Public Funding for Entrepreneurs: What Works Best?*

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Abstract

Using Norwegian administrative data on the population of entrepreneurial firms, I simultaneously compare three public financial support instruments—equity, loans and grants— in a unified setting. I find that public support, regardless of type, increases firm investments by 20%. Revenues increase twice as much after a firm receives a loan as after it receives a grant, implying the financial instrument incentives channel drives the effect of loans. Public equity operates through the certification channel resulting in an increase in firm market capitalization by 36% on the extensive margin only. These findings have direct implications for policymakers weighing alternative policy designs.

Keywords: entrepreneurship, government policy, public funding, firm performance
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1 Introduction

Entrepreneurship generates various economic benefits and catalyzes economic growth and innovation. The supply of financing to entrepreneurial ventures is, therefore, essential for the entire economy. Part of the difficulty entrepreneurs face in raising capital relates to information frictions and moral hazard (e.g., Admati, Pfleiderer, and Zechner, 1994): It is challenging for outside lenders and investors to distinguish potentially successful business proposals from less promising ones, which might lead to market imperfection in the form of private underinvestment in entrepreneurial firms. To correct such private investment distortions, policymakers intervene directly in the entrepreneurial process with various public funding policies (e.g., Lerner, 2009; Bai, Bernstein, Dev, and Lerner, 2021). Policymakers make multiple, interrelated policy design choices when establishing a funding program: what its specific objective should be, whether they should allocate money directly to entrepreneurs or to financial intermediaries investing in entrepreneurial firms, which financial instrument they should use, and what funding amounts should be provided. These questions are highly germane as many governments worldwide revisit their industrial and innovation policies, yet relatively little is known about how to best design such programs.

To answer these questions, this study compares, in a unified setting, the relationship between three main government support mechanisms and firm-level outcomes. This approach contrasts with the dominant one in prior studies in the empirical scholarship on this topic, which has focused on identifying the causal effect of one type of policy lever at a time. I exploit unique and highly detailed administrative data from Norway on the entire population of firms and simultaneously compare grants directly provided to entrepreneurs (DE grants) to loans directly provided to entrepreneurs (DE loans) and to equity provided through financial intermediaries, namely, government venture capital (VC) funds (FI equity). The firm-level data allow me to evaluate four dimensions of (within-) firm outcomes that arguably are

of first-order interest to policymakers and are key objectives of any program seeking to foster innovation and entrepreneurship: (1) innovation output, (2) employment, (3) firm operations, and (4) market capitalization.

Empirically estimating the causal effects of any entrepreneurship support program poses well-known challenges. Most notably is that firms nonrandomly select into applying for and receiving funding. Unobservable factors on the funding provider side, such as government priorities for certain industries or firms, may also introduce selection bias. Finding exogenous variation in funding support to address these concerns is notoriously difficult, and beyond this challenge that studies of any single program typically face, disentangling the effects of multiple coexisting programs is difficult when firms receive more than one type of funding. I perform a number of econometric exercises to increasingly reduce the potential for selection bias and run an enhanced matching staggered difference-in-difference approach with firm, firm age and calendar year fixed effects (Angrist and Pischke, 2008). While the firm fixed effects take care of firm-specific time-invariant characteristics, I control for the firm–year levels of private financing (VC equity, non-VC equity and bank loans) to proxy for time-variant firm characteristics that are unobservable in the available data but are observable to private investors and lenders, who make informed investment and lending decisions. Controlling for the levels of private financing is also important given that the government's decision to provide public funds also frequently depends on the amount of private financing available to the firm.

The enhanced matching starts with the core idea in Guzman and Stern (2015) and Guzman and Stern (2020) that entrepreneurs make choices at the time of firm inception based on their ambitions and expectations, which then predict actual firm performance. I identify all firms with high innovation potential (Andrews, Fazio, Guzman, Liu, and Stern, 2022; Kisseleva, Mjøs, and Robinson, 2024) that are founded during the same time period

and fall within the scope of the government's interest in fostering entrepreneurship but receive solely private financing. Next, I combine elements of the synthetic control (Abadie, Diamond, and Hainmueller, 2010) and the least threshold distance (Breuer, Hombach, and Mller, 2018) methods and calculate the "total distance" between each publicly funded firm and each privately financed firm founded in the same year. To do so, for every pre–public funding calendar year, I calculate the absolute difference ("distance") in each of six outcome variables of interest (patent applications, intangibles ratio, total labor expenses, total operating expenses, total revenues and firm equity market value), in the levels of private VC equity, private non-VC equity, and (private) bank loans and in total assets. I sum up the individual variable-level "distances" across all ten variables and all pre–public funding years to calculate the pre–public funding total distance and keep only the privately financed firm with the least total distance as the matched control firm.[1]

I expect four channels to interplay here. First, FI equity, DE loans and DE grants all reduce financing constraints and should all facilitate firm outcomes to the same extent per invested dollar through the liquidity channel. Second, through the certification channel, receipt of funding conveys the firm's quality to its stakeholders, which in turn affects firm outcomes. The strength of this channel depends on the perceived selection ability of public fund allocators. Given their expertise, the professional investors who manage FI equity are arguably better than the government employees who provide DE grants and loans at solving adverse selection challenges in identifying promising firms (e.g., Brander, Du, and Hellmann, 2015; Hellmann and Thiele, 2019). Third is the financial instrument incentives channel. Grants represent "cheap" money with no conditioning on milestones or repayment obligation, so the opportunity cost of either careless or risk-driven misallocation of DE grants is relatively low. The opportunity costs of misallocating DE loans and FI equity are higher

[1]In cases where more than one matched firm results, which happens only if the total distance is zero, I pick a control matched firm randomly.

because of their associated repayment obligations and requirements to meet milestones to attract further (government) VC financing, respectively, such that the incentives attached to each financial instrument type affect firm outcomes. Fourth is the monitoring channel. DE grants and DE loans involve only provision of funds, with the government employees who make the funding decisions not themselves involved in firm operations. In contrast, beyond simply supplying liquidity, the general partners (GPs) of government VC funds monitor and provide value-adding services and, thus, have a VC treatment effect on firm outcomes (e.g., Bernstein, Giroud, and Townsend, 2016; Hellmann and Thiele, 2019).

After it receives public funding of any type, a firm's overall investment activity increases on average by approximately 20%, resulting in a positive effect on both employment and firm operations. On the intensive margin, each additional dollar (or, rather, Norwegian kroner) increases the firm's investment activity to a similar extent. This is consistent with the liquidity channel, whereby public funding alleviates financing constraints by providing financing that would not be available otherwise. This result is not simply attributable to an immediate, short-term increase in the year of provision or the year after. The analyses reveal positive and statistically significant short- and long-term increases in total revenues when public funds are directly provided to the entrepreneur but only a long-term increase for firms that receive FI equity. The latter is consistent with the evidence that the early-stage firms that attract (government) VC financing engage in a higher degree of experimentation, i.e., more (R&D) investment activity without revenue generation (Kerr, Nanda, and Rhodes-Kropf, 2014).

In the long run, total revenues increase by 42.1% after a firm receives FI equity, an effect of almost the same magnitude as the 46.8% increase among firms that receive a DE loan and twice the size of the 20% increase among firms receiving a DE grant. The larger increase after receipt of FI equity or a DE loan may be attributable either to the financial instrument

incentives channel, which describes how such funding types may give the entrepreneur greater incentives to successfully commercialize her project, or to the certification channel, whereby receipt of public funding flags the entrepreneur's superior quality and allows her to better position herself in the product market. On the intensive margin, an additional dollar of a DE loan again is transformed into twice as much revenue as an additional dollar of a DE grant. This elastic increase is consistent with the the financial instrument incentives channel dominating the certification channel in the effect of DE loans. I do not observe such an elastic increase for each additional dollar of FI equity, suggesting that the certification channel might be more influential for firms receiving this type of funding.

