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Public Venture Capital Governance and Grant Timing in Startup Growth

Evidence from Finland’s Layered Innovation System

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ABSTRACT:
Public funding has been object for various topics throughout the field of research in finance. However, the governance of public venture capital, the timing of public grants, and the interaction of these instruments relative to startup performance remains mostly uncharted in literature. Utilising an extensive panel dataset combining firm-level financials, Business Finland grant records, and VC investment data from the Finnish Venture Capital Association, the study examines three distinct hypotheses on how the governance structure of public VC and the sequencing of public grants relative to VC investments jointly contribute to firm growth in sales and employment. Methodology is built on fixed-effects regression models to to estimate within-firm effects, complemented by robustness checks for grant timing, sectoral heterogeneity, and grant intensity.

The findings provide nuanced results, as the governance factor alone, direct or indirect public VC investment, is surprisingly not associated with firm growth. However, timing of public grants matters, as grants awarded after a VC investment are associated with greater firm growth compared to grants received before VC funding. Furthermore, the interaction analysis connecting VC governance and grant timing suggests that the growth effect of post-VC grants is pronounced for firms supported by indirect public VC, highlighting the value of layered and well-coordinated innovation policy.

The results contribute to the highly relevant conversation of public intervention and mechanisms in creating layered innovation ecosystems where the expertise of private VC companies is leveraged and public tools are implemented strategically through coordination, not in isolation. The results emphasize that maximizing the impact of public funding requires not only addressing market failures but carefully aligning the type and timing of public intervention to reinforce private sector incentives and capabilities.

KEYWORDS: VC, grants, governance, timing, innovation

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TIIVISTELMÄ:
Julkisen rahoituksen roolia on tutkittu laajasti akateemisella tutkimuskentällä, mutta julkisen pääomasijoittamisen hallintorakenteet, julkisten tukien ajoitus sekä näiden välinen vuorovaikutus suhteessa startup-yritysten menestykseen ovat jääneet kirjallisuudessa vähälle huomiolle. Hyödyntämällä laajaa paneeliaineistoa, joka yhdistää yrityskohtaiset taloustiedot, Business Finlandin tukidatan sekä Pääomasijoittajat -yhdistyksen (FVCA) tarjoaman datan Suomen alkuvaiheen sijoituskierroksista vuosina 2015-2020, tutkimus tarkastelee kolmea hypoteesia siitä, miten julkisen pääomasijoituksen hallintorakenne ja julkisten tukien ajoitus yhdessä vaikuttavat yritysten liikevaihdon ja työllisyyden kasvuun. Menetelmänä käytetään kiinteiden vaikutusten (fixed effects) regressiomalleja yritystason vaikutusten arvioimiseksi, täydennettynä herkkyystarkasteluilla tukien ajoituksen, toimialakohtaisten erojen ja tukien intensiteetin suhteen.

Tulokset ovat monivivahteisia: pelkkä hallintorakenne, eli suora tai epäsuora julkinen pääomasijoitus, ei yllättäen ole yhteydessä yritysten kasvuun. Sen sijaan tukien ajoituksella on merkitystä, sillä pääomasijoituksen jälkeen myönnetyt tuet liittyvät voimakkaampaan kasvuun verrattuna ennen pääomasijoitusta myönnettyihin tukiin. Lisäksi hallintorakenteen ja tukien ajoituksen yhteisvaikutus osoittaa, että pääomasijoituksen jälkeen myönnettyjen tukien kasvua edistävä vaikutus korostuu yrityksissä, joita on tukenut epäsuora julkinen pääomasijoitus. Tämä korostaa kerroksellisen ja hyvin koordinoidun innovaatiopolitiikan arvoa.

Tulokset tarjoavat näkökulmia ajankohtaiseen keskusteluun julkisen sektorin roolista ja mekanismeista kerroksellisten innovaatioekosysteemien rakentamisessa, joissa yksityisten pääomasijoittajien osaamista hyödynnetään ja julkiset työkalut toteutetaan strategisesti koordinoiden, ei irrallisina toimenpiteinä. Johtopäätökset painottavat, että julkisen rahoituksen vaikuttavuuden maksimoiminen edellyttää paitsi markkinapuutteiden paikkaamista myös julkisten toimenpiteiden tyypin ja ajoituksen huolellista yhteensovittamista yksityisen sektorin kannustimien ja kyvykkyyksien vahvistamiseksi.

KEYWORDS: VC, grants, governance, timing, innovation

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1 Introduction

In the recent decades, startups have become recognised engines of economic transformation, as their focus on scalable innovations is a fundamental asset for advanced economies aiming to keep up in the global competition and seek long-term growth in a knowledge-driven economy (Audretsch & Keilbach, 2004). Startups are not only considered instruments for job creation, but also units of radical innovation and sectoral disruption, which has made public investment in entrepreneurship and innovation a key component of industrial policy (Uyarra et al., 2019). However, due to various constraints such as limited collateral and uncertainty in future cash flows, many startups often exceed the risk capacity of private financiers, thus requiring government intervention where markets fail to provide capital for potential growth (Hall & Lerner, 2010).

As the characteristics of startups such as small scale, high risk, low collateral and unproven technology pose barriers to taking external finance, the multitude of startups' contribution for disruptive innovation, economic dynamism and the creation of jobs underscores the importance of addressing systemic market failures (Audretsch & Keilbach, 2004). Classic theories of market failure (Arrow, 1962; Nelson, 1959) suggest that such firms are likely to underinvest in innovation because of asymmetric information and the non-excludable, non-rivalrous nature of knowledge spillovers. These market imperfections create a gap between private and social returns, discouraging optimal investment in high-risk, innovation-driven ventures. As a result, even very promising projects may remain undercapitalised especially at first when risks are elevated and commercial viability is uncertain.

Private equity financing, and the early state version of it known as venture capital (VC), address this problem. In 2024, the annual volume of the VC industry reached approximately $368,8 billion, with over $337 billion flowing into tech startups globally (KPMG, 2025; Dealroom, 2025). VC does not just play part in critical financing but also governance, monitoring, and other strategic assistance which can be crucial for startups considering business development and company-defining pivots (Gompers & Lerner, 2001).

However, private VC markets are usually geo-graphically concentrated, highly selective and focused on specific high-return sectors which means a considerable share of the startup population is left out of the growth funding (Kerr & Nanda, 2015).

Public-driven support and intervention in startup growth remains one of the most disputable conversations in academic literature. The distinction between arguments lies in whether public involvement acts as a market facilitator by correcting financing gaps and fostering innovation, or whether it distorts entrepreneurial incentives and crowds out private investment (Lerner, 2002). To eliminate persistent financing gaps, governments throughout developed economies have rolled out a variety of public policy initiatives that aim to foster entrepreneurship and lower the risk on innovation investment (OECD, 2023).

The methods through which public aims to contribute to startup growth are multifaceted. Public innovation grants provide non-dilutive funding for bearing the risk in early-phase R&D and commercialization, while public VC often targets scale-up gaps by co-investing alongside private investors or targeting startups through direct investments. Though both serve the purpose of addressing market failures and promoting long-term growth, there are significant differences in design, targeting and risk tolerance between these instruments. (Uyarra et al., 2019).

The effectiveness of the tools remains disputable. Some studies show that public VC can catalyse innovation and foster entrepreneurial dynamism, while others argues that if public VC misaligns with market incentives, it can crowd out additional private capital often considered more effective and incentive-driven (Brander, et al., 2015; Cumming & MacIntosh, 2006). As non-dilutive instruments, innovation grants can encourage R&D and commercialization if implemented properly. However, if given to a firm that has adequate VC support or targeted at the wrong time considering a company's development cycle, grant support can be redundant or inefficient. (Wallsten, 2000).

During the past three decades, Finland has developed one of Europe's most structured and state-driven innovation ecosystems. Public institutions such as Business Finland and Tesi (Finnish Industry Investment Ltd.) have evolved from traditional forms of funding providers to more sophisticated instruments of industrial policy that engage directly in VC activities (OECD, 2023; Murto et al, 2025). As the primary public provider of R&D and innovation grants in Finland, Business Finland plays an essential role in supporting early-stage ventures through non-dilutive funding programs (Business Finland, 2024). A remarkable policy shift of Tesi to increase direct investments fivefold demonstrates a growing ambition to utilise public capital to shape the innovation economy rather than just supplement private investment (Tesi, 2024). This setup offers an intriguing stage for examining the interaction and dynamics between different public support instruments and their contribution to startup growth. This approach is particularly suitable for research on Finnish startups, as despite plenty of public involvement, Finland still faces challenges in scaling their startups into global growth firms, described as the Finnish paradox (Autio, 2009).

In recent years, the layering and coordination of different public instruments has taken on a more prominent role in the academic conversation, as innovation systems are increasingly seen as complex, path-dependent ecosystems rather than linear pipelines. In this sort of environment, the strategic alignment of policy tools across time and actors becomes a fundamental logic, empathizing that the effectiveness of public support instruments can be greater than the sum of their individual impacts but only if they are sequenced and embedded in complementary governance frameworks. (Guerzoni & Raiteri, 2015).

The sequencing and governance of support can matter significantly. For example, obtaining a grant after securing funding from a professional, market-driven private VC fund may signal quality to additional stakeholders and expedite development (Howell, 2017). In this sequence, public funding complements existing market validation and can contribute to scaling (Czarnitzki & Lopes-Bento, 2014). With alternative governance and

timing, grant funding followed by a direct VC investment from a public institution demonstrates how governments intervene to support ventures of national interest lacking private market validation throughout their early phases (Colombo et al., 2014; Brander et al., 2015). Within the evolving policy landscape, particularly relevant in the Finnish context (Murto et al., 2025; Tesi, 2024), the interaction between these two dimensions remains underexplored yet potentially decisive: the governance structure of public VC (direct vs. indirect) and the sequencing of grants in relation to VC investments (before vs. after).

To this end, this paper utilises an extensive panel dataset that combines Finnish VC investments during the years 2015 and 2020, Business Finland Grant data from 2012 to 2023, and firm-level financials and employment data. This systems-level perspective enables the analysis of how the interplay between VC governance and grant timing contributes to startup growth.

1.1 Purpose of the Study

This thesis investigates the extent to which the design of public funding affects the growth trajectories of early-stage companies in Finland. The focus is particularly on how the governance structure of public VC and timing of grant funding relative to the first VC investment received by a company affects its sales and employment figures.

These questions matter not only for academic inquiry but also for policy design. In Finland, the relevance of this topic has notably increased due to recent policy shifts. The revised strategy of Tesi implies that the role of public capital is more than to fill gaps in the market as before and actively shape the direction of innovations and industrial renewal. As public investors become more active and engaged, there is a growing need to understand how different governance structures and sequencing of different support instruments interact and contribute to startup growth.

First, the thesis explores whether the governance structure of public VC affects startup performance. Prior literature suggests that indirect public VC, where governments allocate capital through private VC funds, can enhance company outcomes due to better-aligned incentives, specialized knowledge, and stronger monitoring capabilities (Cumming & Johan, 2009). In contrast, direct public VC may suffer from weaker commercial governance and political inefficiencies (Brander et al., 2015). This distinction is tested by the following hypothesis:

H1: Startups backed by indirect public VC exhibit stronger growth than those supported by direct public VC.

Second, the study examines whether the timing of a public grant relative to first VC investment received by a startup matters. Grants provided after a startup has secured VC funding are more likely to be complementary, reinforcing ventures that have already passed market validation. On the other hand, grants targeted before VC investment may risk supporting unvalidated or low-potential firms or even crowd out later private involvement (Howell, 2017). Thus, the study tests the following hypothesis:

H2: Startups that receive public grants after VC investment demonstrate stronger growth than those receiving grants before VC investment.

Third, the thesis investigates whether the timing effect of innovation grants depends on the governance type of public VC. The interaction between indirect public VC and well-timed grant support may amplify startup growth by combining rigorous private oversight with flexible public co-financing, reflects the logic of layered policy mixes, where coordination and sequencing are key to policy success (Uyarra et al., 2019). To address this interaction, the following hypothesis is estimated:

H3: The effect of post-VC grants is stronger for firms backed by indirect public VC than for those backed by direct public VC.

Implementing this empirical framework, the thesis aims to provide insights that can inform both academic debates in innovation policy and practical decisions on how to allocate public funds across early-stage firms in Finland and similar developed economies. If governments wish to foster transformative entrepreneurship, understanding when and how to intervene in the financial lifecycle of startups becomes a critical concern.

