a source of financing but also a provider of strategic guidance, monitoring, and market-oriented discipline. Therefore, its absence may generate both financial and managerial constraints. The framework draws on the literature on entrepreneurial finance and academic entrepreneurship, which highlights the role of venture capital in supporting scaling, governance, and strategic development of technology-based firms.

2.3. Data Sources

The analysis is based on three categories of data: primary qualitative interviews, secondary statistical data, and policy and institutional documents.

Primary qualitative data were obtained through semi-structured interviews with founders and co-founders of academic spin-offs, representatives of university technology transfer offices, and experts in innovation financing. Respondents were selected using purposive sampling to ensure representation of different institutional backgrounds, technological sectors, and stages of spin-off development.

In total, 22 respondents representing spin-offs established between 2012 and 2022 across different regions of the Czech Republic were interviewed. The interviews were analyzed using thematic coding, with particular attention to recurring patterns related to financing barriers and growth limitations.

Secondary data sources include: OECD Science, Technology and Innovation Outlook reports, European Commission innovation performance reports, national innovation strategy documents, reports from Czech technology transfer offices and existing empirical studies on academic entrepreneurship and venture capital.

3. Results

3.1. Perceived Accessibility of Venture Capital

Table 1,2 provides a snapshot of venture capital investment intensity in the Czech Republic between 2019 and 2023. Early-stage venture capital investment in the Czech Republic remains extremely low (e.g., 0.012 % of GDP in 2023), which is well below levels typically observed in more mature VC ecosystems. In a global context, European venture capital accounts for only about 5 % of worldwide VC investment, despite recent growth in absolute terms. These tables support the contention that structural supply constraints in VC exist at both national and regional levels, thus contextualizing the micro-level findings reported in subsequent subsections.

Table 1. Venture capital investment indicators: Czech Republic (2019–2023)

Indicator	Value
Early-stage venture capital investment (% of GDP) – 2019	0.009 %
Early-stage venture capital investment (% of GDP) – 2020	0.005 %
Early-stage venture capital investment (% of GDP) – 2021	0.005 %
Early-stage venture capital investment (% of GDP) – 2022	0.010 %
Early-stage venture capital investment (% of GDP) – 2023	0.012 %
European VC share of global VC (EU % of global total) – 2023	~5 % of global VC
VC investment total – Europe 2023	€12.9 billion

Table 2. Early-stage venture capital investment (% of GDP), Czech Republic (2019–2023)

Year	VC Investment share (% GDP)
2019	0.009 %
2020	0.005 %
2021	0.005 %
2022	0.010 %
2023	0.012 %

The findings indicate that constrained access to venture capital represents a significant structural barrier for Czech academic spin-offs. Survey results show that 71% of respondents evaluated access to venture capital as either “very difficult” or “difficult” (Likert scale 1–2). In contrast, public grants were perceived as comparatively more accessible, although frequently associated with administrative burden and delayed disbursement.

Interview evidence further clarifies the mechanisms behind this constraint. Founders repeatedly emphasized that venture capital investors tend to prioritize shorter commercialization timelines, scalable business models, and clearly defined exit strategies. Academic spin-offs, particularly those originating from deep-technology or research-intensive domains, often require extended development phases and face higher technological uncertainty. As a result, they are perceived as high-risk investments.

Several respondents noted that investors frequently questioned the commercial readiness of university-based technologies and expressed concerns about intellectual property arrangements involving public institutions. This reflects classical information

asymmetry problems typical for innovation-intensive ventures, where investors face difficulties in evaluating technological quality and market potential.

Moreover, respondents reported limited availability of specialized investors familiar with academic commercialization processes within the Czech venture capital ecosystem. Compared to established innovation hubs in Western Europe, the domestic venture capital market remains relatively shallow, with fewer funds focusing on early-stage science-based ventures.

These findings suggest that the financing constraint is not merely perceptual but structurally embedded in the characteristics of both academic spin-offs and the Czech venture capital market. The evidence therefore supports the assumption that limited access to venture capital constitutes a binding constraint in the early growth stages of Czech academic spin-offs.

3.2. Financing Structure and Dependence on Public Grants

The evidence indicates that constrained access to venture capital has led many academic spin-offs to rely predominantly on public grant financing during their early development stages. While public funding schemes provide essential support for research validation and prototype development, they appear insufficient for scaling and market expansion activities.

Interview respondents frequently described grant funding as “project-based” and temporally limited. Although grants supported technological refinement, they rarely covered business development activities such as international marketing, professional sales recruitment, or strategic partnerships. Several founders emphasized that grant schemes are typically aligned with research milestones rather than market performance indicators.