Indeed, receipt of FI equity sends a strong positive certification signal to the private capital markets, which is associated with an average increase of 36% in the firm equity market value. When I estimate the effect of the public funding amounts on firm market capitalization, the joint F-test rejects the null hypothesis that differential amounts coming from different public funding sources have a different effect on the firm equity market value. This result shores up the interpretation that the certification channel is determinant: What matters to private investors is the fact that government VCs invest in the firm, not how much. If the monitoring mechanism were at play, we would expect to observe an elastic increase with each dollar provided, as GPs should be more willing to increase their involvement when the provided financing amount is higher, which, in turn, would lead to a higher market capitalization. The effect of funds provided directly to entrepreneurs does not work through the certification channel: The magnitude of the effect on firm equity market is comparably very low for DE grants (an increase of 1.3%) and nonexistent for DE loans (near zero and statistically nonsignificant).

As a robustness check, to avoid mutual contamination of the estimates in the staggered difference-in-difference model, I estimate heterogeneous treatment effects as proposed by

Sun and Abraham (2021). Estimating this model requires that the underlying subsample of publicly funded firms (and their matched counterparts) receive public funding solely from one source (DE grant *or* DE loan *or* FI equity) and do so after their year of inception. The results yielded by this exercise on employment, firm operations and market capitalization remain qualitatively unchanged, suggesting homogeneity in the effect of public funding on these firm outcomes. However, DE grants have a heterogeneous, positive and continuously increasing effect on the number of patent applications. This result connects to the finding in Howell (2017) that grants enable the firm to invest in reducing technological uncertainty, resulting in higher innovation output.

Are the various policy designs substitutes for each other, or do they represent tools that are differentially appropriate for supporting firms with different business models or at different stages in their lifecycles or, more generally, for achieving different policy goals? Cross-sectional analyses reveal that public equity provided through intermediaries seems to complement funds provided directly to entrepreneurs. Specifically, policymakers might prefer FI equity if they want to promote growth in already profitable firms or stimulate private capital markets by increasing the market capitalization of financially struggling firms and firms facing high uncertainty. On the other hand, policymakers might consider programs providing funding directly to entrepreneurs to be substitutes for each other when the aim is to foster innovation output and/or investment activity in the firms with the most innovation potential, the firms facing uncertainty and/or financing constraints and the firms that contribute the most to job creation. Policymakers might prefer DE loans over DE grants because loans are supposed to be repaid to the government while grants are essentially free money. An additional benefit of DE loans and of the associated repayment obligation is their positive effect on revenues in these firms, which stimulates product commercialization.

The approach in this paper diverges from the common one in prior studies—namely,

that of evaluating individual programs in isolation. While some studies of this kind find positive effects of programs providing funds to entrepreneurs directly (e.g., Jones and Williams, 1998; Lerner, 1999; Howell, 2017; Azoulay, Graff Zivin, Li, and Sampat, 2018; Zhao and Ziedonis, 2020; Tian and Xu, 2021), others find no evidence of such effects (e.g., Wallsten, 2000; Gans and Stern, 2003; Lee, 2018). For programs providing funds through financial intermediaries, Leleux and Surlemont (2003) provide evidence that the participation of government VCs attracts investment to the industry as a whole. Brander, Du, and Hellmann (2015) show that this additional investment has a positive effect on firm exits. In the angel investment context, Denes, Howell, Mezzanotti, Wang, and Xu (2020) confirm that angel investor tax credits increase angel investments. However, they find no significant effect on state-level entrepreneurial activity. At the micro level, Alperovych, Hübner, and Lobet (2015) provide evidence that government VC–backed firms are less efficient than both private VC–backed and non-VC-backed firms.

In contrast, this paper argues that governments do not make decisions on the establishment or allocation of budgets to programs in isolation but rather take into consideration trade-offs between programs of various designs. Thus, this paper contributes to the scarce literature on the interplay of (entrepreneurship) policies. Hellmann and Thiele (2019) theoretically evaluate several policy designs and conclude that funding subsidies—as opposed to founding-related subsidies and incentives—are the optimal policy. My paper ties into this literature stream in that it compares various policies allocating government money to entrepreneurs. The most broadly related paper is that of Pless (2020), who analyzes the interdependency of direct R&D subsidies and tax incentives. She finds that these are complements for small firms but substitutes for larger firms and that this subsidy-interaction effect improves firm productivity. My paper evaluates direct funding as opposed to indirect R&D subsidies and tax incentives, which, arguably for the most part, have no immediate

effect on young firms with negative earnings or no eligible R&D activity.

The rest of this paper is structured as follows. Section 2 describes the institutional background, data and sample selection. Section 3 describes the empirical strategy. Section 4 provides the results of the analyses, while Section 5 concludes.

2 Institutional Background, Data and Sample

2.1 Institutional Background

The Norwegian government is the forerunner among all developed countries in terms of general government spending per capita (see Figure A1), which makes Norway an ideal country setting in which to simultaneously evaluate various policy designs. Although Norway is a small country in terms of population, its economic structure and the relative importance of its private capital markets are similar to those of other advanced Western economies (see Figure A2). Thus, it is reasonable to expect that lessons learned from Norway can be generalized to other economic settings.[2]

I evaluate three public funding instruments established at the national level, with a focus on financing domestic entrepreneurial firms directly or through a financial intermediary: grants made directly to entrepreneurs (DE grants), loans made directly to entrepreneurs (DE loans), and equity provided through financial intermediaries—government VC funds (FI equity).[3] The government agency Innovation Norway's DE grants are supposed to provide entrepreneurs with critical liquidity for innovative products that do not exist in the market.

[2]Further background on the Norwegian innovation system, startups and VC market can be found in Hvide and Jones's (2018) Appendix V and Kisseleva, Mjøs, and Robinson (2024).

[3]I do not evaluate R&D subsidies as a separate program because they are provided as tax relief to all firms in Norway and, for the most part, have no immediate effect on young firms with negative earnings (e.g., Färnstrand Damsgaard, Hjertstrand, Norbäck, Persson, and Vasconcelos, 2017; Nilsen, Raknerud, and Iancu, 2020; Pless, 2020).

A numerical algorithm assigns applicants a score based on their financial information. Applicants are automatically ineligible for the grant if their score falls below a predefined score threshold, while approval for firms above the threshold is based on a positive qualitative judgment. This program design is similar to that of the Small Business Innovation Research (SBIR) Phase I R&D grants, described in Howell (2017). The same government agency awards DE loans to entrepreneurial firms that are unable to finance innovative projects through bank loans on regular terms. Neither DE grants nor DE loans are tied to specific conditions or requirements to spend the provided public funding on wages or other specified expenses (as is the case, for example, in Sweden or Germany). FI equity is provided to entrepreneurs through government-supported and government-owned VC funds (see Brander, Du, and Hellmann, 2015). Government VC funds are managed by private equity professionals and invest on the same terms and conditions as private VCs, with the stated exit strategy for each investment. The government's objective is to offer better capital access for innovative Norwegian firms and stimulate the private capital market to provide equity to these firms. The annual budget proposals for DE grants and DE loans are made by the Ministry of Trade, Industry and Fisheries, while the budget is approved by parliament. These are nonrolling annual budgets, which implies that the allocated budget is spent in that particular year. Similarly to the directly provided funding, the establishment of and allocation of capital to the financial intermediaries (government VCs) that administer public equity are based on annual budget proposals from the Ministry of Trade, Industry and Fisheries and are approved by parliament. The allocated government capital is made partially available for investments upon the signing of a contract with the government VC management firm and partially in tranches on call.[4]

[4] A time-series overview of the government capital supply into these three programs and its interrelation with total government expenditures and economic conditions can be found in Tables A1 and A2.