1.2 Contribution of the Study

This thesis aims to contribute to the literature and policy debate by providing new empirical evidence on the interaction between the governance structure and the timing of public startup finance. Studied typically in isolation, a growing number of scholars are proposing more detailed and design-oriented evaluations of the two dimensions of instruments in innovation policy (Uyarra et al., 2019; Lopes & Farias, 2022).

The primary contributions of this thesis are threefold.

First, this study provides a rare empirical comparison of direct and indirect model of public VC relying on detailed firm-level data from Finland, a country where both governance models coexist under identical institutional settings. Most of the literature focuses on a US or pan-European dataset, so this study will present new evidence from a smaller, state-active market with public actors who contribute significantly to early-stage financing.

The thesis not only assesses the effectiveness of public support instruments but also establishes if their sequencing matters for the growth of firms. By concentrating on timing, we can systematically assess how direct and indirect public VC governance models interact with grant funding throughout the financing lifecycle. This is a contribution to the literature emerging on funding complementarities and coordination.

The study uses a unique dataset comprising Business Finland grants, Finnish VC deals from the Finnish Venture Capital Association, and firm-level financial data from Valu8

and Orbis databases. The complete dataset allows for the use of firm-fixed effects models that controls for unobserved heterogeneity and provides robust treatment estimates over time.

Addressing these dimensions, this thesis seeks to inform scholars and policymakers about how institutional design, governance architectures and the sequence of public funding impact the development of startups. The aim of the results is to produce insights which will be equally valuable not only for Finland but also for other innovation-driven economies relying on active public funding ecosystems to support entrepreneurship.

1.3 Structure of the Study

This thesis is structured into six chapters, each building upon the before contributing either empirically or theoretically.

Chapter 1 introduced the research context, motivation, and objectives, situating public startup support within a broader policy framework. It also presented three hypotheses focusing on (1) the governance structure of public VC, (2) the timing of innovation grants, and (3) the interaction between the two. These hypotheses aim to address gaps in the academic literature and are grounded in the specific institutional context of Finland's layered innovation financing system.

Chapter 2 presents the theoretical framework. After covering the fundamentals of VC, the chapter examines the economic rationale for public startup intervention. Additionally, the chapter develops concepts related to VC governance and grant sequencing within layered policy systems.

The literature review in Chapter 3 compiles existing research regrading public VC governance structures, public grants, and the timing grant funding relative to VC. The chapter identifies an important gap in the literature: there is no integrated analysis that studies the interplay between governance, timing, and startup performance.

Chapter 4 describes the data and methodology. It summarizes the data collection process, consisting of firm-level financials, investments, and public funding information. This chapter establishes how the main variables are constructed and outlines the fixed effects panel regression approach used to estimate the association between different governance and sequences of public support and company outcomes.

Chapter 5 presents the empirical results. The regression estimates for the hypotheses are reported with statistical significance of underlying findings. Also included are robustness checks from rational standpoints.

Chapter 6 concludes the thesis. The results can be relevant for the design of innovation policy, regarding the increasing volume of direct public investment in startups. The chapter ends with a discussion of how these insights could enhance the coordination between public VC governance and innovation grant timing.

2 Theoretical Framework

This section covers the conceptual fundamentals of the study, detailing the mechanisms of VC and the rationale for public intervention as well as the timing factor between instruments. Additionally, the chapter elaborates the architecture of the Finnish innovation ecosystem and the public entities engaged in fostering startup growth.

2.1 Venture Capital

VC plays an important part in leveraging the potential of young companies in competitive markets by equity investments, providing fundamental recognition and support as traditional bank loans are often out of reach for startups (Gompers & Lerner, 2001; Da Rin et al., 2011). In addition to capital, VC investors provide active guidance and access to networks, enabling startups to leverage various forms of human capital (Kaplan & Strömberg, 2004).

Startups are often initiated by founders with strong vision but limited access to capital and managerial professionalism. Whereas the vision for the idea might be clear, the means for execution and capital to get there form one of the fundamental challenges founders can face. An investment from a VC fund addresses both challenges, as VC engagement often come with strategic guidance and access to networks via sector-specialized fund managers and VC company professionals that recognise the venture's potential for growth and scale. This intersection of willingness to engage in high-risk ventures and active investor collaboration is optimal for aligning the incentives of VC investors and company founders. (Kaplan & Strömberg, 2004; Hellman and Puri, 2002).

One of the key characteristics of VC funding lies in the stage-driven approach of funding, where startups receive funding in sequential series-based rounds (e.g., Seed, Series A, Series B), with continued access to capital determined by milestones such as technical breakthrough, commercial validation, or team development (Gompers, 1995; Kerr & Nanda, 2015). As the structure of VC funds is often illiquid, this sequencing enables

determine stages for financially uncertain ventures and offers investors the chance to sell their portion of the venture investment if the progress does not meet expectations (Gompers, 1995). This approach also facilitates ongoing monitoring and post-investment engagement, which has been shown to improve firm performance (Chemmanur et al, 2011).

Expectations by venture capitalists such as scalability and innovation can determine the willingness to invest in a company, even if it means committing to multiple years of negative profit (Gompers, 1995). On the other side, VC-backed firms can be category definers where the risk appetite of investors eventually contributes to job creation, patenting, and new market formation (Kortum & Lerner, 2000; Haltiwanger et al., 2013).

The engagement of VC funding across startups is not equal, as the characteristics defining VC investors' expectations depend on factors associated with startups in areas with innovation ecosystems and are skewed toward high-tech or biotech sectors with expected returns beyond other asset classes (Gompers & Lerner, 2001). This can lead to market failures, where promising ventures are left unfunded, particularly in less concentrated or emerging markets (Nanda & Rhodes-Kropf, 2013).

VC is in many ways different to other capital forms, but one distinction standing out is its governance intensity. Taking a board seat at the invested company is not automatic but usual for a VC firm, utilising the active role to influence hiring practices and provide operational support and creating a hands-on engagement that has been positively associated with innovation outcomes and faster scaling (Deb et al., 2024). This experience and professionalism provided by VC fund managers can contribute to the fundamentals in business development, company-determining pivots, and international scaling (Bottazzi et al., 2008).

2.1.1 Structure of VC Funds

The business model of VC companies is built on close-ended funds with typical lifespan of 8 to 12 years, where capital is pooled from participating organisations and individuals

(Metrick & Yasuda, 2010). The pooled money is then allocated to multiple startups aligning with the investment strategy established by the VC company managing the underlying fund (Gompers & Lerner, 2001). This practise forms the foundations for a VC fund model, where the managing VC company acts as the general partner (GP) of the fund determining investment decisions, and participating investors such as pension funds, family offices, and public fund-of-funds invest capital as limited partners (LP) (Kaplan & Schoar, 2005).

In this model, the GP is responsible for sourcing deals, conducting due diligence, managing the portfolio, and eventually exiting the investments via IPOs, trade sales, or secondary buyouts (Gompers & Lerner, 1999). The volume of incentives for this responsibility can differ among funds, but the typical structure is that GP's take a small portion of the total amount invested as a management fee, e.g. 2%, and a carried interest, typically 20% of the funds profits above the hurdle rate (Kaplan & Schoar, 2005). With this structure, GPs are in a well-incentivised position to maximize fund returns, forming a clear distinction between capital providers regarding responsibilities and accountability. In this division, GPs are active agents in control of the fund and LPs take a more passive role as GPs sustain the autonomy and encouragement to long-term entrepreneurial risk-taking. However, LPs ought to conduct due diligence on the GP's track record, team, and strategy before committing capital (Lerner, et al., 2007).

For public capital, the approach to VC investing is mainly twofold. One of the most common structures established is a fund-of-funds (FoF) model, where an institution allocates capital to multiple VC funds as an LP instead of direct investments in startups, creating diversification while leveraging the expertise and specialisation of private VC companies (Mayer et al., 2001). In addition to these benefits, the indirect model of startup investing helps VC funds raise needed capital and gain recognition through commitments from public institutions such as Tesi and European Investment Fund (Brander et al., 2015).

Investing directly to startups, governments can support ventures in fields of national interest that can be viewed too risky for private market validation (Lerner, 2002). On the other hand, this approach can often lack these contractual governance dynamics, increasing risks of political interference, mission drift, or misaligned investment incentives (Brander et al., 2015).

2.2 Public Startup Support

Financing constraints are a persistent challenge for startups, especially in their early phases. These challenges are particularly pronounced for firms in innovation-driven sectors, where imperfect information, high uncertainty and externalities can lead to market failures (Arrow, 1962; Nelson, 1959). As private market validation can be impossible for firms trying to prove themselves, public sector intervention is often justified to correct these inefficiencies. This forms the foundation for modern innovation policy and motivates the use of targeted instruments such as innovation grants and public VC (David et al., 2000).

2.2.1 Market Failures

Innovation activities are often tied to results that are uncertain, intangible and difficult for private market to assess, leading to underinvestment (Hall & Lerner, 2010). Arrow (1962) points out how knowledge spillovers from R&D generate an externality that drives a wedge between private and social returns, discouraging optimal investment. Nelson (1959) similarly argues that markets often fail to adequately value scientific advancement, which can result in startups with high growth potential being systematically denied access to financing.

Stiglitz and Weiss (1981) offer further insight from the context of credit rationing in a market with imperfect information, and argue that due to the asymmetry of information between the entrepreneur and the capital provider, investors have challenges assessing a startup's quality and potential accurately, raising the perceived risk profile of a venture

and thus driving up the cost of capital or even outright exclusion from funding markets. Such dynamics are even more pronounced in high-tech or science-based firms that are inherently uncertain and intangible (Berger & Udell, 1998).

These conditions defining the environment for startups, early-stage financing can be viewed as a targeted response to persistent market failure (David et al., 2000). Without intervention, economies can exhibit reduced innovation, leading to slowed structural transformation in the long-term (Aghion et al., 2009). To address these concerns, governments have established a range of policy tools designed to correct these failures, notably non-dilutive grants, facilitated loans, and public equity financing (Kerr & Nanda, 2015).

2.2.2 Public Intervention

The fundamental rationale for innovation to attract public support is the difference between private and social returns (Uyarra et al., 2019). Innovations creating spillover such as new technologies, processes, and knowledge infrastructure can generate significant utility to society. Thus, public funding is encouraged to step in even if the projected benefits are not sufficient to attract commercial capital (Flanagan et al., 2011). From this perspective, public support is not just compensatory but a form of strategic targeting in shaping innovation ecosystems (Mazzucato, 2016).

Public funding policies hold significant responsibility in promoting entrepreneurship and technological upgrading (Murto et al., 2025). Audretsch and Keilbach (2004) argue on behalf of “entrepreneurship capital”, determining innovative firm creation which depends on the aggregate level of institutional support, knowledge flows and capital access. In countries like Finland, the necessity of this role is grounded in dependence on technology-intensive exports as well as the persistent challenges in scaling domestic ventures (Murto et al., 2025; Autio, 2009). Often referred to as the “equity gap” or valley of death; a stage in which startups are too risky for traditional financiers to provide but too capital-intensive to bootstrap, public fundings can be the catalyser in bridging the gap (Da Rin

et al., 2011). In developed economies, this gap is commonly addressed through various forms of public support, which includes non-dilutive funding such as innovation grants and direct and indirect equity investments implemented through governments' private equity capital arms, such as Tesi in Finland (OECD, 2023).

2.2.3 Grants vs. Public Equity

Grants and public VC both seek to address early-stage innovation financing constraints, but they differ substantially in their economic logic, mechanisms and policy implications. Grants are a non-dilutive form of funding that expect no financial return, as the instruments aim to lower barriers for market entry, de-risk scientific experimentation and support of the production of knowledge that creates positive externalities for societies. (Uyarra et al., 2019).

In contrast, VC equity investments by the public have a return expectation, usually with respective monitoring and value-add (Lopes & Farias, 2022). Whereas grants are usually obtained before product-market validation, public VC is usually implemented closer to commercialization (Kerr and Nanda, 2015). The logic and technical execution of public investments follows private funding, but the rationale can differ fundamentally, based on national interests or established policies by governments (Cumming & Li, 2013).

The selection and signalling processes are notably distinct for grants and VC funding, where grants usually operate through an application process subject to limited market screening, and VC funding is assumed to involve rigorous due diligence and signalling confidence from the investor (Hall & Lerner, 2010). Serving different purposes with same ends, this difference underlines the practical setup where both tools can be used as complementary instruments in a layered innovation system.