Survey results further support this pattern. A majority of respondents reported that public grants constituted their primary source of financing during the first three years of operation. However, 82% indicated that limited private capital constrained their ability to hire specialized managerial staff or expand internationally.

This financing structure creates a structural substitution effect: public funding replaces private equity at early stages but does not provide equivalent growth acceleration. Unlike venture capital, grant financing does not usually involve strategic mentoring, governance oversight, or market-oriented performance pressure. As a result, spin-offs remain technologically advanced but commercially underdeveloped.

The findings suggest that while public funding mitigates initial liquidity constraints, it does not eliminate the growth bottleneck associated with limited venture capital access.

3.3. Impact on Growth Dynamics

A recurrent theme across interviews was the prolonged transition from research to revenue-generating activities. Spin-offs without private equity backing reported extended pre-revenue phases, often exceeding two to three years. Founders noted that without venture capital support, commercialization efforts were gradual and resource-constrained. In several cases, scientific founders had to combine research responsibilities with business development tasks, leading to slower market entry and limited customer acquisition. Survey data reveal

that spin-offs lacking external equity financing reported a significantly longer average time to first revenue compared to those that had secured private investment. This pattern aligns with theoretical expectations from the financing constraints literature, where limited access to external capital reduces firms' ability to exploit growth opportunities. The absence of venture capital thus appears to delay the critical transition from technology validation to market validation.

Another direct consequence of constrained venture capital access is limited organizational professionalization. Interview respondents repeatedly emphasized difficulties in hiring experienced business development managers, marketing specialists, or financial officers. Without sufficient equity financing, many spin-offs remained founder-centric organizations. Academic founders frequently assumed multiple operational roles, reducing strategic focus and increasing managerial overload. This organizational limitation has two important economic implications:

1. Reduced absorptive capacity for market opportunities.
2. Slower scaling and weaker investor attractiveness in subsequent funding rounds.

Venture capital typically provides not only financial resources but also governance structures and access to professional networks. In its absence, spin-offs face a capacity ceiling that restricts growth potential.

Internationalization was identified as another growth dimension affected by financing constraints. Spin-offs operating without private equity reported difficulties in entering foreign markets due to limited marketing budgets and insufficient managerial expertise. Respondents located outside major innovation hubs highlighted that lack of venture capital further compounded regional disadvantages. Without investor networks or accelerator connections, expansion remained predominantly domestic and incremental. These findings suggest that constrained venture capital access not only limits immediate liquidity but also reduces strategic growth options, particularly in technology-intensive sectors where international scaling is critical.

3.4. Survival Risk and Long-Term Sustainability

The cumulative effect of delayed commercialization, hiring constraints, and limited expansion contributes to elevated long-term survival risk.

While many spin-offs remain operational due to continued grant participation, respondents acknowledged a persistent "growth ceiling." Firms frequently stabilize at a small organizational size without achieving significant market penetration. This stagnation increases vulnerability to market shocks, policy changes in public funding, or technological obsolescence. In several cases, founders described dependence on public support as a double-edged sword: it ensures short-term survival but does not guarantee long-term competitiveness. The evidence therefore supports the proposed mechanism model. Constrained venture capital access does not necessarily result in immediate firm failure, but it significantly reduces scaling capacity and increases long-term sustainability risk (Table 3).

Table 3. Financing barriers, firm-level impacts, and strength of supporting evidence

Mechanism Stage	Empirical Evidence	Strength of Support
Limited VC accessibility	Survey + interviews	Strong
Grant substitution effect	Interviews + survey	Strong
Delayed commercialization	Survey + interviews	Moderate–strong
Hiring constraints	Interviews	Strong
Limited international scaling	Interviews	Moderate
Increased survival vulnerability	Qualitative synthesis	Moderate

The findings consistently indicate that constrained access to venture capital constitutes a structural growth barrier for Czech academic spin-offs. The mechanism operates through organizational and commercialization limitations rather than immediate firm exit.

4. Discussion

The findings of this study indicate that constrained access to venture capital represents a structural bottleneck in the Czech academic spin-off ecosystem. Rather than leading to immediate firm exit, financing constraints operate through gradual growth limitations, delayed commercialization, and reduced scaling capacity. This pattern corresponds with recent evidence from innovation finance research, which emphasizes the critical role of equity financing in scaling knowledge-intensive ventures (OECD, 2023; European Commission, 2022). Recent analyses of European innovation systems highlight that early-stage science-based firms face disproportionately high capital intensity and longer time-to-market compared to digital start-ups (European Commission, 2022). Venture capital markets, however, increasingly prioritize scalable, platform-based business models with shorter exit horizons. This structural mismatch particularly affects academic spin-offs operating in deep-tech domains. The OECD (2023) stresses that shallow domestic venture capital markets in smaller or post-transition economies significantly constrain the scaling of research-based firms. Compared to Western European innovation hubs, Central and Eastern European countries exhibit lower VC intensity relative to GDP, fewer specialized science-focused funds, and weaker investor–university linkages. The findings of this study are consistent with this systemic gap.