2.2 Data and Sample Description

Norwegian administrative data are recognized for their quality and detail and have been used prominently in research in labor economics, finance and innovation (among the most recent examples, see Meling, 2021; Fagereng, Mogstad, and Rønning, 2021; Ring, 2023). I base my analyses on comprehensive micro-level administrative data provided by the Norwegian tax authority and the government innovation agency Innovation Norway. I identify *all* Norwegian firms that directly received public funding (DE grants and DE loans) in the overview provided by Innovation Norway. My main data source for identifying *all* firms that receive FI equity is the annual tax declarations of the population of Norwegian public and private limited liability companies and their shareholders. Their equity transaction records include all share purchases, sales, and liquidations by all investors in all firms in Norway as reported to the tax authority for the purpose of calculation of the wealth tax. The ownership relationship allows me to identify government (VC) investors, while the purchase dates, transaction amounts and number of shares transacted allow me to calculate the firm-level market equity value for every firm from its inception. I calculate the firm's market equity value as the number of shares outstanding at the end of each calendar year multiplied by the most recent share price in a financing round or a secondary purchase (from existing investors) as reported to the tax authority. The tax transaction records and Innovation Norway overview also include a unique national firm identification number (*organisasjonsnummer*); this is allocated to all firms registered in Norway and to foreign institutional shareholders of these firms. The firm identification number is consistently used in all firm registries and allows the data to be merged to financial statements, business registry data, and patent data obtained from the Norwegian patent office.

The sample consists of 1,751 firms founded between 2004 and 2017 that received public funding in the period 2004–2018. FI equity was allocated 349 times through government VCs

to 125 firms during this period, while DE grants and DE loans were provided 1,692 times to 1,255 firms and 656 times to 588 firms, respectively. Thus, 12% of the sample firms received funding multiple times and from different sources. This implies that the programs cannot be evaluated in isolation for every firm in the sample. Figure 1 shows the distribution of each public funding type across the sample firms. Approximately 80% of the firms receiving public funds of multiple types received both a grant and a loan provided directly to the entrepreneur.

Insert Figure 1 here.

Table 1 describes the sample firms in the year that they first received public funding and in the year prior to its receipt, if the relevant data are available. It reveals that all three programs target entrepreneurial firms at the very early stage. FI equity is provided at the earliest age (median of one year old), while DE loans are provided latest, at the median age of three years, and DE grants in between, at the median firm age of two years. DE grants offer the smallest public funding amounts, in both median and average terms, while the FI equity investment amounts are the largest and most skewed, implying the highest level of heterogeneity in the provision of public funding (which matches the heterogeneity in demand).

The median publicly funded firm has not yet raised any private VC financing or received a private bank loan. The distributions of private financing and of the firm equity market value are, however, highly skewed. Some DE grant–receiving firms have raised the highest amounts of private non-VC equity and have received the largest private bank loans. Despite their young age, firms receiving FI equity have the highest market capitalization (i.e., firm equity market value, calculated as the latest market price observed either in a financing round or secondary trade multiplied by the number of shares outstanding), in both

median and average terms. At the same time, the skewness among DE grant–receiving firms is enormous.

Insert Table 1 here.

Table 1 also reveals the highly skewed distribution of firm innovation output, employment, operations and size prior to receipt of public funding. The median firm has not yet applied for any patents, while a few firms, especially those selected by government VCs, have already done so. On average, all firms disclose approximately 16%–19% of their assets as intangibles on their balance sheets. A median publicly funded firm has two or three employees, where DE loan–receiving firms pay their employees more, on average, than do firms receiving public funding from other sources. At the same time, the median DE loan–receving firm is the largest in terms of total assets, total revenues and investments in both labor and other (non-labor-related) operating activities.

3 Empirical Strategy

I perform a number of econometric exercises to increasingly reduce the potential for selection bias and estimate the following enhanced matching staggered difference-in-difference model with firm, firm age and calendar year fixed effects (Angrist and Pischke, 2008):

$$\begin{aligned} Outcome_{i,t} = \alpha &+ \beta_1 FI\ Equity_{i,t} + \beta_2 DE\ Grant_{i,t} + \beta_3 DE\ Loan_{i,t} \\ &+ \beta_4 VC\ Equity_{i,t} + \beta_5 NonVC\ Equity_{i,t} + \beta_6 Bank\ Loan_{i,t} \\ &+ \beta_7 Total\ Assets_{i,t} + \delta_i + \gamma_{i,t} + \theta_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

I analyze firm-level outcomes $Outcome_{i,t}$ on four dimensions that arguably are of first-

order interest to policymakers and are key objectives of programs seeking to foster innovation and entrepreneurship: (1) innovation output, (2) employment, (3) firm operations, and (4) market capitalization. I measure innovation output by the total[5] number of patent applications as a direct measure of the innovation output and the intangibles ratio as a measure related to (capitalized) knowledge capacity. Total labor expenses proxy for employment.[6] As two measures of firm operations, I use total other (non-labor-related) operating expenses to assess the firm's (non-labor-related) investment activity and total revenues to assess the commercialization success of the firm. Finally, I look at the market capitalization of the firm—namely, firm equity market value, calculated as the number of shares outstanding by the latest share price observed either in a financing round or in a secondary trade of that firm.

$FI\ Equity_{i,t}$, $DE\ Grant_{i,t}$ and $DE\ Loan_{i,t}$ are firm–year dummy variables of interest for the post–public funding period, taking value one if firm i receives the specified type of public funding in or prior to year t. I control for the firm–year levels of total private financing $VC\ Equity_{i,t}$, $NonVC\ Equity_{i,t}$ and $Bank\ Loan_{i,t}$ to proxy for time-variant firm characteristics that are unobservable in the available data but observable to private investors and lenders, who make informed investment and lending decisions. Controlling for the levels of private financing is also important given that the government's decision to provide public funds frequently depends on the amount of private financing available to the firm. $Total\ Assets_{i,t}$ controls for the firm size in each year t. While the firm fixed effects δ_i take care of firm-specific time-invariant characteristics, the calendar year $\gamma_{i,t}$ and firm age $\theta_{i,t}$ fixed effects account for market- and lifecycle-specific characteristics. Following the arguments in Cohn, Liu, and Wardlaw (2022), I report Poisson estimates for the total

[5]By "total," I mean cumulative up to year t.

[6]While Table 1 reports the number of employees, the number of observations (nonmissing values) in the business registry data is significantly lower than that for labor expenses reported in the financial statement data.

number of patent applications and ordinary least squares (OLS) estimates for the continuous outcome variables, where I use their log-linear transformation (plus one), except in the case of the intangibles ratio. Continuous covariates representing private financing are log-linear transformed (plus one) as well. Standard errors are clustered at the firm level.

I identify all firms with high innovation potential that are founded during the same time period and fall within the scope of the government's interest in fostering entrepreneurship following Kisseleva, Mjøs, and Robinson (2024), who apply the method described in Andrews, Fazio, Guzman, Liu, and Stern (2022) and Guzman and Stern (2015, 2020) to the Norwegian context. Table B1 presents each step of the selection procedure, which yields 46,121 firms with high innovation potential, out of which 45,166 (98%) receive private financing only. Next, I combine elements of the synthetic control (Abadie, Diamond, and Hainmueller, 2010) and least threshold distance methods (Breuer, Hombach, and Mller, 2018) and calculate the total distance between each publicly funded firm and each privately financed firm founded in the same year. To do so, for every pre–public funding calendar year, I calculate the absolute difference (distance) in each of six outcome variables of interest (total patent applications, intangibles ratio, total labor expenses, total (non-labor-related) other operating expenses, total revenues and firm equity market value), in the levels of private VC equity, private non-VC equity, (private) bank loans and in total assets. I sum up the individual variable-level distances across all ten variables and all pre–public funding years to calculate the pre–public funding total distance and keep only the privately financed firm with the least total distance as the matched control firm. When there is more than just one matched firm, which is the case only if the total distance is zero, I pick the matched control firm randomly.[7] I include both publicly funded and privately financed matched firms in the

[7]Figure B1 shows the distribution of the least total distance between publicly funded firms and their privately financed matched counterparts, implying the successful matching procedure of firms similar to each other being more frequent in occurrence. Figure B2 compares the development of the matched firms from firm inception up to the firm age of five for the six outcome variables of interest.

estimation of Equation 1.