2.3 Governance of Public VC

The models through which public VC initiatives are governed can have a significant effect on the performance of the targeted company. These models can be broadly divided into two categories, where public can invest directly in startups or with through an indirect model where a government institution invests in private VC funds directly or through constructed fund-of-funds Grilli & Murtinu (2014). The recognition of differences and utilities between these models is essential, as the characteristics of the governance models can influence the firm level outcome such as growth, survival and innovation significantly (Colombo et al., 2014).

2.3.1 Direct and Indirect Public VC

Direct public investments are usually driven by policy mandates that prioritize national interest such as creating jobs or strategic sectors, where the targeted startups are prioritized potentially at the expense of return maximization or rigorous firm selection (Cumming & Johan, 2009). These policies create flexibility to the risk public capital can take in on in contrast to private capital, as the focus is not only in spurring new early-stage innovations but also enabling the scaling phase in subsequent funding rounds (Murto et al., 2025). On the other hand, direct public VC could encounter more political interference, softer selection criteria and limited performance-based accountability (Luukkonen et al., 2013).

With the indirect VC model, public investors delegate the investment decisions and portfolio monitoring to the underlying private VC funds and executives, incentive alignment and selection efficiency of which are often recognized superior (Gonzalez-Uribe & Leatherbee, 2018). The level of autonomy that is allowed to the fund managers is a clear distinction between the models, as with indirect public VC, a public investor partners with a private fund as a limited partner, allowing the fund managers of the private VC company to make decisions without public interference (Deb et al., 2024). Furthermore, the

indirect public support can offer positive signalling for the private fund, possibly attracting more private capital and increasing fund sizes (Da Rin et al., 2006).

An increasing number of studies support the indirect model over direct public investments, as they are argued to result in superior firm performance. Grilli and Murtinu (2014) argue that indirect public VC funds, managed by private VC professionals, provide better firm-level growth metrics than public VC funds that are managed directly by government professionals. The performance-based considerations along with the positive effects of signalling and crowding in private capital through the indirect model offer a clear theoretical framework for examining these questions further (Colombo et al., 2014).

2.3.2 Incentives, Monitoring, and Value-Add

Motivation, commitment and the level of professionalism of people involved are other factors to which the governance of public VC models contributes. For fund managers, the governance structure determines the incentive landscape fundamentally, as indirect models operate under the compensation structures based on the fund's performance (e.g., carried interest) which creates strong incentives to find and invest in high potential ventures and support them actively throughout their lifecycle (Lin & Kim, 2015). Operating with multiple stakeholders, the monitoring capabilities of private VC companies are also a beneficial aspect of the indirect model (Cornelli et al., 2021). Other factors argued to enhance robustness of monitoring mechanisms of private VC are the performance benchmarks and periodic capital calls of the fund structures (Kaplan & Strömberg, 2004).

On the contrary, direct public investors usually have different performance-based competitors or may face less pressure to adequately screen or monitor investments (Luukkonen et al., 2013). Critical for scaling innovation-driven start-ups, the post-investment value-add from strategic advice, access to networks, and support for future fundraising might also be weaker with the direct model (Bertoni & Tykvová, 2015).

Furthermore, indirect VC funds tend to become more specialized and develop niche sectoral professionalism, which supports the quality of due diligence and post-investment assistance (Croce et al., 2018) with sector-based capabilities and knowledge often take key roles within complex, high uncertainty environments such as those found in the biotech & clean energy & deep tech sector companies (Bertoni & Tykvová, 2015).

2.3.3 Signalling Effects

Signalling is another central benefit of indirect public VC. Signalling theory in entrepreneurial finance suggests that an investment from a public entity in a private VC fund can reduce information asymmetry and attract private investors, indicating venture potential (Lerner, 1999). This perspective highlights that public capital flowing through competitive private VC structures may validate fund managers in underdeveloped markets and reduce search costs for private LPs while also enabling larger fund sizes (Brander et al., 2015). This can mobilize private capital and create effectiveness between innovation ecosystems and VC funding (Guerini & Quas, 2016).

On the other hand, direct public investments can cause distortions in the market by if capital is allocated to less productive companies (Lerner, 2002). This crowding-out -effect indicates that certain designs of public VC programs can displace private capital involvement, as public VC investments are not subject to the same market-driven incentives as private investments and risks of adverse selection and underperformance become persistent (Köppl et al., 2025). This effect can be due to negative reputational effects associated with poorly governed public VC, especially when exits of investments are weak or overly subsidized, influencing private market's view of the efficiency of public funding (Cumming & Johan, 2009).

2.4 Innovation Grants

One of the most pronounced mechanisms through which governments can address the persistent challenge of startups' financial constraints is non-dilutive grant funding,

designed to support R&D, prototyping, and commercialization (Meuleman & De Maeseneire, 2012). As startups are characterized by high-risk, long-time horizons, or externalities that deter private investment, grant instruments have become a central role in investment policies across governments that aim to prevent market failures and support innovation (Hall & Lerner, 2010).

2.4.1 Characteristics

Grant programs are pronounced schemes in many developed economies with varying characteristics (OECD, 2021). For example, Business Finland provides funding for Finnish innovation ventures, the Small Business Innovation Research (SBIR) program addresses innovation in U.S, and the Innovate UK program supports British startups (OECD, 2021). These schemes differ in various styles depending on grant program goals and the stage of company development but serve the same end of catalysing innovation by providing funding for R&D and prototype research (Howell, 2017). Whereas grants can be unconditional, milestone-tied, or require cost-sharing, another main common factor for these instruments is ensuring of additionality, where the goal is to deploy grants that enable activities that would not have occurred without their contribution (Clarysse et al., 2009).

Overall, attracting VC funding is considered more difficult than grant funding for a startup, and although grants are mainly designed for early-stage operations, it is not unusual to receive grants after securing VC funding (OECD, 2023; Howell, 2017). The possibility of positioning grants in both sides of an equity investment opens conversation for the effectiveness of a grant depending on the timing (Howell, 2017). In this stage-driven efficiency context, factors such as the level of risk the public sector assumes and whether grant funding acts as a complement to or substitute for subsequent funding become fundamental points for assessment, as grants in the early stages of funding may reduce barriers to entry and allow for experimentation while post-VC grants may reinforce scaling and commercialization (Howell (2017). Distinguishing between funding mechanisms and determining the appropriate sequencing of policy instruments is critical for maximizing efficiency and avoiding redundancy in innovation policy (Guerzoni & Raiteri, 2015).

2.4.2 Purposes

Innovation policies in develop economies rely on early-stage instruments aimed at firms without external finance (OECD, 2021). Receiving grants before initial VC funding is usual for unproven firms in ideation or research phases, where the main purpose of non-dilutive funding is to promote experimental entrepreneurship while reducing market entry barriers for enabling technological validation, hiring initial staff, and conducting needed research, early grant funding can be crucial (Guerzoni & Raiteri, 2015).

At their core, grant schemes developed entrepreneurial ecosystems are designed to support breakthroughs in innovation and encourage patenting with the aim of growing long-term sales when accurately targeted (Takalo et al., 2013). However, firms receiving pre-VC grants lack the validation of market-based capital providers, facing the risk of not being able to deliver commercial success, leading to the possibility of inefficient allocation of resources and limited economic return (Wallsten, 2000). Additionally, grants allocated to firms without market validation may influence founders' motivation to pursue commercial validation, potentially slowing the transition to market-driven financing (Brown et al., 2017).

In contrast to early-stage support, grants received after VC funding have fundamentally different logic in utility. Targeted for firms past market validation, these grants aim to function as accelerators for proven operations investors have subjected to rigorous due diligence (Howell, 2017). With active engagement from VC professionals, firms with post-VC grant funding can be in a better position to scale and commercialize innovations (Howell, 2017; Takalo et al., 2013). In this sequence, grants on the post-VC side complement sequential public-private funding synergy and the variations of layered innovation systems (Einiö, 2014).

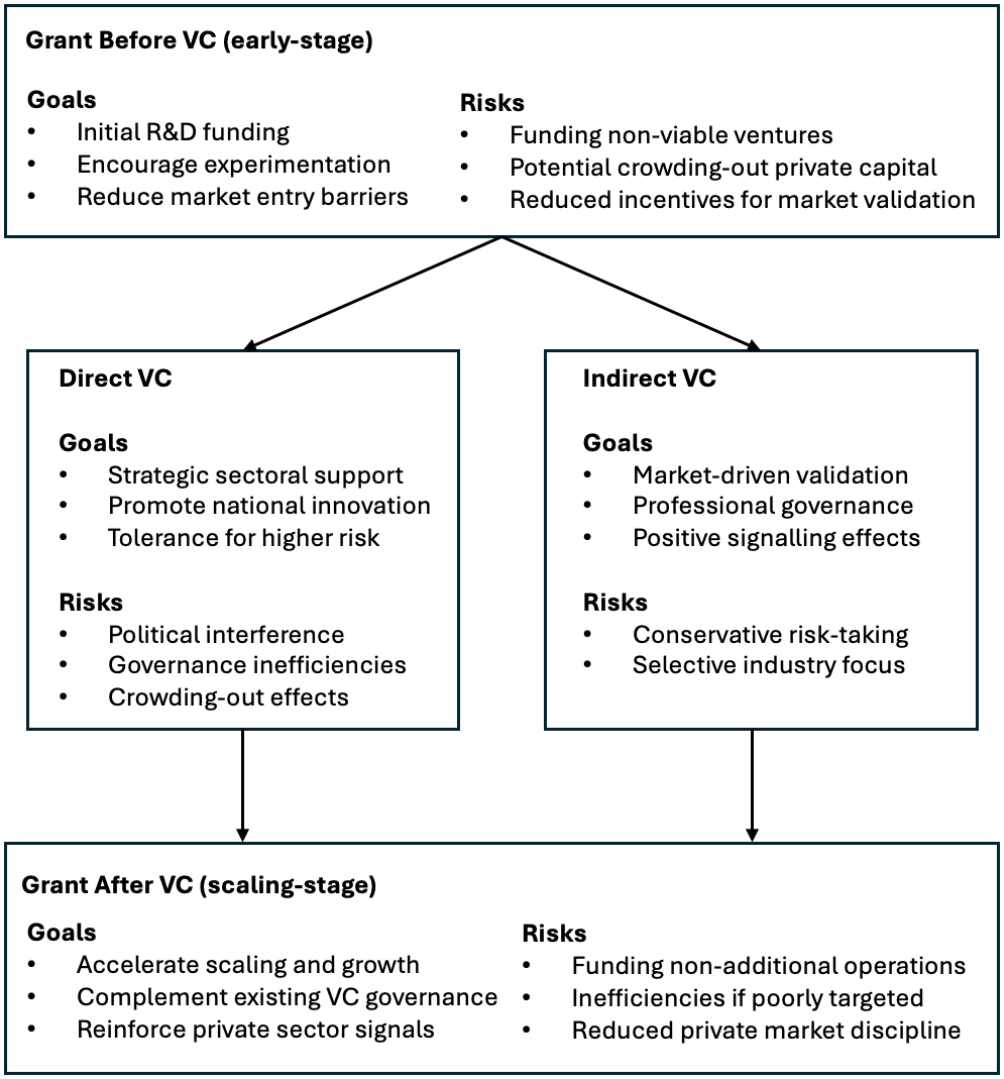
Existing policy designs support this approach, as the U.S. Department of Energy's ARPA-E program complements already funded ventures with grants to accelerate potential operations for faster commercialization (Howell, 2017). Additionally, patenting and product

development beyond the early phase can be complemented by post-VC grants, as selection effects and better alignment with firm readiness enhance the effectiveness of public funding (Howell, 2017). However, post-VC grants can become less effective if directed to firms that would have scaled successfully regardless, raising concerns about public resource efficiency (Aerts & Schmidt, 2008).

2.5 Instrument Synergies

Developed economies that seek to develop layered innovation ecosystems through public support cannot address the efficiency of tools as standalone instruments (Guerzoni & Raiteri, 2015). Deploying support throughout firms' lifecycle, governments must ask not only whether to implement grants or equity financing, but how and when these instruments should be combined (Busom, 2000). At their most efficient, public grants can bridge the gap between the development of potential innovations and private market validation and become complementary instruments that de-risk ventures and induce grow alongside VC investment (Takalo 2013). This fundamental idea where the interaction of instruments, rather than just their presence, can matter significantly for the effectiveness of innovation ecosystems (Howell, 2017). Figure 1 illustrates the interplay and sequencing of different public instruments throughout a firm's lifecycle.