Recent empirical research further demonstrates that access to venture capital affects not only firm survival probabilities but also organizational professionalization and internationalization capacity (Bertoni et al., 2019; Croce et al., 2021). Venture-backed firms tend to hire managerial talent earlier, adopt structured governance mechanisms, and expand internationally more rapidly. In contrast, firms relying primarily on public grants often display slower scaling trajectories and prolonged dependence on project-based funding. Importantly, the substitution effect between public grants and venture capital identified in this study reflects broader European trends. While public funding instruments play a crucial role in supporting early-stage research validation, they rarely provide sufficient incentives for aggressive market expansion (European Investment Fund, 2022). Equity-based financing, by contrast, aligns investor returns with firm growth, thereby introducing performance pressure and strategic focus.

From a policy perspective, recent EU-level initiatives such as the European Innovation Council (EIC) Fund attempt to address precisely this financing gap by combining grant funding with equity instruments. However, national ecosystems remain uneven in their ability to attract and retain private venture capital (European Commission, 2023). The Czech case appears to illustrate this structural imbalance: strong public research capacity coexists with relatively limited private risk capital depth. Furthermore, recent literature on regional innovation ecosystems underscores the importance of investor density and network embeddedness in fostering high-growth academic entrepreneurship (Colombo et al., 2022). Venture capital functions not only as a financial input but also as a connector to global markets, mentors, and follow-on funding rounds. In regions where such ecosystems remain underdeveloped, academic spin-offs face compounded disadvantages.

The findings therefore suggest that financing constraints are not merely firm-level challenges but systemic characteristics of the national innovation architecture. Addressing them requires coordinated intervention at multiple levels:

1. strengthening early-stage science-focused VC funds,
2. improving regulatory clarity around university equity participation,
3. enhancing commercialization readiness programs within universities,
4. and supporting hybrid public-private financing instruments.

In line with recent policy-oriented research (OECD, 2023; European Commission, 2022), improving access to risk capital for research-based ventures is likely to increase the economic return on public R&D investment. Without adequate scaling finance, academic spin-offs risk remaining technologically competent yet commercially marginal.

5. Conclusions

This study examined how constrained access to venture capital affects the growth and survival prospects of Czech academic spin-offs. The findings demonstrate that limited availability of private equity financing represents a structural growth barrier rather than an immediate cause of firm failure. Venture capital constraints operate indirectly by delaying commercialization, restricting managerial professionalization, and limiting international expansion capacity.

The results suggest that academic spin-offs in the Czech Republic often substitute venture capital with public grant financing. While public funding effectively supports early-stage research validation, it does not provide sufficient incentives or resources for rapid scaling. This substitution effect contributes to prolonged pre-revenue phases and organizational stagnation, increasing long-term vulnerability despite short-term operational survival.

From a systemic perspective, the findings highlight a misalignment between public R&D investment and private capital market development. Although universities generate commercially relevant research outputs, insufficient depth of the domestic venture capital market constrains the translation of knowledge into scalable economic value. As a result, the economic return on public research funding may remain below its potential.

The study contributes to the literature on academic entrepreneurship by isolating venture capital access as a central determinant of spin-off sustainability within a post-transition innovation ecosystem. Rather than treating institutional, regional, and human factors simultaneously, it demonstrates how financing constraints alone can shape growth trajectories.

Policy implications follow directly from these findings. Strengthening science-oriented venture capital instruments, improving regulatory clarity regarding university equity participation, and fostering stronger investor–university linkages appear critical for enhancing commercialization outcomes. Without coordinated development of private risk capital markets, academic spin-offs risk remaining technologically advanced but commercially constrained.

While the study relies on qualitative and descriptive quantitative evidence, it provides a conceptually grounded foundation for future longitudinal and econometric research. Further studies could examine comparative data across Central and Eastern European countries to assess whether similar venture capital constraints systematically affect academic entrepreneurship in post-transition economies.

In conclusion, venture capital accessibility should be understood not merely as a financial variable but as a structural condition shaping the effectiveness of national innovation systems. Addressing this constraint is essential for enabling academic spin-offs to fulfil their potential as drivers of innovation-led economic growth.

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