4 Empirical Results

4.1 What Type of Public Funding Works Best?

Table 2 presents the results from estimating the effect of receipt of public funding on the extensive margin on firm outcomes as shown in Equation 1. I do not observe any meaningful and/or statistically significant association between receipt of FI equity and innovation output (Columns (1)–(2)). Receipt of either a DE grant or a DE loan increases the ratio of capitalized R&D expenses to total assets on average by approximately 0.04 percentage points (Column (2)). While the sign and statistical significance indicate the existence of a positive effect, the small magnitude of the coefficients (given the average intangibles ratio of 16–19% one year prior to receipt of public funding), together with the lack of a meaningful and statistically significant association with the number of patent applications, leaves room for debate over whether providing public funds directly to entrepreneurs in fact effectively stimulates innovation output.

In contrast, receiving public funding increases the firm's overall investment activity on average by approximately 20% (Columns (3)–(4)). This association is of the same magnitude regardless the source of the public funding (statistically insignificant joint F-tests) and type of investment (labor- or non-labor-related), implying a positive effect on both employment (Column (3)) and firm operations (Column (4)). We can interpret these results as an indication that the liquidity channel predominates here by relieving financing constraints and providing funding that would not be available otherwise.

Insert Table 2 here.

When I measure firm operations in terms of total revenues in Column (5), I observe that firms experience a positive and statistically significant increase in revenues after direct receipt of public funds but not after receipt of FI equity. This result aligns with the evidence in Kerr, Nanda, and Rhodes-Kropf (2014) that the early-stage firms that attract (government) VC financing engage in a higher degree of experimentation, i.e., more (R&D) investment activity without revenue generation. While total revenues increase by 12.4% after a firm receives a DE grant, they do so twice as much after it receives a DE loan. The larger increase after DE loans could be attributable to either the financial instrument incentives channel, whereby the obligation of loan repayment increases the entrepreneur's incentives to successfully commercialize her project, or to the certification channel, whereby the receipt of funding flags the entrepreneur's superior quality and allows her to better position herself in the product market.

Column (6) shows that receipt of FI equity sends a strong positive certification signal to the private capital markets: It is associated with an average increase in the firm equity market value of 36%. Given that receipt of FI equity is not followed by an increase in innovation output or revenues and that investment activity increases in the receiving firm to the same extent as it does for all publicly funded firms, it is unlikely that VC monitoring is responsible for this increase. The effect of funds provided directly to entrepreneurs does not run through the certification channel: The magnitude of the equity market valuation effect is comparably very low for DE grants (an increase of 1.3%) and nonexistent for DE loans (near zero and statistically nonsignificant).

Beyond the questions of to whom and how government should allocate public funds, the question of what funding amounts should be provided remains. Is it more effective to provide large chunks of money, or are small amounts sufficient to boost firm outcomes? To measure the per-dollar effect of government money, I rerun Equation 1 but replace the firm–

year dummies $FI\ Equity_{i,t}$, $DE\ Grant_{i,t}$ and $DE\ Loan_{i,t}$ with the natural logarithm (plus one) of the total amount of the specified type of public funding provided in or prior to year t.

Table 3 shows the results and confirms the channels at work as identified when we look at receipt of funding on the extensive margin above. Each kroner provided increases firm's investment activity, regardless of the source of the public funding, consistent with its relaxing financing constraints through the liquidity channel. An additional dollar of a DE loan is transformed into twice as much revenue as an additional dollar of a DE grant. This elastic increase on the intensive margin is consistent with the financial instrument incentives channel dominating the certification channel.

Insert Table 3 here.

When I estimate the effect of public funding at the intensive margin on market capitalization, the joint F-test rejects the null hypothesis that the amounts of public funding from different sources have differential effects on the firm equity market value. This result implies that the effect of FI equity operates through the certification channel, as what matters is the fact that government VCs invest in the firm, not how much. If the monitoring mechanism were at play, we could expect to observe an elastic increase with each provided dollar, as GPs should be more willing to increase their involvement when the provided financing amount is higher. Overall, I find evidence that all channels except monitoring are influential in the effect of provision of different types of public funding at the extensive and intensive margins.

4.2 Short-Term vs. Long-Term Effects

One might argue that government money—especially that provided without obligations or incentives—provides only immediate stimulation to entrepreneurs, with no long-term

implications for firm outcomes. To test this argument, I rerun Equation 1 and, in addition, interact each of $FI\ Equity_{i,t}$, $DE\ Grant_{i,t}$ and $DE\ Loan_{i,t}$, which are firm–year dummies for the post–public funding period taking value one if firm i receives the specified type of public funding in or prior to year t, with the time dummy variable $Long_t$, which takes value one for the post–public funding period (at least two years after the receipt of public funding). This implies that I separate the immediate effect in the same year $t = 0$ and in the year after receipt of public funding $t = 1$ from the long(er)-term effect.

Table 4 reveals that the immediate, short-term increases in firm outcomes do not drive the main results. The magnitude of the increase in the intangibles ratio is still small (0.04–0.05 percentage points) in both the short and long term after direct receipt of public funding. The average increase in the firm's investment activity is the net effect of higher long-term and lower short-term increases in total labor and other non-labor-related operating expenses. In contrast to FI equity, for which I observe a large, positive and statistically significant effect only in the long run, both DE grants and DE loans provide an immediate short-term investment boost to firms. The fact that these firms invest public money immediately after receiving it indicates that they are more financially constrained than those receiving FI equity even when they enjoy the same levels of private financing.

Insert Table 4 here.

The absence of an average increase in total revenues after receipt of FI equity is attributable to the offsetting short-term effect. In fact, in the long run, total revenues increase by 42.1% after the firm receives FI equity, an increase of almost the same magnitude as the 46.8% after receipt of a DE loan and twice the 20% increase after receipt of a DE grant. This implies that government VCs prioritize experimentation only in the short term. With regard to market capitalization, the results remain unchanged regardless of the horizon.

4.3 Heterogeneous Treatment Effects

The average effect of public funding on startups may vary depending on at what firm age they receive the governmental support (Sun and Abraham, 2021; Goodman-Bacon, 2021; Callaway and SantAnna, 2021). To avoid mutual contamination of the estimates in the staggered difference-in-difference model in Equation 1, I run the aggregated cohort model proposed by Sun and Abraham (2021). The effects are calculated separately by firm age at the time of receipt of public funding and then aggregated to the time-to-funding level. Estimating this model requires that the underlying subsample of publicly funded firms (and their matched counterparts) receive public funding solely from one public funding source (DE grant *or* DE loan *or* FI equity) and do so after their year of inception.

To allow straightforward comparison of the results for the same underlying subsample of firms, I first replicate Table 4 for all firms receiving public funding from only one source in Table 5 and for firms that receive public funding from only one source and do so after the year of inception in Table 6. After I exclude firms that receive public funding from multiple sources in Table 5, the results with regard to funds provided directly to the entrepreneur remain unchanged. The long-term increases in investment activity and total revenues after receipt of FI equity hold in magnitude but become statistically insignificant. This might be attributable either to the small number of observations and, therefore, low statistical power or to the greater heterogeneity among firms receiving FI equity, as described in Table 1.

Insert Table 5 here.

The results in Table 6, which additionally excludes firms that receive FI equity in their inception year, provide evidence that it is the latter factor that is determinant. In particular, firms receiving FI equity at age one or after experience the highest increases of 65.3% in total labor expenses, of 70.5% in other operating expenses and of almost 80% in

total revenues in the long run. This implies that the selection of firms into FI equity after their performance in the initial year has been observed yields more effective provision of public equity because of the decreased uncertainty. In addition, the potentially offsetting interplay of different policy designs become apparent when I evaluate the number of patent applications. Namely, firms apply for patents (statistically) significantly more after receiving FI equity only, while no increase is observed when I include firms receiving public funding from multiple sources in Table 4.