Figure 1. Sequencing and Governance of Public VC and Innovation Grants[1]



2.5.1 Layered Innovation Systems

The blended structure of public innovation support, from early-stage grants to follow-on VC investments and subsequent grants aims to address changing bottlenecks startups face in risk, experimentation, validation, and scale (Aghion, et al., 2009). Moreover, it tailors support mechanisms to each stage, where early grants support experimentation, VC commercial validation and follow-on support to accelerate growth (OECD, 2023).

[1] Original figure. In line with Colombo et al. (2014), Howell (2017), Guerzoni & Raiteri (2015), and Uyarra et al. (2019).

According to Guerzoni and Raiteri (2015), the utility in these layered systems does not rely on the effectiveness of each instrument separately but also on their interdependencies, where the goal is to minimize overlaps and additionality, while maximizing positive spillovers between instruments. Thus, effectiveness of interactions among the instruments can contribute significantly to the marginal impact of each policy tool depending on how and when they are combined (Uyarra et al., 2019).

2.5.2 Strategic Alignment

The governance model of public VC can influence the effectiveness of grants (Grilli & Murtinu, 2014). As post-VC grants are targeted to complementary already funded companies, through indirect models they ought to reinforce professionally vetted firms and leverage the governance benefits of private VC fund managers (Guerzoni & Raiteri, 2015) In direct VC models, the selection and monitoring can be a substantially weaker element compared to private VC fund managers and their capabilities, as grants are allocated to firms without private market validation, creating the of misallocation based on weaker criteria or political logic amplifying inefficiencies (Colombo et al., 2014; Wallsten, 2000).

This interplay suggests an interaction between governance and timing where the institutional quality of the capital provider moderates the effectiveness of follow-on grant support (Uyarra et al., 2019). To create an effective innovation system a smart policy architecture is required to govern the distribution of public support, where coordination between institutions is needed to foster a shared vision, align incentives, and build feedback loops that adjust over time (Mazzucato, 2016). These considerations of layered public engagement are particularly suitable for Finland's innovation system, where an established policy is to back companies at several phases of their development (OECD, 2023).

2.6 The Finnish Innovation System

The design of Finland's ecosystem is well-known for its multifaceted support for innovation, growth and networking. With recognized strengths in institutional layers, research intensity, and collaborative culture, Finland possesses a high-performing innovation hub in the global North (OECD, 2023). However, challenges regarding funding shortages and commercialization undermine its international competitiveness (Murto et al., 2025).

The Finnish model is based on a complementary architecture of public non-dilutive grants, loan instruments, and early-stage equity, with a compact community of incubators and accelerators (OECD, 2023). The strategic role of public VC has become more substantial in recent years, raising the essential question of its interaction with other funding instruments (Tesi, 2024).

2.6.1 Architecture and Key Actors

The public support for startups in Finland is orchestrated by a few key institutions. Business Finland plays a central role by providing non-dilutive grants, loans and innovation vouchers for startups' R&D and internationalization projects. In 2024, funding from Business Finland neared €611 million euros, which consisted of €383 million supporting company-focused research, development, and innovation; €177.5 million allocated specifically for research; and €50 million earmarked for industry-oriented programs. (Business Finland, 2025).

Tesi acts as the main public private equity and VC arm of the Finnish government. Its mandate determines support for startups either via direct equity investments, or indirect investments to private VC funds directly or through fund-of-funds. In 2024, Tesi's total investments and commitments amounted to EUR 116 million, compared to EUR 235 million in 2023. Of this, EUR 53 million was allocated to fund commitments, EUR 35 million to direct investments in regular operations, and EUR 28 million to follow-on investments under pandemic-era special investment programmes. By the end of 2024, Tesi's assets

under management totalled EUR 2.6 billion, and the company held ownership stakes in 546 Finnish companies, either directly or indirectly through its portfolio funds. (Tesi, 2025).

In addition to non-dilutive grants, Business Finland has also contributed to indirect VC investments through its own VC arm, but according to the new mandate outlined by the Finnish government, all equity-based instruments, including those of Business Finland, will transfer under Tesi's management (Ministry of Economic Affairs and Employment of Finland, 2024). This merging aims to enhance strategic alignment and remove duplicative roles that have historically crated fragmentation in startup funding (Tesi, 2025). The reorganization will position Tesi as the main public actor for startup support, ranging from initial seed capital to growth-state equity with the aims to simplify access to financing for startups as well as alignment of public investment instruments with long-term goals (Ministry of Economic Affairs and Employment of Finland, 2024).

2.6.2 The Evolving Role of Public Capital

The Finnish transformation of public support for startups also outlines changes in capital allocations. Investments by the public sector represent a significant portion of the total VC funding in Finland, contributing roughly 37% of all capital raised by Finnish VC funds between 2019–2023. (FVCA, 2025; Murto et al., 2025). Historically, most of the Tesi's capital has been committed to indirect models, supporting ventures though private VC funds with the goal of market development, enhancing fund ecosystems and attracting private LPs by providing early capital and credibility with crowding-in effects (Tesi, 2024). However, the upcoming policy revision implies a fundamental change in the portfolio allocation of the government institution.

According to the Ministry of Economic Affairs and Employment (2024), the Finnish government intends to increase Tesi's direct investments fivefold, while growing the volume of fund investments by only 16%. This increase is ought to be aimed at bridging the early growth equity gap that typically spans between seed funding and commercial traction

and is associated with high capital intensity and long R&D cycles (Murto et al., 2025). By targeting investments toward startups that are strategically significant but face challenges securing funding from the private sector, Tesi's policy shift aims to modify the role of public VC from a primarily catalytic investor to a more strategic one, with implications for firm selection, innovation directionality, and private sector dynamics (Tesi, 2024).

This redirection of innovation policy has several implications. First, it suggests growing influence of the public on choosing, governing and scaling up high potential firms. Second, it may imply changes in how grants and equity instruments influence each other, particularly if grants increasingly precede or complement public VC rounds managed by Tesi itself. Third, concerns of crowding-out risks become apparent, especially if public funds increasingly compete with private capital, rather than crowding-in the latter. However, the new model promises improved strategic fit, reduced fragmentation, and potentially more swift deployment of capital in areas of national importance (Tesi, 2025).

2.6.3 A Forward-Looking Innovation System

The innovation strategy of Finland does not only rest upon public funding structures but also on culture, community, and global relevance. With Slush, Europe's biggest startup conference, and the various incubators like Maria01, Startup Sauna, and A Grid, Finland is positioning itself as a startup-focused country (Murto et al, 2025; Tesi, 2025). This ecosystem of digital infrastructure and a strong education system offers not just a solid foundation for innovation but an optimal environment for scaling ventures (Ministry of Economic Affairs and Employment of Finland, 2024).

Challenges remain, however. Finnish startups face challenges in scaling internationally and often rely on domestic public capital instead of attracting international investors, according to the yearly Startup Pulse Report (Tesi, 2025). Through ongoing centralization of VC support under Tesi, it is crucial for agile governance, greater transparency, and incentives to crowd in private expertise. Through properly coordinated innovation policies, Finland can become a model nation for public-private innovation finance, where

layered strategic support not only reduces risks but also accelerates the life cycle and support around startups (Murto et al, 2025).

3 Literature Review

This section covers prior research on public VC governance models, non-dilutive grants, and the interplay of the instruments and timing, positioning the study within the relevant academic debate.

3.1 Empirical Evidence on Public Venture Capital

Public sector VC initiatives have become instrumental in addressing financing gaps for early-stage, high-risk firms. Yet, their effectiveness can depend on proper governance structure, wheatear public agencies deploy capital directly or through professional fund managers (Brander et al., 2015; Colombo et al., 2016). Recent empirical studies have made the effort to compare the performance of these approaches, producing evidence in line with the theoretical expectations covered (Grilli & Murtinu, 2014; Bertoni & Tykvová, 2015).

3.1.1 Direct vs. Indirect Public VC

Colombo, Cumming, and Johan (2014) offer one of Europe's most thorough examinations of public VC governance instruments. The study suggests indirect public VC outperforms direct VC in terms of firm growth, follow-on investment probability, and innovation output. These metrics are argued to stem from the incentives and the autonomy following indirect VC, thus contributing to more rigorous firm selection and active post-investment support. Grilli and Murtinu (2014) come to an equivalent finding in high-tech European firms. The study finds firms backed indirectly via public VC funds to increase their employment and sales significantly more than firms that are backed directly via public investments. These insights indicate that indirect models are more efficient at facilitating scale-up, particularly in competitive innovation sectors. In line with these findings, research by Colombo et al. (2014) show similar results, as the superior selection criteria of private VC funds, amplified by considerable incentives, leads to higher firm growth and innovation.

A study by Bertoni and Tykvová (2015) investigates biotech firms, focusing on the features of public capital. They observe that public VC increased patent output, but this effect was more pronounced when public investors co-invested with private VC. Based on the empirical results, the authors argue that while direct government VC may positively impact innovation, it should be embedded in hybrid governance models with private participation for effective outcomes. These insights are consistent with views supporting hybrid models in public finance, where funding is placed strategically and coordinated with other capital providers, not in isolation (Grilli & Murtinu, 2014).

Support for the significance of the governance type is also introduced in a study by Bertoni et al. (2015) where they find that in a sample of European startups, the ones backed by private VC exhibit stronger innovation performance and growth outcomes than those supported by direct or hybrid public VC funds.

3.1.2 Crowding and Signalling -Effects

Public investors can catalyse multifaceted effects through their investment decisions. As market-based operators can view the motivation and incentives of government-based investors contradicting the fundamentals of market efficiency private investors follow, an investment in a company by government can cause a crowding-out -effect that pushes private capital towards other targets (Guerini & Quas, 2016). In contrast, a capital investment in a VC fund can signal trust for the private market, enhancing the possibilities of the fund the raise the needed capital and execute underlying investments (Deleidi et al., 2020).

Examining Canadian data, Cumming and MacIntosh (2006) find that direct public VC can have the effect of crowding out private investment, particularly in a market where government actors are dominant or conduct investments without sufficient due diligence. The findings are aligned with research by Armour and Cumming (2006), where the study suggests effective legal and other institution frameworks are needed to prevent distortions when governments directly intervene in the equity markets.

On the other hand, indirect public VC may signal quality and attract subsequent financing. Analysing co-investment schemes in Europe, Guerini and Quas (2016) find that the hybrid governance structure of deploying both public and private capital is associated with superior performance and survival of the firm as compared to either public VC or private VC. The study implies blended funding structures with aligned incentives combine the strengths of public mission orientation and private sector efficiency, thus providing the best of both worlds. Aligning with the positive effects of cooperation, Bertoni et al. (2015) demonstrate how public VC investments that include private co-investors are prone to focus on later-stage deals and firms with greater growth potential. This complements the argument for co-investment schemes, where governance quality and private sector participation enhance additionality.

Deleidi et al. (2020) challenge the binary view of government investment either crowding in or crowding out private capital. They offer an empirical analysis across 17 countries and demonstrate that impact of public investment depends critically on the type of instrument and the market environment. Used alongside policy alignment and technology missions the study finds direct government investments contributing to substantial crowding-in effects. Their metrics show surprisingly positive effects, as the utilised model estimates that an increase of one unit in public investment can mobilize between 0.8 and 1.5 units of private investment, depending on national institutional quality and prior private sector involvement.

The study elaborates that the crowding-in effect was stronger in countries where public investment was targeted, stable, and embedded in a broader industrial strategy, reinforcing the idea that design and governance structure are key to signalling credibility to private investors.

3.1.3 Post-Investment Support

Another noteworthy factor in indirect public VC models is the post-investment support, often described as value-added services. The concept refers to the mentoring,

governance support, and access to strategic networks that come with private VC companies, as partners are usually sector-specialised professionals, or they hold valuable network connections with underlying characteristics. These fundamental utilities are persistent in the empirical literature, such as in the study by Kaplan and Strömberg (2004), where the authors show that a VC's control over a firm's decision-making contributes to growth and exit outcomes significantly, when investor incentives are effectively aligned.