Insert Table 6 here.

Tables B2–B4 report the results from estimating heterogeneous treatment effects, which are summarized in Figure 2. The results remain qualitatively unchanged. Similarly to the estimations in Table 6, Figure 2, together with Tables B2–B4, confirms the increase in firms' investment activity, total revenues and market capitalization and the lack of a (statistically) significant increase in innovation output after receipt of FI equity or DE loans. However, the results reveal that DE grants have a heterogeneous effect on the number of patent applications. This number increases continuously, starting immediately after the firm receives a DE grant (a positive and statistically significant coefficient of 0.044 in $t = 0$) and continuing for up to five years after (a positive and statistically significant coefficient of 0.224 at $t = 5$). This result connects to the finding in Howell (2017) that grants enable the firm to invest in reducing technological uncertainty, resulting in higher innovation output.

Insert Figure 2 here.

In addition, while receipt of FI equity is followed by some of the greatest increases in firm outcomes at certain time periods, these increases are neither constant nor characterized by an obvious (increasing) trend (the magnitude of the associated coefficients is volatile)—nor

do they last as long as the increases after public funds are provided directly (the coefficients become statistically insignificant over time). One might argue that this is because of the heterogeneity among FI equity allocators and thus government VC GPs. This represents an additional layer of complexity for governments to consider when designing policies involving public equity.

4.4 Substitutes or Complements?

The analyses so far have implicitly assumed that the various policy designs are substitutes in relation to each firm outcome (along the lines of Pless, 2020). What if these tools are differentially appropriate for firms with different business models or at different development stages of their lifecycles or, more generally, address different policy goals and thus can serve as complements in a holistic approach to policy design? I examine this question by conducting several cross-sectional tests as I replicate Table 2 for different subsample of entrepreneurial firms. Tables 7–9 present the results for innovation output (patent applications and intangibles ratio), investment activity (total labor and other operating expenses), and product (total revenues) and capital markets (firm equity market value), respectively. Column (1) in each of Tables 7–9 restricts the sample to firms whose reported industry is research and development, while Column (2) in each of the tables does so for information, communication and technology firms. These two industry groups arguably feature the most innovation potential. Column (3) in each table looks at firms that are very early stage (up to two years old) in the year they first receive public funding from any source. These are the youngest firms, whose prospects are subject to the greatest uncertainty. Column (4) in each table evaluates the subsample of firms that have received cumulatively little private financing (less than 500,000 NOK, corresponding to approximately 63,000 USD) up to the year they first receive public funding from any source, while Column (5) in each table does so

for firms whose balance sheets show them to have been running low on cash (less than 8,000 NOK, corresponding to approximately 1,000 USD) in the year prior to their first receipt of public funding. These two groups are the most financially constrained firms. Column (6) in each table evaluates public funding in the firms that have not yet successfully commercialized their products, as mirrored by the lack of revenues in the year they first receive public funding from any source. Column (7) in each table restricts the sample to firms with more than ten employees in the year they first receive public funding from any source. These firms have contributed more than others to job creation, and their failure would have a stronger adverse labor-related effect. Finally, and in contrast to the subsamples in Columns (3)–(7), where governmental help might be critical for firm development or even survival, Column (8) in each table looks at firms that are already profitable in the year they first receive public funding from any source. Such firms have already successfully commercialized their products, with the proceeds exceeding their expenses, and should be able to generate internal financing.

The results reveal that public equity provided through intermediaries seems to complement loans and grant provided directly to the entrepreneur while loans and grant are themselves substitutes in many cases. In R&D-heavy firms, FI equity now has a strong and statistically positive effect on the number of patent applications (Table 7 Panel A, Column (1)), consistent with (government) VCs promoting innovation output through the monitoring channel (Bernstein, Giroud, and Townsend, 2016). I find no statistically significant effect in the cross-sections in Table 8 Panel A (Panel B) in (most of) the analyzed subsamples, implying that the positive effect of FI equity on investments found across the pooled estimations is driven by relatively older, nontech firms with sufficient funding, which already generate revenues but still invest a great deal. Particularly in profitable firms, FI equity as the only public funding source has a positive effect on other operating expenses (Table 8 Panel B

Column (8)) and revenues (Table 9 Panel A, Column (8)). At the same time, FI equity as the only source provides strong signaling value for firms facing financing constraints or uncertainty, for which other quality signals are not (yet) available (Table 9 Panel B Columns (3)–(6)). This is also the case for tech firms (Table 9 Panel B Column (2)), with tech being the traditional industry in which VCs' boast expertise. The signaling value of DE grants is significantly lower here. Thus, policymakers' choice might fall on FI equity if they want to promote growth in profitable firms or stimulate private capital markets by increasing the market capitalization of financially struggling firms and firms facing high uncertainty.

On the other hand, DE loans and DE grants go hand in hand for the intangibles ratio (Table 7 Panel B Columns (1)–(4), (6)) and for both labor expenses (Table 8 Panel A Columns (1)–(4), (7)) and other operating expenses (Table 8 Panel B Columns (1)–(7)). This implies that policymakers could consider programs providing funding directly to entrepreneurs to be substitutes when the aim is to foster innovation output and/or investment activity in the firms with the most innovation potential, in those facing uncertainty and/or financing constraints and in those that contribute the most to job creation. Policymakers might prefer DE loans over DE grants because loans are supposed to be repaid to the government while grants are essentially free money. An additional benefit of DE loans and of the associated repayment obligation is their positive (and statistically significant) effect on revenues in these firms (Table 9 Panel A Columns (1)–(5), (7)), which stimulates product commercialization.

5 Conclusion

This paper empirically compares the effect of government grants, government loans and equity provided through government venture capital funds on entrepreneurial firms.

My approach diverges from the single-program evaluations common in prior studies and evaluates the interplay of three programs simultaneously in a unified, single-country setting. The micro-level approach helps clarify how recipient firms utilize public money. I provide evidence that the type/source of public funding matters for firm outcomes because the effects of the different funding types operate through different mechanisms. In particular, DE grants work through the liquidity channel. The effect of DE loans operates through the combination of the liquidity channel and the financial instrument incentives channel, while that of FI equity operates through the combination of the liquidity and the certification channels. While the liquidity and financial instrument incentives channels are important for increasing firm outcomes on both the extensive and intensive margins of funding receipt, the certification channel of public equity is effective only on the extensive margin.

The findings of this paper have direct implications for policymakers weighing alternative policy designs. Policymakers might prefer public equity if they want to promote growth in already profitable firms or stimulate private capital markets by increasing the market capitalization of financially struggling firms and firms facing high uncertainty. At the same time, they might prefer public loans over public grants when their aim is to foster innovation output and/or investment activity in the firms with the most innovation potential, in those facing uncertainty and/or financing constraints and in those that contribute the most to job creation. An additional benefit of public loans is their stimulation of product commercialization in these firms.

My conclusions about the effectiveness of various types of public funding are based solely on their monetary effect on recipient entrepreneurial firms. I abstract here from the government's administrative costs in establishing and managing programs, and I do not consider spillover effects between firms that might benefit the overall economy or estimate the effect on private capital market participants, as this outcome is not a government objective

targeted by all funding programs. While entrepreneurial firms are the central focus of this paper, I believe that my microeconomic comparison of the channels driving the effects of public funding is relevant to broader contexts, such as during financial or economic crises when governmental interventions are being considered.

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Figure 1: **Distribution of Types of Public Funding in Norway**

Figure 1 shows the distribution of the allocation of each type of public funding aimed at stimulating entrepreneurship: public grants allocated directly to entrepreneurs (DE grants), public loans allocated directly to entrepreneurs (DE loans), and public equity provided through financial intermediaries, that is, government venture capital (VC) funds (FI equity), and their combinations. The Norwegian firms that have received public funding of any type represent 3.80% of all the firms with innovation potential founded between 2004 and 2017 as identified in Table B1.

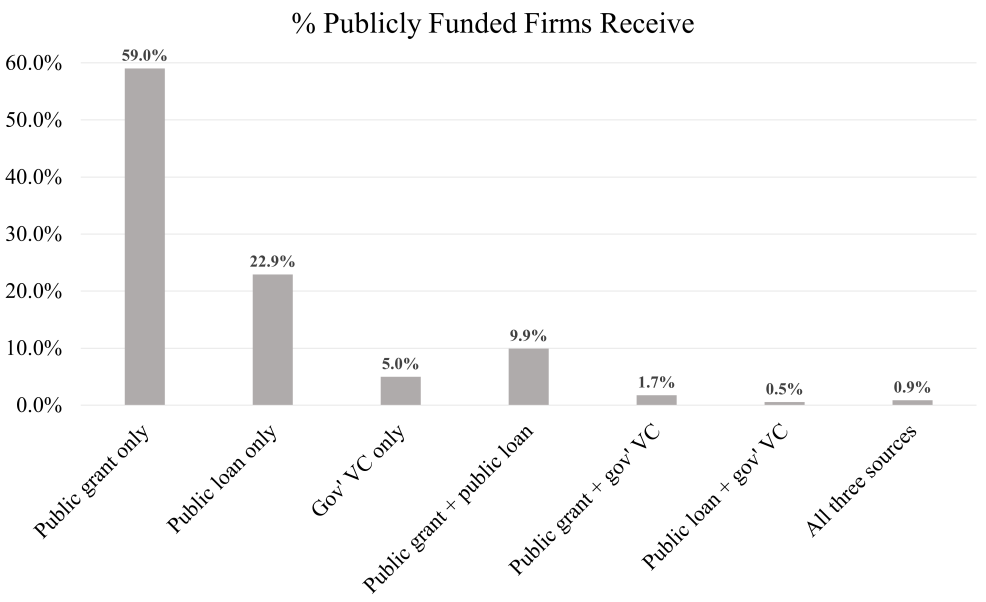


Figure 2: **Heterogeneous Treatment Effects**

Figure 2 graphically summarizes the estimation results in Tables B2–B4 from the aggregated cohort model proposed by Sun and Abraham (2021). The effects are calculated separately by the firm's age upon receipt of public funding and then aggregated to the time-to-public funding level. The underlying subsample of publicly funded (and matched control) firms comprises firms receiving public funding from only one source (similarly to the sample in Table 5) and starting only from the year after firm inception (similarly to the sample in Table 6).

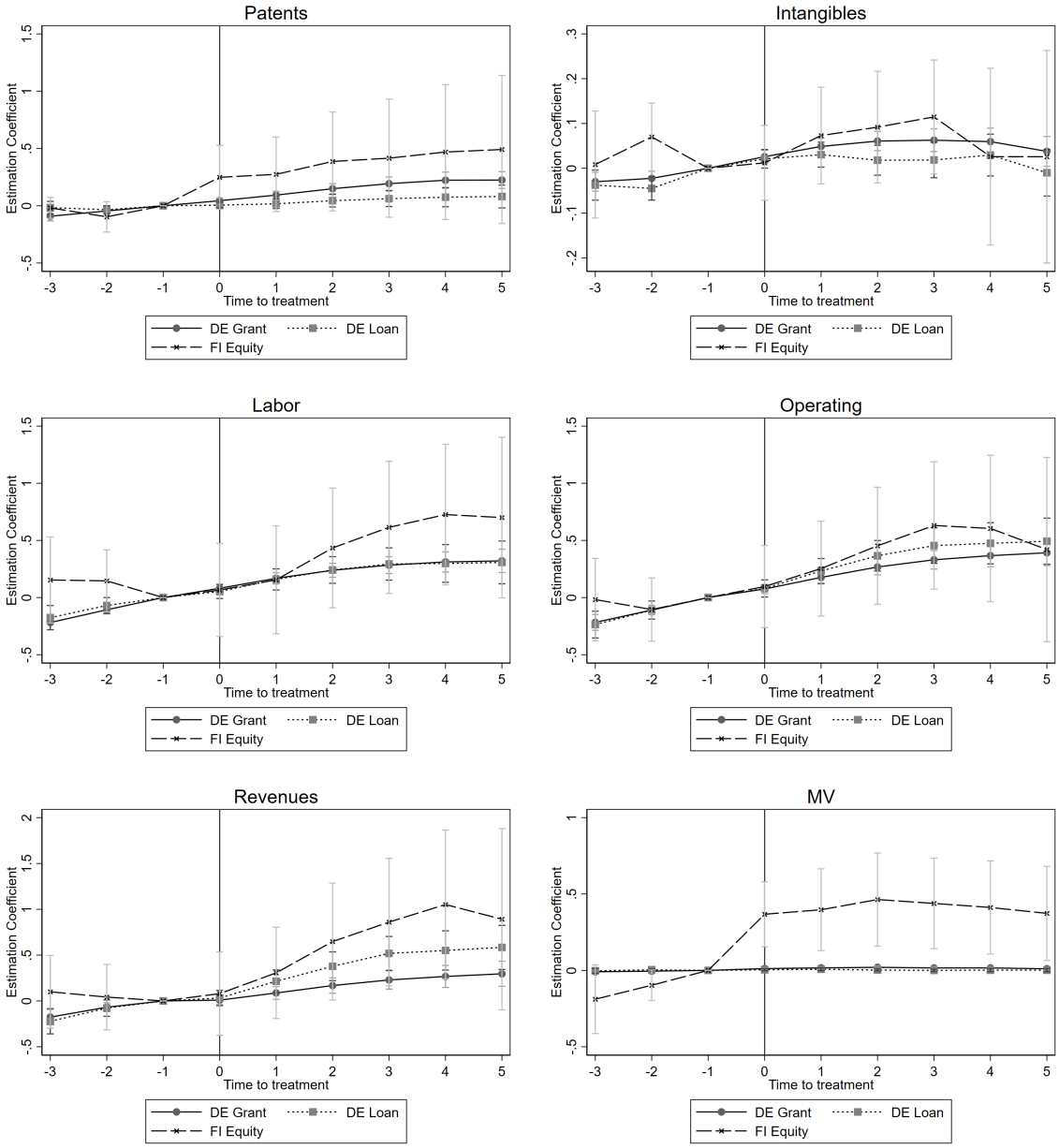


Table 1: Description of Publicly Funded Firms

Table 1 provides descriptive statistics of publicly funded firms in the year that they first receive public funding ($t = 0$) and in the year prior to receipt of funding ($t = -1$), if the data are available, from each of the government programs aimed at stimulating entrepreneurship: public grants allocated directly to entrepreneurs (DE grants), public loans allocated directly to entrepreneurs (DE loans), and public equity provided through financial intermediaries, that is, government venture capital (VC) funds (FI equity). Firm equity market value is calculated as the number of shares outstanding by the latest share price observed either in a financing round or in a secondary trade. Amounts are reported in millions of Norwegian kroner (NOK) (on average approximately eight NOK to the USD).