Gompers et al. (2020) demonstrate these post-investment utilities through comprehensive metrics, where strategic guidance is among the most prevalent services provided by VC companies, with approximately 87% of actively engaging in strategic advising. Additionally, 72% facilitate investor introductions, and 69% provide customer networking opportunities. Authors continue to elaborate the hands-on approach VC professionals tend to have, as operational guidance is offered by 65% of VCs, while support in board recruitment and employee hiring is provided by 58% and 46%, respectively. These findings indicate the motivation VCs have for the deep dive to the fundamentals of business development instead of mere financial support.

In the cross-section of strategical and operational guidance, the innovation performance of startups is also shown to be affected by active VC guidance. Li and Zhao (2022) demonstrate how VC can significantly improve firms' innovation performance. They highlight that this effect is amplified with the increase in investment rounds.

However, post-investment value differs based on governance. Luukkonen et al. (2013) conduct a unique comparison between European public VC and private VC funds, where they find that private VCs provide post-investment services more intensely than public VCs. The study suggests that although public VC does help stabilize firms and to provide access to initial funding, it is less successful in enabling firms internationalize or raise further funding rounds, suggesting the presence of crowding-out effects. Results imply that direct public VC may not be sufficient to support startups in one of their crucial

elements, scaling ventures, especially given its lack of strategic and operational involvement.

Division in post-investment value is also addressed in a study by Köppl-Turyna et al. (2025), where the research demonstrates the superior effectiveness of indirect public investments over direct models. The paper finds that private VC funds perform constantly better due to their networks with strong track records, an asset which direct public VCs often lack.

3.2 Empirical Findings on Innovation Grants

Grants awarded to companies by public institutions are some of the most popular tools to enable early-stage firms to overcome financing constraints and promote R&D activity (Business Finland, 2025). Existing literature has established that grant funding programs can have a significant impact on business' innovation, employment and revenue levels if properly targeted (Hall & Lerner, 2010). Whether a grant is effective or not may depend on various factors like timing, firm characteristics and established policies (Aerts and Schmidt, 2008). One of the most fundamental questions in the conversation of public effectiveness is additionality, the concept that considers whether public support delivers resources or supports behaviour that wouldn't happen otherwise (Czarnitzki and Lopes-Bento, 2013).

3.2.1 R&D Activity and Innovation Output

According to numerous analyses, innovation grants for R&D by the public sector can boost companies' innovative capacity by leading to more patent applications, greater R&D intensity, and the launch of new products. Measuring patent applications and new product development, Czarnitzki & Lopes-Bento (2013) provide robust evidence on micro-level firm data from Flanders. Their findings offer solid empirical ground for research on innovation grants, as the results indicate that firms receiving public R&D grants exhibited significantly greater innovation output compared to similar firms without

subsidies. Critical for startups and companies aiming to scale globally, the paper concludes that public grants significantly improve firms' innovation persistence, enhancing their longer-term innovative capacity (Czarnitzki & Lopes-Bento, 2013). These findings form coherent and expected rationale for the utility startups can gain from receiving non-dilutive support.

Furthermore, Guerzoni and Raiteri (2015) provide robust arguments on behalf this rationale, as they conduct a European-level study, finding public subsidies to significantly increase firms' patenting and R&D expenditures. Their analysis demonstrates that this impact is particularly strong for SMEs, indicating how grants can effectively target financially constrained firms that demonstrate high innovation potential.

Finnish firms show similar characteristics in a quasi-experimental setup by Takalo et al. (2013). The study demonstrates that after receiving grants, firms' sales and patenting significantly increased especially when the firm subsequently acquired VC funding. This evidence indicates the interplay grants are part of in a nation-wide innovation system, where grants are most effective when used to complement private markets' capital.

Size is shown to be another factor in the effectiveness of public grant funding. Bronzini and Iachini (2014) find that early-stage startups receiving a public innovation grant are much more likely to utilise that funding for R&D activities in comparison to bigger companies, where grants tend to be used as substitutes for private R&D funding This highlights the reduced additionality and the need to aim and tailor grant schemes for effective results.

3.2.2 Firm Growth and Employment

Besides R&D outcomes, the effect of grants on the growth in firms' employment and sales has been recognized in existing literature. Research by Einiö (2014) illustrates significant positive employment growth and VC backing probability for firms with Finnish grant variations. The effect is particularly strong among innovative startups, suggesting

that well-targeted grants can become a gateway to financing and scaling up. Furthermore, Business Finland (2024) provides descriptive evidence of superior performance in turnover, employment, and value-added metrics of funded startups and scaleups compared to non-funded peers. The study demonstrates that funded scaleups show higher growth within 1–2 years after funding, and grant program participants showed signs of stronger internationalization and productivity in the long-term.

The complementary relationship between grants and private R&D funding is supported widely in research, as David et al. (2000) conclude in their wider meta-review of literature. However, they note that the estimates vary widely due to differences in measurement, sectors and the design of grants. According to a comparison of the grant programs in Germany by Aerts and Schmidt (2008), there is also heterogeneity in the additionality effects, implying that some firms significantly increase R&D due to the grant while others exhibit little change in behaviour.

More recent Finnish evidence by Hirvonen et al. (2025) finds that EU technology subsidies to manufacturing SMEs (1994-2018) boosted employment by 23 % without altering workforce skill composition, suggesting expansion rather than automation effects.

3.2.3 Additionality, Targeting, and Crowding Out

Most central conversations around non-dilutive funding are often related to additionality and targeting issues (OECD, 2020). The argument with additionality is that startups or other ventures that are on track to conduct certain activities that take the business forward and are financially capable to execute, should not be targets for innovation funding (Czarnitzki & Licht, 2006).

A foundational study on the crowding-out effect is by Wallsten (2000), where the author investigates the phenomenon in the context of the SBIR program in the U.S. The research provides evidence of crowding out, where each grant dollar appears to replace an equivalent amount of firm-financed R&D. The study underlines that firms receiving SBIR

funding were already R&D-intensive, complicating causal inference about whether grants prompt behavioural change or simply substitute for planned spending.

Meuleman and De Maeseneire (2012) examine whether R&D grants improve the access of startups to external finance, discovering that grants positively affect a firm's chances of acquiring a loan and creating debt capacity. However, when controlling for firms' stage and sector, the effect of grants on equity financing was not as pronounced. These findings support the view of grants opening new channels for financing is strategically deployed but also risk redundancy if misaligned with firm needs.

In the Finnish context, Business Finland's early-stage grants are allocated through a multi-phase evaluation process that assesses firm-level growth potential, financial credibility, and alignment with national strategic priorities. This structured approach reduces the risk of grant misallocation and supports innovation readiness even before market validation. (Business Finland, 2025).

3.3 Findings on Timing and Interaction

A large portion of the literature is analysing the impact of public funding programs in isolation. An emerging stream of work that is paying attention to timing and sequencing of the instruments is settling alongside this framework. The scope of research addressing this fundamental has important implications for layered innovation systems that aim to support firms during their lifecycle by combining grants, equity and others in a structured and stage-timed process (Magro & Wilson, 2019).

3.3.1 Timing of Intervention

As addressed in previous framework, the effectiveness of public funding depends greatly in timing (Aerts, Schmidt, 2008; Bronzini and Iachini, 2014). Grants at early-stage can enable firms to overcome initial financial and innovation barriers but can also fund non-viable ventures if not adequately screened (Busom, 2000; Wallsten, 2000). On the other

side of a VC investment, grants awarded after attracting market signal may be more effective, as they support firms with commercial validation (Howell, 2017).

Mistimed grants can make startups less prone for seeking private capital and more reliant on government assistance. Busom (2000) emphasises this critical aspect, arguing that if early non-dilutive support replaces competitive discipline, this exacerbates already-existing worries of crowding-out and rent-seeking behaviour. The study estimates that at least 30 per cent to 50 per cent of the firms that were awarded grants would have carried their R&D activities even in the absence of public support. This partial extra benefit may not be inefficient, but it raises questions about opportunity cost and policy design.

Howell (2017)'s analysis on the U.S. ARPA-E program offers insights into the timing effects of public grants relative to private investments. Using a regression discontinuity design, the study finds that public grants awarded after private VC investment led to significantly greater commercialization outcomes than grants awarded before VC. The paper argues that grants will have the most effective impact when they are granted to firms with market validation and viewed potential by private investors. These findings support the complementary role of a grant and mitigating adverse selection and maximizing marginal returns from grant deployment. This is consistent with Takalo et al., 2013, supporting Finnish innovation grants before as well as after VC. The paper establishes evidence of grants as early-stage and scaling accelerators, implying a sequencing advantage.

3.3.2 Layered Policy Systems and Complementarity

Guerzoni and Raiteri (2015) present a conceptual framework for policy mix inter-actions, distinguishing between supply-side tools (grants) and demand-side tools (procurement). Their study demonstrates how policy combinations with well-timed sequencing have a much bigger impact on innovation than stand-alone instruments, and the effect of

complementarity is strongest with different bottlenecks and different stages of the firms examined.

The distinction of the effectiveness in layered innovation systems is addressed in research by Lanahan and Feldman (2015), that studies U.S. company data. The study illustrates how U.S. states introduce matching and other complementary grant programs to the U.S. federal scheme serving same purpose and show that these state add-ons affect the grant program application activity and success. These methods underline the layered mechanisms of innovation policies, and the need for effective coordination.

Mazzucato (2016) argues the state must not just address market failures but also engage in shaping markets through a coordinated sequencing of policy instruments. Instead of addressing inefficiencies in innovation environments through pure funding, governments can take an active role and act as entrepreneurial agents, designing funding pathways for firms with transformational potential. This implies that the capability of guiding strategical proceeding by the government could positively contribute to innovation governance.

These institutional capabilities are addressed in a study by Uyarra et al. (2019). Their research argues that timing and layering of the support are objects for a lack of good administration, alignment of incentives and misalignment of evaluation, that can reduce synergy or create redundant support across funding agencies. In Finland's context, where Business Finland and Tesi each operate with their own logics and governance models, these questions are profound.

3.3.3 Interaction Effects Between Grants and VC

A growing portion of research shows that grants and public VC can reinforce each other when properly sequenced. Guerini and Quas (2016) study co-investment deals combining public and private VC and discover that public grants benefit the firm more when

they precede or succeed equity financing in a short timeframe. This finding adds to the smart layering execution, where grant support catalyses private investment or scales it.

The interaction is shown to be pronounced in R&D activities, as Hottenrott and Lopes-Bento (2014) demonstrate in their paper about public funding acting as a catalyst for private R&D investment. Their findings show that firms receiving public grants experience a subsequent increase in private sector R&D contributions. This indicates a significant crowding-in effect, reinforcing the complementary role of public and private funding.

Utilizing Finnish data, findings of Einiö (2014) align with covered theory. The study shows that firms receiving R&D subsidies are more likely to subsequently attract VC, while the interaction between the two forms of subsidy leads to greater long-term firm performance. The results indicate that funding layering works best when consistent with firm milestones and embedded in institutional logic that rewards follow-on financing.

Research by Czarnitzki and Lopes-Bento (2013) analyses micro-level data from Flanders and argues that firms receiving such public grants showed a higher R&D persistence and R&D output over time with more pronounced impact for public grants following an equity investment. The results imply public support provides high value for money when sequenced to support already vetted ventures.

Even with all this knowledge, very few empirical studies systematically examine the interplay between governance structure and grant timing. This thesis aims to address this gap directly. Most literature considers either timing or governance on their own without combining them to evaluate conditional effects on firm growth. The separated approach described leaves us questioning how varied types of public funding, introduced at different levels, affect the startup trajectory.

Adding to the understanding of public investment effects, Söderblom et al. (2015) analyse Swedish startups receiving early-stage public grants. The study shows that such grants have limited direct effects but rather contribute indirectly by signalling legitimacy, which improves access to financial and human resources. These findings highlight the importance of how public support is perceived and structured, providing value and effecting the growth of startups beyond the monetary face value of a support instrument.

3.3.4 Implications for Finland's Innovation System

Finland's innovation policy architecture is a compelling context for studying funding sequencing. The country has a long tradition of public grants (Business Finland) and equity financing (Tesi, ELY centers) that has evolved into a layered system to assist startups from ideation to internationalization. As Tesi's investment strategy is evolving to execute a significant increase in direct funding during the next five-year window, the complementary of these investments with grants raises questions of coordinated in timing and logic (Tesi, 2024). This puts Finland in a challenged place regarding the goal of optimizing the growth phase of companies aiming to scale globally, as the government must be in the right place at the right time for accurate capital and support allocation.