	DE grants			DE loans			FI equity		
Total public funding allocation	3,626 millions NOK			2,928 millions NOK			3,950 millions NOK		
	N	mean	p50	N	mean	p50	N	mean	p50
Firm age at $t = 0$	1,255	3.0	2.0	588	3.4	3.0	125	1.9	1.0
Public funding amount at $t = 0$	1,255	1.50	0.79	588	3.47	2.00	125	12.40	3.63
Private Financing at $t = -1$									
VC equity raised	1,141	1.92	0.00	514	4.56	0.00	86	21.94	0.00
Non-VC equity raised	1,141	34.87	0.23	514	11.67	0.62	86	23.44	1.85
Bank loan	1,141	42.26	0.00	514	6.14	0.00	86	2.18	0.00
Market Capitalization at $t = -1$									
Firm equity market value	1,110	37.95	0.30	498	17.33	0.75	85	45.91	3.38
Innovation Output at $t = -1$									
Number of patent applications	1,141	0.3	0.0	514	0.3	0.0	86	0.6	0.0
Intangible assets/Total assets	1,080	16.1%	0.3%	496	19.0%	3.8%	74	17.8%	4.5%
Employment at $t = -1$									
Number of employees	914	32.1	2.0	444	9.6	3.0	60	5.1	2.0
Total labor expenses	1,141	49.61	0.71	514	16.84	2.28	86	7.87	0.54
Firm Operations at $t = -1$									
Total assets	1,141	186.20	1.75	514	27.41	4.88	86	18.05	4.27
Total revenues	1,141	278.00	0.81	514	56.47	3.08	86	13.55	0.24
Other operating expenses	1,141	201.30	2.12	514	63.46	7.17	86	24.40	2.38
Operating profit	1,141	11.07	-0.03	514	-2.35	-0.05	86	-3.95	-0.74

Table 2: Extensive Margin of Public Funding

Table 2 reports Poisson (Column (1)) and OLS (Columns (2)–(6)) estimates from the enhanced matching staggered difference-in-difference regression model as shown in Equation 1. The dependent variables are six firm-level outcomes on four dimensions that arguably are of first-order interest to policymakers and are key objectives of programs seeking to foster innovation and entrepreneurship. Firm equity market value in Column (6) is calculated as the number of shares outstanding by the latest share price observed either in a financing round or in a secondary trade. *FI Equity*, *DE Grant* and *DE Loan* are firm–year dummy variables for the post–public funding period taking value one if the firm receives the specified type of public funding in or prior to year t. I control for the firm–year levels of total private financing *VC Equity*, *NonVC Equity* and *Bank Loan*. $Total\ Assets_{i,t}$ controls for the firm size in each year t. I include both publicly funded and privately financed matched firms in the estimation. Firm, firm age and calendar year fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

	Patent Applications Poisson (1)	Intangibles Ratio OLS (2)	Ln (Total Labor Expenses+1) OLS (3)	Ln (Total Operating Expenses+1) OLS (4)	Ln (Total Revenues+1) OLS (5)	Ln (Firm Equity Market Value+1) OLS (6)
FI equity (1/0)	0.141	0.005	0.243**	0.222*	0.158	0.360***
	[0.110]	[0.030]	[0.117]	[0.132]	[0.143]	[0.082]
DE loan (1/0)	0.127	0.047***	0.168***	0.255***	0.284***	0.005
	[0.086]	[0.011]	[0.034]	[0.037]	[0.046]	[0.007]
DE grant (1/0)	0.058	0.042***	0.221***	0.203***	0.124***	0.013***
	[0.052]	[0.007]	[0.023]	[0.024]	[0.029]	[0.005]
Ln (VC equity+1)	-0.099***	0.008	0.185***	0.138***	0.070	0.290***
	[0.020]	[0.011]	[0.037]	[0.039]	[0.053]	[0.030]
Ln (Non-VC equity+1)	0.019	0.003	0.218***	0.287***	0.098***	0.942***
	[0.048]	[0.006]	[0.023]	[0.025]	[0.029]	[0.008]
Ln (Bank loan+1)	0.019	0.003	0.060***	0.051**	0.057*	0.001
	[0.027]	[0.004]	[0.018]	[0.021]	[0.031]	[0.003]
Ln (Total assets+1)	0.045*	0.025***	0.165***	0.228***	0.242***	0.007**
	[0.023]	[0.005]	[0.015]	[0.018]	[0.020]	[0.003]
Observations	2,304	16,618	19,860	19,860	19,860	19,617
(Pseudo) R-squared	56.7%	72.1%	93.8%	94.5%	93.0%	99.6%
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm age FE	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes
H0: FI equity = DE loan = DE grant						
F/chi2 statistic	0.70	0.97	0.90	0.82	4.84	9.85
Prob > F/chi2	0.70	0.38	0.41	0.44	0.01	0.00

Table 3: Intensive Margin of Public Funding

Table 3 reports Poisson (Column (1)) and OLS (Columns (2)–(6)) estimates from the enhanced matching staggered difference-in-difference regression model as shown in Equation 1. The dependent variables are six firm-level outcomes on four dimensions that arguably are of first-order interest to policymakers and are key objectives of programs seeking to foster innovation and entrepreneurship. Firm equity market value in Column (6) is calculated as the number of shares outstanding by the latest share price observed either in a financing round or in a secondary trade. *FI Equity*, *DE Grant* and *DE Loan* are continuous variables representing the amount of the specified type of public funding received in or prior to year t. I include both publicly funded and privately financed matched firms in the estimation. Control variables as shown in Table 2 and firm, firm age and calendar year fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

	Patent Applications Poisson (1)	Intangibles Ratio OLS (2)	Ln (Total Labor Expenses+1) OLS (3)	Ln (Total Operating Expenses+1) OLS (4)	Ln (Total Revenues+1) OLS (5)	Ln (Firm Equity Market Value+1) OLS (6)
Ln (FI equity+1)	0.018	-0.017	0.111**	0.080	0.104	0.085**
	[0.030]	[0.014]	[0.054]	[0.064]	[0.068]	[0.040]
Ln (DE loan+1)	0.061	0.015**	0.138***	0.204***	0.234***	0.000
	[0.040]	[0.007]	[0.033]	[0.037]	[0.044]	[0.006]
Ln (DE grant+1)	0.005	0.026***	0.209***	0.184***	0.112***	-0.002
	[0.041]	[0.008]	[0.025]	[0.025]	[0.035]	[0.008]
Observations	2,304	16,618	19,860	19,860	19,860	19,617
(Pseudo) R-squared	56.7%	71.9%	93.8%	94.5%	93.0%	99.6%
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm age FE	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes
H0: FI equity = DE loan = DE grant						
F/chi2 statistic	1.20	3.99	2.35	1.39	2.87	2.27
Prob > F/chi2	0.55	0.02	0.10	0.25	0.06	0.10

Table 4: Short- vs. Long-Term Effects

Table 4 reports Poisson (Column (1)) and OLS (Columns (2)–(6)) estimates from the adjusted enhanced matching staggered difference-in-difference regression model shown in Equation 1. The dependent variables are six firm-level outcomes on four dimensions that arguably are of first-order interest to policymakers and are key objectives of programs seeking to foster innovation and entrepreneurship. Firm equity market value in Column (6) is calculated as the number of shares outstanding by the latest share price observed either in a financing round or in a secondary trade. *FI Equity*, *DE Grant* and *DE Loan* are firm–year dummy variables for the post–public funding period taking value one if the firm receives the specified type of public funding in or prior to year t. $Long_t$ is a time dummy variable, which takes value one for the post–public funding period at least two years after the receipt of public funding. This implies that I separate the immediate effect in the same year $t = 0$ and in the year after receipt of public funding $t = 1$ (main effect) from the long(er)-term effect (interaction effect). I include both publicly funded and privately financed matched firms in the estimation. Control variables as shown in Table 2 and firm, firm age and calendar year fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