As covered earlier, Finland's track record shows challenges in scaling growth-ready companies. Autio (2009) argues this difficulty can be due to gaps in capital availability but also in misalignment in timing and governance across funding sources. This insight and possible implications reflect the core of market efficiency, which governments should aim for by filling the gaps at the right time and possibly stepping aside for private funding (Tesi, 2024).

3.4 Positioning of the Thesis

Earlier sections covered various empirical studies on the efficient use of public innovation grants, the institutional structures for public VC, and the timing of funding instruments within layered policy frameworks. Collaborative work on these separate topics

has matured considerably over the past decade. That said, an important gap in the literature still exists. A better understanding of governance and timing and how that interaction shapes outcomes, like startup growth in sales and employment would be useful.

3.4.1 Limitations of Existing Approaches

Public funding has been object for various topics throughout the field of research in finance. Across regions, diverse methodologies from difference-in-difference to regression discontinuity design have been applied to illustrate frameworks for the record of government intervention in the startup market. However, most of these studies have assessed the average treatment effect of innovation grants or public VC without distinguishing the role of governance structures or grant sequencing in a layered funding environment. Evaluations of grants tend to treat public funding as single contributions, not accounting for how its impact may depend on its position in a firm's funding trajectory (Howell, 2017; Czarnitzki & Lopes-Bento, 2013). The need for distinction between variations in public funding models rises also in the lack of analysis of public VC's interactions with other public funding instruments addressing innovation (Guerzoni & Raiteri, 2015).

3.4.2 The Research Gap

Building on covered theory and literature, this thesis addresses a clear gap in research on public startup support, which appears to be the evaluation of interaction effects. Whereas the significance of sequencing and layering is addressed fundamental factors in recent literature (Brown et al., 2017) few studies have investigated timing explicitly with the governance model of public VC. Differing in autonomy and benefits, these previously covered models of direct and fund-of-funds investments bring important depth to research aiming to cover longitudinal growth effects over cross-sectional or limited-period panel data. By leveraging a matched panel of Finnish startups across multiple years, this thesis incorporates both time variation and structural policy variation, enabling insights to fill the research gap.

4 Empirical Framework

This section outlines the data collection procedure, data sources, data organizing procedures, and variable definitions, followed by descriptive statistics and the empirical models applied to test the hypotheses.

4.1 Data

4.1.1 Data collection

The empirical analysis of this thesis is based on a panel dataset of Finnish start-ups, covering the period from 2015 to 2023, where data from various institutions and commercial establishments were merged to create a firm-level panel that could track the performance, VC rounds, and public grants over time. Every observation identifies a firm-year resulting in unbalanced panel of 3465 observations across 385 unique firms. The panel structure allows for intra-firm comparisons across time, enabling the identification of dynamic treatment effects associated with public venture capital and grant interventions. While the VC deal data spans 2015–2020, firm-level financials and grant exposure were collected from 2012 to 2023 to allow for a longer post-treatment observation window as well as earlier identification of grants received. This ensures sufficient time for the effects of VC investments and grant sequencing to have an effect in firm performance.

Data was collected from four main sources. Data on venture capital investments including company names, investment dates and investors participating in the funding round was collected from the dataset received from Finnish Venture Capital Association Only the first VC investment per firm was included to establish a coherent reference point for the grant data. The involvement of public VC in a funding round, either direct or indirect was identified from the VC deal dataset by checking if a Finnish public investor participated to the round with direct investment or it was an LP in a fund participating to the funding round through a fund-of-funds model. This classification enabled the

construction of governance-type indicators that reflect the institutional logic and incentive structures behind public capital deployment.

The original dataset from FVCA included only company names, which required matching these entities with national business identifiers to merge investment data with firm-level financials and grant records. The collection of these was conducted by running a batch search with the company names in the Valu8 database, which provides identification numbers and metadata for private companies. Where batch search was inconclusive, manual verification from the Finnish Business Information System was conducted to ensure accuracy in firm-level tracking.

Data on Business Finland's innovation and R&D grant programs were retrieved from Business Finland's public funding registry. The database includes project-level information on grant amounts, approval dates, and recipient firms. Using the national identifiers retrieved from Valu8 database, the timing and overall grant exposure for each company were matched to the original dataset. After recognizing the correct companies and respective identification numbers, company financials such as net sales, total assets and employee count along with industry classification numbers were retrieved from the Valu8 database.

The data collection procedure faced some challenges in terms of quality, particularly regarding missing values in the financial data retrieved from Valu8. To ensure maximal data completeness across the sample timeframe, a secondary matching was performed using the Orbis (Bureau van Dijk) database, from where missing firm-year observations were manually cross-verified and filled in where available.

The datasets were merged using automated and manual methods to ensure consistency and correct time alignment across funding and performance data. Only firms with sufficient financial reporting and observable VC or grant history were retained in the final sample. The resulting panel allows for year-by-year tracking of public interventions and

firm performance and is well-suited for fixed effects regression models that exploit within-firm variation over time.

4.1.2 Variables

The panel dataset for the empirical analysis contains outcome variables, and a rich set of explanatory and control variables to study the impact of underlying public financial intervention on startup growth. The key variables used in the analysis, their formal symbols, and a short description of how they were operationalized from their original data sources are listed in Table 1 below.

Table 1. Variable Descriptions

Variable	Sign	Description
Dependent variables		
(log) Sales	S	Natural log of sales each year
(log) Employees	E	Natural log of employee counts each year
Explanatory variables		
(log) Total Assets	LTA	Natural log of total assets each year
Direct VC	DG	1 = Firm funded by direct public VC in first funding round
Indirect VC	IG	1 = Firm funded by indirect public VC in first funding round
Private-only VC	PO	1 = Firm funded by only private VC in first funding round
Grant Before VC	GB	1 = Firm received a BF grant before first VC round
Grant After VC	GA	1 = Firm received a BF grant after first VC round
Grant After Direct VC	PG_DG	1 = Firm received a BF grant after direct public VC
Grant After Indirect VC	PG_IG	1 = Firm received a BF grant after indirect public VC
Grant Before Direct VC	PR_DG	1 = Firm received a BF grant before direct public VC
Grant Before Indirect VC	PR_IG	1 = Firm received a BF grant before indirect public VC
Firm Age	AGE	Firm age in years each year
IT Sector Firm	IT	1 = IT sector firm
R&D Sector Firm	RD	1 = R&D sector firm
Other Sector Firm	OT	1 = Another sector firm
Cumulative Grant After VC	CG	Total amount of grant funding after VC

All regressions have the natural logarithm of annual net sales and the natural logarithm of the number of employees as dependent variables. These growth measures are

standard in the empirical entrepreneurship literature (e.g., Coad et al., 2013; Haltiwanger et al., 2013). The log-transformation reduces skewness and permits interpretation of the coefficients in percentage terms. The explanatory variables fall into two main categories: the governance structure of VC and the timing of public grants. To capture the dimensions of public VC involvement, binary indicators for direct government venture capital and indirect government venture capital have been constructed, latter delivered via state-backed fund-of-funds programs. These variables are 1 for the whole panel data period of a firm with underlying governance structure.

Recent literature on innovation policy has prominently featured the sequencing of public and private investment, where the argument is that grant support after VC is a catalytic complement rather than a substitute (Howell, 2017). Aligning with prior research (Howell, 2017; Takalo et al., 2013), the thesis uses the approval date of grants as the timing reference. This reflects the moment when firms receive official commitment, enabling strategic planning and signalling to external investors.

The timing of grants in respect to first VC round received by a company is measured via two dummy variables. To investigate joint effects between governance models and grant timing, the analysis forms four variables to identify layered effects of intervention, where grants are provided before or after direct or indirect public VC. These variables contribute to the sequencing logic that is central to Hypotheses 2 and 3, allowing the analysis to evaluate how the order and governance in of public funding influence growth of Finnish startups. In the panel data, these six different dummy variables get the value of 1 from the year forward the underlying condition is filled, allowing for an examination of within-firm variations.

Firm age and size represent the main control variables, which are known predictors of growth paths and absorptive capacity for external finance (Haltiwanger et al., 2013). Additionally, the analysis recognizes 3 sectoral dummies: IT, R&D intensive and other

sectors to account for differences in innovation cycles and capital requirements across sectors.

4.1.3 Descriptive statistics

Table 2 presents descriptive statistics for the whole sample of variables included in the empirical analysis, where a set of Finnish startups received public grants between 2012 and 2023, and/or venture capital investments between 2015 and 2023. The variables signalling firm-level outcomes have fewer datapoints due to missing values or the lack of active years of companies. The firm-level dummies are established across the whole dataset, each as 0 or 1. These descriptive statistics help assess the variation in key variables and highlight the distribution of funding types and timing across the sample.

Table 2. Descriptive Statistics

This table presents descriptive statistics for the whole sample. Financial variables are in thousands of euros

	N	Mean	SD	Min	Max
Sales	3465	1215.43	800.15	1.00	2165
Employees	3465	75.41	52.33	1.00	134.00
Total Assets	3465	1472.96	859.91	1.00	2488.00
(log) Sales	2300	-0.38	2.26	-6.91	7.77
(log) Employees	2131	2.30	1.12	0.00	6.85
(log) Total Assets	2543	0.35	1.90	-6.91	7.13
Firm Age	3180	7.23	7.02	0.00	80.00
Direct VC	3465	0.16	0.37	0.00	1.00
Indirect VC	3465	0.33	0.47	0.00	1.00
Private-only VC	3465	0.50	0.50	0.00	1.00
Grant Before VC	3465	0.34	0.47	0.00	1.00
Grant After VC	3465	0.41	0.49	0.00	1.00
Grant Before Direct VC	3465	0.02	0.14	0.00	1.00
Grant After Direct VC	3465	0.13	0.33	0.00	1.00
Grant Before Indirect VC	3465	0.10	0.30	0.00	1.00
Grant After Indirect VC	3465	0.21	0.40	0.00	1.00
IT Sector Firm	3465	0.44	0.50	0.00	1.00
R&D Sector Firm	3465	0.08	0.28	0.00	1.00
Other Sector Firm	3465	0.47	0.50	0.00	1.00
Cumulative Grant After VC	3465	497	1956	0.00	34540

4.2 Methodology

To investigate the differences in VC governance and firm-level outcomes in Hypothesis 1, an ordinary least squares approach without firm-level fixed effects is deployed. To identify outcomes for H2 and H3, the analysis employs fixed effects panel regressions that leverage year and within-firm variation over time, thereby controlling for time-invariant heterogeneity across firms.

4.2.1 Panel structure and estimator

The dataset consists of company-level panels for the years 2015–2023. The panel includes 385 unique Finnish startups with a categorization of sources of funding including direct and indirect government venture capital and public grants. The unbalanced panel structure allows following firm trajectories over time, capturing both pre-treatment baselines and post-treatment dynamics.

The general approach for the empirical research relies on fixed effects to control for unobserved firm-level heterogeneity. Hypothesis 1 is an exception of this, as the variables determining the VC governance of the startup, *Direct VC* and *Indirect VC* denote the firm governance and are time-invariant for firms. To address this, a pooled OLS model with year fixed effects is deployed enabling the inclusion of these key variables. The estimation for hypotheses 2 and 3 is conducted by using firm and year fixed effects panel regressions, as they rely on within-firm variation in grant timing and its interaction with VC governance.

The general form of the fixed effects regression model is specified as follows:

$$Y_{it} = \beta_1 X_{it} + \beta_2 Z_{it} + \gamma_i + \varepsilon_{it}$$

Standard errors are clustered at the firm level to account for serial correlation and heteroskedasticity within firms over time.

4.2.2 Hypotheses and models

The study estimates three central hypotheses regarding the effect of public venture capital governance and grant timing on startup growth.

4.2.2.1 Hypothesis 1 (H1): Governance of Public Venture Capital Matters

H1: Startups backed by indirect public VC exhibit stronger growth than those supported by direct public VC.

To test this, the following model is estimated:

$$Y_{it} = \alpha + \beta_1 \cdot DG_i + \beta_2 \cdot IG_i + \gamma_1 \cdot AGE_{it} + \gamma_2 \cdot LTA_{it} + \delta_t + \varepsilon_{it}$$

Where:

- Y_{it} = Growth outcome variable for firm i in year t.
- DG_i = Dummy variable equal to 1 if the firm has received *direct* public VC investment, 0 otherwise.
- IG_i = Dummy variable equal to 1 if the firm has received *indirect* public VC investment, 0 otherwise.
- AGE_{it} = Firm age in years.
- LTA_{it} = Log of total assets, controlling for firm size.
- δ_t = Year fixed effects, capturing macroeconomic conditions and time trends.
- ε_{it} = Error term.

This specification distinguishes between the two forms of public VC allocation:

- Direct investments: Government organizations invest directly into startups (DG_i).
- Indirect investments**:** Government capital is channelled through private VC funds (IG_i).

The two dummy variables in the regression for direct public VC and indirect public VC reflect the difference in growth outcomes (e.g., log sales or employment) relative to the private-only VC firms. This separation of models is established with in prior literature, suggesting that the utility regarding governance mechanisms and e.g. the post-investment value from investor experience may differ significantly (Bertoni et al., 2015; Brander et al., 2015). One pronounced view is that direct public VC may lack the value-adding capabilities of private intermediaries, which can affect the strategic advancement of the firm and lead to different growth outcomes (Chemmanur et al., 2011).

Control variables include firm age and the logarithm of total assets, accounting for maturity and scale effects. No firm fixed effects are included, preserving variation in VC governance across firms.

4.2.2.2 Hypothesis 2 (H2): Grant Timing Influences Growth

H2: Startups that receive public grants after VC investment demonstrate stronger growth than those receiving grants before VC.

This is tested via:

$$Y_{it} = \alpha + \beta_1 GA_i + \beta_2 GB_i + \gamma_1 AGE_{it} + \gamma_2 LTA_{it} + \mu_i + \delta_t + \varepsilon_{it}$$

Where:

- Y_{it} = Growth outcome variable for firm i in year t.
- GA_i = Time-varying dummy equal to 1 from the first year in which the firm received a public grant after its first VC investment and in all subsequent years, 0 otherwise.
- GB_i = Time-varying dummy equal to 1 from the first year in which the firm received a public grant before its first VC investment and in all subsequent years, 0 otherwise.
- AGE_{it} = Firm age in years.

- LTA_{it} = Log of total assets.
- μ_i = Firm fixed effects, capturing unobserved, time-invariant firm characteristics.
- δ_t = Year fixed effects, capturing macroeconomic and time-specific influences.
- ε_{it} = Error term.

In the core of this model is the question of whether the timing of grants acts as a complement or substitute to VC funding. Literature suggests that grants issued after VC investment may amplify innovation outcomes due to stronger governance, greater legitimacy, and private market validation. (Howell, 2017; Czarnitzki & Lopes-Bento, 2014). On the other hand, grants received before any VC funding can serve as a signal of potential but may lack follow-on support. The hypothesis is tested using firm and year fixed effects to isolate the within-firm effects of grant timing.

4.2.2.3 Hypothesis 3 (H3): Governance Moderates the Effect of Grant Timing

H3: The effect of post-VC grants is stronger for firms backed by indirect public VC than for those backed by direct public VC.

This is estimated by:

$$Y_{it} = \alpha + \beta_1 PG\_IG_i + \beta_2 PR\_IG_i + \beta_3 PG\_DG_i + \beta_4 PR\_DG_i + \gamma_1 AGE_{it} + \gamma_2 LTA_{it} + \mu_i + \delta_t + \varepsilon_{it}$$

Where:

- Y_{it} = Growth outcome variable for firm i in year t
- PG_DG_i = Dummy equal to 1 from the first year the firm received a Business Finland (BF) grant after receiving direct public VC, 0 otherwise.
- PG_IG_i= Dummy equal to 1 from the first year the firm received a BF grant after receiving indirect public VC, 0 otherwise.

- PR_DG_i = Dummy equal to 1 from the first year the firm received a BF grant before receiving direct public VC, 0 otherwise.
- PR_IG_i = Dummy equal to 1 from the first year the firm received a BF grant before receiving indirect public VC, 0 otherwise.
- AGE_{it} = Firm age in years.
- LTA_{it} = Log of total assets.
- μ_i = Firm fixed effects.
- δ_t = Year fixed effects.
- ε_{it} = Error term.

This structure allows the analysis to test whether the growth effect of public grants depends on both their timing and the governance channel through which VC support is provided. Prior literature argues that the quality and intensity of post-investment support vary across governance models, and these differences can condition how public grants influence firm performance (Da Rin et al., 2011; Colombo et al., 2014). This approach also addresses the criticism that grant, or VC alone cannot explain growth outcomes, and thus tests whether grants are more effective when paired with indirect governance, or in a specific order.

4.2.3 Identification and Assumptions

To estimate the effect of public grants and VC on startup growth, the identification strategy implemented exploits within-firm panel identification strategy. Using a fixed effects panel regression model, the analysis controls for firm characteristics that do not vary over time and could otherwise bias coefficient estimate if correlated with treatment assignment. This method contributes to a more efficient isolation of the impact of public intervention, since it compares each firm to itself over time, whilst also considering the observed and unobserved heterogeneity that does not vary over time.

A major assumption of the fixed effects model is strict exogeneity, requiring that the idiosyncratic error term is uncorrelated with the explanatory variables and conditional

on the fixed effects and time-varying controls. Practically, a shock to firm growth in the future should not affect the current, or past receipt of grants or VC funding. While this this assumption is pronounced, it can be challenged in some cases, such as if grant funding is provided in reaction to firm underperformance. Establishing lagged treatment variable contributes to mitigating concerns over simultaneity and reverse causality to some extent, accommodating delayed causal pathways and reducing bias from reactive funding behaviour.

Another requirement is the absence of perfect collinearity. The fixed effects model, by eliminating time-invariant firm level components, cannot directly estimate variables that do not vary within firms over time, such as established governance structures or sectoral categories. Although the thesis does not utilize a formal difference-in-differences design, it assumes the fixed effects approach implicitly leans on a parallel trend's assumption. This relies on firms staying on detected trajectories over time in the absence of treatment.

Additionally, the analysis assumes the models used to test conditional effects have the correct interaction specification. In particular, the study assumes that the marginal effect of grant timing is modified linearly by the type of VC governance. This setup is established in heterogeneous treatment effect modelling (Angrist & Pischke, 2009) and reflects the policy logic that public funding operations depend not only on timing but also on the governance structure of the VC partner.

5 Results

Next the study presents the empirical findings based on the econometric framework covered in the previous chapter. The analysis aims to explain the characteristics of public support for startups through three hypotheses regarding governance type, grant timing, and the interaction of these factors.

To estimate the impact of public grant timing and VC governance on startup growth, OLS-based fixed effects panel regression models are deployed. The dependent variables are the natural logarithm of annual net sales and number of employees. Firm fixed effects are included to remove bias from unobserved time-invariant firm characteristics, and year fixed effects control for aggregate temporal shocks. Standard errors are clustered at the firm level, and both growth outcomes are measured in log-differences to capture proportional changes in firm performance over time.

5.1 Governance of Venture Capital

Table 3 presents the results testing Hypothesis 1. The key variables of interest are *Direct VC* and *Indirect VC*, which capture whether a firm received public VC directly from a government institution or indirectly through a government-backed private VC fund.

The estimates for *Direct VC* are negative both models (-0.234 for sales and -0.150 for employees) but surprisingly, statistically insignificant, considering existing theory and literature. These results indicate that receiving funding through either VC model is not associated with stronger growth in either sales or employment, compared to private-only funded startups. Although the sign hints at potentially lower performance compared to baseline, the effect is modest in size and imprecisely estimated.

The *Indirect VC* estimates show similar results for both models with near-zero and statistically insignificant effects on both sales and employment growth. This implies there

is no detectable effect on firm growth during the observed period with indirectly funded firms when compared to their private-only counterparts.

Firm age and *Total Assets* are consistently positive and highly significant, meeting the expectation that more mature and larger firms tend to exhibit stronger growth and employment. The R-squared values suggest that the model explains approximately 53% of the variance in both log sales and log employees.

The results lead to rejection of Hypothesis 1, as the findings indicate against the expectations that there is no significant difference in growth metrics between directly and indirectly funded startups.

Table 3. Public VC Governance and Startup Growth

	(log) Sales	(log) Employees
Direct VC	-0.234	-0.150
	(0.183)	(0.125)
Indirect VC	0.008	0.062
	(0.156)	(0.038)
Firm Age	**0.050*** **	**0.019** **
	(0.015)	(0.006)
(log) Total Assets	**0.812*** **	**0.449*** **
	(0.045)	(0.026)
Firm FE	No	No
Year FE	Yes	Yes
Observations	2287	1980
Adj. R^2	0.530	0.532
RMSE	1.536	0.764

* p<0.1, ** p<0.05, *** p<0.01

5.2 Grant Timing

Next, we'll cover the results for Hypothesis 2, which tests if the timing of support by public grant affects growth among Finnish firms that have received VC funding. The hypothesis suggests that grants received after VC funding are more effective in stimulating growth, as they scale up and complement private validation rather than substituting for early uncertainty (Guerzoni & Raiteri, 2015; Howell, 2017).

Table 4 presents the binary variables on grant timing introduced in previous sections. Here the main interest is if a firm received a Business Finland grant before or after VC funding, and wheatear this timing influences firm growth. The coefficient measures the average growth differential for firms during treated periods with respect to untreated periods, while controlling for firm size as well as fixed effects.

The results offer strong support for Hypothesis 2. Receiving a grant after first-round VC investment is significantly and positively associated with both firm sales and employee count. Specifically, firms that received grants after VC funding experience on average a 40.9% increase in log sales and a 15% increase in log employees, compared to firms that did not. The support for Hypothesis 2 is strong with both coefficients showing significance at the 0.001 level.

Conversely, the results indicate receiving a grant before VC funding is linked to statistically significant and negative effect regrading sales (−0.556, $p < 0.1$). The effect on employment is positive but insignificant. This suggests grants received before market validation may not adequately prepare firms for rapid commercial growth, and in certain cases, they may even limit their ability to scale. Discouraging private follow-on investment or postponing the market discipline imposed by equity investors might be possible factors for these findings.

These findings align with acknowledged theoretical frameworks and existing literature, where post-VC grant allocation is argued to leverage existing investor validation and

sector-specialized governance, thus facilitating more productive use of public funding (Howell, 2017; Czarnitzki & Lopes-Bento, 2014).

Table 4. Grant Timing on Startup Growth

	(log) Sales	(log) Employees
Grant Before VC	**-0.556***	0.126
	(0.272)	(0.114)
Grant After VC	**0.409*****	**0.150*****
	(0.092)	(0.047)
(log) Total Assets	**0.584*****	**0.317*****
	(0.054)	(0.034)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	2287	1980
Adj. R^2	0.847	0.849
R^2 (within)	0.222	0.256
RMSE	0.777	0.403

* p<0.1, ** p<0.05, *** p<0.01

5.3 VC Governance and Timing of Grants

Having shown that grant timing matters, the next hypothesis illustrates whether its effect depends on the governance structure of the VC received. Hypothesis 3 posits that the impact of public grant timing on growth is conditional upon whether the firm was backed by direct or indirect public VC**.** To examine this, the study utilises four interaction dummies, allowing to distinguish how different combinations of public support influence firm outcomes.

Table 5 reports the fixed effects regression results for H3. The findings show varying effects on VC governance and grant timing. *Grant After Indirect VC* is positive and statistically significant for employment (0.124, $p < 0.1$), indicating that hiring can be effectively

increased by layered public support after indirect VC participation. For sales, the results show no statistical significance albeit positive coefficient.

The other three interaction variables show no statistical significance for either outcome. *Grant Before Direct VC* and *Grant Before Indirect VC* exhibit negative but non-significant correlations with sales, whereas *Grant After Direct VC* has a near-zero effect on sales and very little effect on employees. This aligns with earlier findings that the governance of direct VC does not generate substantial growth benefits even when combined with public grants.

The results support Hypothesis 3 partially. Findings indicate that there may be governance and complimentary support from the privately managed VC funds, that enhance the effectiveness of subsequent public funding, particularly in scaling workforce size. The interaction between grant timing and VC governance appears to matter for employee growth, when grants are awarded after indirect public VC funding. This aligns with theory and literature covered as indirect VC pathways exhibit more robust synergies with public grant timing than direct VC channels.

Table 5. VC Governance and Grant Timing

	(log) Sales	(log) Employees
Grant After Direct VC	-0.002	0.051
	(0.208)	(0.084)
Grant Before Direct VC	-0.240	-0.048
	(0.299)	(0.208)
Grant After Indirect VC	0.193	**0.124***
	(0.160)	(0.061)
Grant Before Indirect VC	-0.096	0.242
	(0.240)	(0.129)
(log) Total Assets	**0.568*****	**0.311*****
	(0.054)	(0.311)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	2287	1980
Adj. R^2	0.843	0.849
R^2 (within)	0.203	0.257
RMSE	0.813	0.396

* p<0.1, ** p<0.05, *** p<0.01

5.4 Robustness Checks

To test the robustness of the core results, the study estimates alternative model specifications that account for timing, magnitude, and sectoral heterogeneity of grants. These additional regressions help validate the stability and credibility of the main findings.

5.4.1 Lagged Grant Timing

To assess whether the effect of public grant funding emerges with a delay, a one-year lag for the *Grant After VC* variable used in Hypothesis 2 is formed. This addresses the possibility that grants can take time to demonstrate effectiveness in firm performance and

growth. This delay is standard in innovation-driven sectors where investments in R&D, hiring, and marketing do not yield immediate returns (Czarnitzki & Lopes-Bento, 2013).

Table 6 presents the results for the lagged specification. The findings offer partial robustness for Hypothesis 2, as the lagged grant treatment is associated with a 27.5% increase in sales, whereas a 7.4% increase in employees is statistically insignificant. This could suggest that whereas the positive effects of public grant support on sales are not immediate but persist over time, job creation may take longer to materialize or is less sensitive to grant timing than revenue generation.

Table 6. Robustness Check: Grant After VC (t+1)

	(log) Sales	(log) Employees
Lagged Grant After VC	**0.275****	0.074
	(0.087)	(0.048)
(log) Total Assets	**0.573*****	**0.325*****
	(0.054)	(0.033)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	2296	1989
Adj. R^2	0.845	0.848
Within R^2	0.207	0.248

* p<0.1, ** p<0.05, *** p<0.01

5.4.2 Grant Intensity

To elaborate the effects of public grants beyond timing, the study explores if the magnitude of grant support after VC matters. To test this, the *Grant After VC* dummy is paired with an indicator measured as the cumulative amount of grants received after VC funding. The interaction term allows to examine whether the complementary effect of grants after VC correspond with firm performance.

The results are presented in Table 7 below. The dummy variable for receiving a grant after VC remains strongly significant for both sales (0.427, $p < 0.01$) and employment (0.145, $p < 0.01$), indicating that timing of grant funding indeed matters. Conversely, for both outcomes, the coefficient for the cumulative grant amount following VC is statistically insignificant (−0.014 for sales and 0.120 for employment). These findings imply that obtaining a grant following VC, regardless of its magnitude, leads to significant growth impacts. This may indicate declining marginal returns to public capital or indicate that the timing the grant and signalling value are more significant than its actual amount.

Table 7. Robustness Check: Grant Intensity

	(log) Sales	(log) Employees
Grant After VC	**0.427*** **	**0.145*** **
	(0.093)	(0.047)
Cumulative Grant After VC	-0.014	0.120
	(2727)	(5928)
(log) Total Assets	**0.562*** **	**0.321*** **
	(0.054)	(0.033)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	2296	1989
R^2 adj.	0.847	0.849
R^2 (within)	0.217	0.254

* p<0.1, ** p<0.05, *** p<0.01

5.4.3 Sectoral Heterogeneity and Firm Age

The final robustness test for Hypothesis 2 examines if the industry or age of a firm matters in terms of the effect of grant timing on both sides of VC funding. by incorporating controls for firm age and sectoral heterogeneity (IT and R&D sector dummies).

Results show that *Grant After VC* remains positive and statistically significant on employee growth (0.163, $p < 0.1$) but negative and insignificant on sales growth. Either of

the outcomes is significant for *Grant Before VC. Total Assets* and *Firm Age* behave as expected, both positively associated firm outcomes, as bigger and more mature firms show stronger growth trajectories.

Table 8. Robustness Check: Sectoral Heterogeneity and Age

	(log) Sales	(log) Employees
Grant After VC	-0.078	**0.163***
	(0.148)	(0.082)
Grant Before VC	-0.137	0.142
	(0.125)	(0.078)
(log) Total Assets	**0.812*****	**0.445*****
	(0.043)	(0.027)
Firm Age	**0.046*****	**0.019*****
	(0.013)	(0.006)
IT Sector Firm	0.179	0.132
	(0.129)	(0.079)
R&D Sector Firm	**-1.166*****	**-0.315***
	(0.319)	(0.146)
Firm FE	No	No
Year FE	Yes	Yes
Observations	2287	1980
R^2 adj.	0.550	0.553
R^2 (within)	0.521	0.532

* p<0.1, ** p<0.05, *** p<0.01

6 Conclusion

This thesis investigates the role governance and timing play in public support aiming to foster startup growth in Finland. Particularly, the study focuses on the two governance models of public venture capital, direct and indirect, and the timing of non-dilutive grants related to a VC investment and underlying governance. Established literature persistently challenges the logic of government intervention and offers multifaceted conclusions regarding the governance models in public investments. Furthermore, rationales for public grants before and after market validation strengthen the need to examine the interplay of these instruments in layered innovation systems with significant public involvement.

Recognizing the research gap in established literature, the thesis examines the evolving state of public intervention in Finland. Changes in the mandate of the private equity and VC arm for the Finnish government, Tesi, offer an optimal environment to investigate the effectiveness of different investment models and their interplay with non-dilutive grants. To illustrate the effects of these distinct financing instruments in a layered innovation system, the study utilises a comprehensive panel dataset conducted of multiple sources, that covers VC investments in Finland between 2015 and 2020, Business Finland grant data from 2012 to 2023, and firm-level financials as well as the distinction between governance models of public investments in funding rounds.

The empirical research of the paper builds on this setup, testing three hypotheses that utilise variables constructed from investment governance and grant timing data. Specifically, the analysis focuses on revenue growth and changes in employee count, examining how governance structures and timing of grant funding influence these outcomes. The results provide nuanced evidence on the unique setup, covering the interplay of timing and governance for the first time in established literature.

Against expectations, Hypothesis 1 is not supported as the estimation shows no evidence on the significance of the indirect governance model. The results contradict previous

literature, for example the findings of Köppl et al., (2025), that show European indirect government models yielding superior growth over the direct model. One plausible explanation for the absence of significant results in the Finnish context is the relatively small scale and concentrated nature of the domestic VC market, which may reduce observable performance differences between governance structures.

The second hypothesis is strongly supported. Receiving a grant after securing VC funding yields significantly stronger revenue and employee growth outcomes for a startup compared to receiving a grant before VC funding. This is aligned with work by Howell (2017), that shows grants received after market validation in the U.S. to be more efficient in deployment, as established investor governance reinforces scaling and commercialization. Covering Finnish-only startups, acknowledgement of differences in institutional design is needed when reflecting the results to the broader field of research. For example, the federal systems in the U.S. significantly affect the way governmental bodies engage in VC investments, as responsibilities and funding mechanisms are often decentralized to state-level agencies. This results in heterogeneous program objectives, evaluation criteria, and investment strategies across jurisdictions (Lerner, 2009).

Hypothesis 3 is partly supported. The interaction variables showcasing the governance and timing show that when grants are deployed after indirect public VC, the effect on employee growth is significantly stronger than other governance-timing combinations. While results on revenue growth remain unsignificant, the established view on the indirect model's utilities can explain the hiring capabilities that come with investments governed through private VC companies and their networks (Bertoni & Tykvová, 2015).

6.1 Policy Implications

This thesis and the empirical findings offer information and implications for developed economies with Finnish-like innovation ecosystems, where the need for public support is addressed through various instruments. Most importantly, the thesis underscores the importance of coordinated sequencing grants and VC investments, as they can reinforce

each other if deployed correctly. Additionally, the non-dilutive grant support mechanisms should not only focus on the early stage of a company's lifecycle but provide scaling capital at critical post-investment inflection points. This post-investment grant support can be especially effective when deployed to a company with indirect governance, as the private-led VC funds can yield superior results when it comes to leveraging available assets.

In Finnish context, where the innovation-intensive ecosystem often fails to scale companies internationally, any support in the "Death Valley "-phase can crucial. However, the shift in Tesi's mission to deploy increased amounts of capital directly to growth companies, particularly for the purpose of successful scaling, can diminish the significance of grant funding. In any case, the coordination between government agencies must be efficiently executed, not only to foster innovative entrepreneurship but to optimize the funding decisions across instruments.

6.2 Limitations

While the panel dataset enabled a robust empirical analysis, several limitations should be acknowledged. First, as the analysis focuses on early-stage companies, patent data and qualitative innovation metrics would have served the study greatly but were excluded due to data constraints. This limits the scope of innovation measurement to financial performance indicators, which can be irrelevant metrics for innovative or research-intensive ventures that tend to show growth in financial figures after multiple years of product development, clinical trials, or other long-term R&D activities. Second, causality remains an issue despite of fixed effects, as unobserved heterogeneity might distort the results.

Furthermore, the data only includes companies with VC funding. Thus, the effectiveness and subsequent outcomes on financial variables of a pre-VC grant must be interpreted with caution, as the sample excludes firms that may have received grants but never

attracted VC, potentially biasing the estimated effects toward more growth-oriented or investment-ready companies.

6.3 Future Research

A clear avenue for future research on governance and timing factors is the integration of patent and other intellectual property data. Such approach would provide more robust analysis on the essence of startups, capturing their innovative capacity and long-term value creation beyond employment and revenue metrics.

A qualitative approach to the governance model and grant funding decision-making processes could serve the field of research greatly. Authentic views of government officials could bring understanding not only to the human factor behind decisions but also to the level of coordination between government agencies. Additionally, interviews with private VC professionals could provide objective analysis on the effectiveness and cooperation utilities with public entities and their funding instruments.

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Appendices

Appendix 1. Number of firms by VC funding type

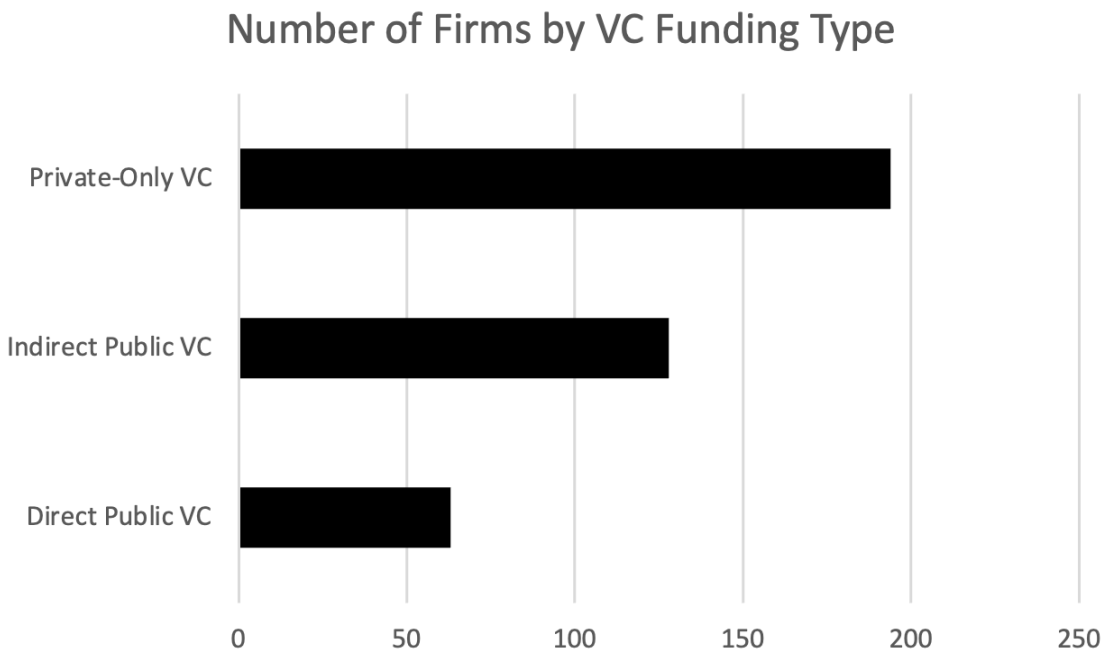

Figure 2. Number of Firms by VC Funding Type