	Patent Applications Poisson (1)	Intangibles Ratio OLS (2)	Ln (Total Labor Expenses+1) OLS (3)	Ln (Total Operating Expenses+1) OLS (4)	Ln (Total Revenues+1) OLS (5)	Ln (Firm Equity Market Value+1) OLS (6)
FI equity (1/0)	0.131	0.007	0.141	0.148	0.014	0.378***
	[0.097]	[0.028]	[0.100]	[0.101]	[0.123]	[0.076]
FI equity × Long (1/0)	0.145	0.002	0.424***	0.387**	0.421**	0.336***
	[0.149]	[0.046]	[0.157]	[0.187]	[0.192]	[0.097]
DE loan (1/0)	0.118	0.053***	0.120***	0.164***	0.156***	0.004
	[0.077]	[0.010]	[0.028]	[0.031]	[0.038]	[0.006]
DE loan × Long (1/0)	0.144	0.042***	0.249***	0.394***	0.468***	0.005
	[0.112]	[0.015]	[0.046]	[0.050]	[0.062]	[0.008]
DE grant (1/0)	0.062	0.036***	0.188***	0.166***	0.102***	0.013***
	[0.052]	[0.007]	[0.020]	[0.020]	[0.024]	[0.005]
DE grant × Long (1/0)	0.061	0.052***	0.295***	0.295***	0.201***	0.014**
	[0.078]	[0.010]	[0.031]	[0.033]	[0.040]	[0.006]
Observations	2,304	16,618	19,860	19,860	19,860	19,617
(Pseudo) R-squared	56.7%	72.1%	93.8%	94.6%	93.1%	99.6%
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm age FE	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes
H0: FI equity × Long = DE loan × Long = DE grant × Long						
F/chi2 statistic	0.49	0.69	0.75	1.73	7.83	6.60
Prob > F/chi2	0.78	0.50	0.47	0.18	0.00	0.00

Table 5: Single Source of Public Funding

Table 5 replicates Table 4 for the subsample of publicly funded firms (and their matched counterparts) that receive public funding solely from one public funding source (DE grant *or* DE loan *or* FI equity). It reports Poisson (Column (1)) and OLS (Columns (2)–(6)) estimates from the adjusted enhanced matching staggered difference-in-difference regression model shown in Equation 1. The dependent variables are six firm-level outcomes on four dimensions that arguably are of first-order interest to policymakers and are key objectives of programs seeking to foster innovation and entrepreneurship. Firm equity market value in Column (6) is calculated as the number of shares outstanding by the latest share price observed either in a financing round or in a secondary trade. *FI Equity*, *DE Grant* and *DE Loan* are firm–year dummy variables for the post–public funding period taking value one if the firm receives the specified type of public funding in or prior to year t. $Long_t$ is a time dummy variable, which takes value one for the post–public funding period at least two years after the receipt of public funding. This implies that I separate the immediate effect in the same year $t = 0$ and in the year after receipt of public funding $t = 1$ (main effect) from the long(er)-term effect (interaction effect). I include both publicly funded and privately financed matched firms in the estimation. Control variables as shown in Table 2 and firm, firm age and calendar year fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

	Patent Applications Poisson (1)	Intangibles Ratio OLS (2)	Ln (Total Labor Expenses+1) OLS (3)	Ln (Total Operating Expenses+1) OLS (4)	Ln (Total Revenues+1) OLS (5)	Ln (Firm Equity Market Value+1) OLS (6)
FI equity (1/0)	0.648*	0.045	0.117	0.160	0.035	0.301***
	[0.380]	[0.033]	[0.136]	[0.141]	[0.158]	[0.099]
FI equity × Long (1/0)	0.788	0.028	0.380	0.337	0.393	0.317**
	[0.515]	[0.046]	[0.236]	[0.276]	[0.279]	[0.139]
DE loan (1/0)	-0.015	0.054***	0.101***	0.187***	0.170***	0.013**
	[0.124]	[0.013]	[0.035]	[0.039]	[0.048]	[0.005]
DE loan × Long (1/0)	0.024	0.049***	0.277***	0.482***	0.534***	0.019***
	[0.163]	[0.017]	[0.058]	[0.062]	[0.076]	[0.007]
DE grant (1/0)	0.046	0.039***	0.191***	0.178***	0.115***	0.011***
	[0.052]	[0.007]	[0.021]	[0.022]	[0.027]	[0.004]
DE grant × Long (1/0)	0.031	0.059***	0.302***	0.326***	0.231***	0.014***
	[0.069]	[0.010]	[0.034]	[0.035]	[0.043]	[0.004]
Observations	1,929	14,654	17,551	17,551	17,551	17,324
(Pseudo) R-squared	57.8%	71.3%	93.5%	94.4%	92.9%	99.6%
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm age FE	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes
H0: FI equity × Long = DE loan × Long = DE grant × Long						
F/chi2 statistic	2.12	0.31	0.15	3.21	7.82	2.38
Prob > F/chi2	0.35	0.74	0.86	0.04	0.00	0.09

Table 6: Public Funding from Single Source After Firm Inception Year

Table 6 replicates Table 4 for the subsample of publicly funded firms (and their matched counterparts) that receive public funding solely from one public funding source (DE grant *or* DE loan *or* FI equity) and do so after their year of inception. It reports Poisson (Column (1)) and OLS (Columns (2)–(6)) estimates from the adjusted enhanced matching staggered difference-in-difference regression model shown in Equation 1. The dependent variables are six firm-level outcomes on four dimensions that arguably are of first-order interest to policymakers and are key objectives of programs seeking to foster innovation and entrepreneurship. Firm equity market value in Column (6) is calculated as the number of shares outstanding by the latest share price observed either in a financing round or in a secondary trade. *FI Equity*, *DE Grant* and *DE Loan* are firm–year dummy variables for the post–public funding period taking value one if the firm receives the specified type of public funding in or prior to year t. $Long_t$ is a time dummy variable, which takes value one for the post–public funding period at least two years after the receipt of public funding. This implies that I separate the immediate effect in the same year $t = 0$ and in the year after receipt of public funding $t = 1$ (main effect) from the long(er)-term effect (interaction effect). I include both publicly funded and privately financed matched firms in the estimation. Control variables as shown in Table 2 and firm, firm age and calendar year fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

	Patent Applications Poisson (1)	Intangibles Ratio OLS (2)	Ln (Total Labor Expenses+1) OLS (3)	Ln (Total Operating Expenses+1) OLS (4)	Ln (Total Revenues+1) OLS (5)	Ln (Firm Equity Market Value+1) OLS (6)
FI equity (1/0)	0.577	0.032	0.188	0.245*	0.136	0.357***
	[0.374]	[0.032]	[0.143]	[0.136]	[0.176]	[0.096]
FI equity × Long (1/0)	0.702	0.050	0.653***	0.705***	0.797***	0.376***
	[0.512]	[0.045]	[0.217]	[0.232]	[0.282]	[0.129]
DE loan (1/0)	-0.062	0.053***	0.100***	0.182***	0.167***	0.011**
	[0.130]	[0.013]	[0.034]	[0.039]	[0.047]	[0.005]
DE loan × Long (1/0)	-0.022	0.047***	0.275***	0.478***	0.533***	0.016**
	[0.163]	[0.017]	[0.058]	[0.062]	[0.076]	[0.007]
DE grant (1/0)	0.002	0.038***	0.193***	0.175***	0.112***	0.009**
	[0.051]	[0.007]	[0.021]	[0.022]	[0.027]	[0.004]
DE grant × Long (1/0)	-0.023	0.056***	0.315***	0.330***	0.243***	0.013***
	[0.070]	[0.010]	[0.034]	[0.035]	[0.043]	[0.004]
Observations	1,862	14,298	17,030	17,030	17,030	16,807
(Pseudo) R-squared	58.6%	71.2%	93.7%	94.6%	93.1%	99.7%
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm age FE	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes
H0: FI equity × Long = DE loan × Long = DE grant × Long						
F/chi2 statistic	1.96	0.14	1.48	4.14	8.66	3.93
Prob > F/chi2	0.38	0.87	0.23	0.02	0.00	0.02

Table 7: Unveiling Cross-Sectional Variation: Innovation Output

Table 7 replicates Table 2 for different subsamples of entrepreneurial firms. The dependent variables are two proxies for innovation output: patent applications (Panel A) and the intangibles ratio (Panel B). Column (1) evaluates firms conducting research and development, while Column (2) evaluates information, communication and technology firms. Column (3) looks at firms up to two years old in the year they first receive public funding from any source. Column (4) evaluates the subsample of firms that received cumulatively little private financing (of less than 500,000 NOK, corresponding to approximately 63,000 USD) up to the year of first receiving public funding from any source, while Column (5) examines firms running low on cash (less than 8,000 NOK, corresponding to approximately 1,000 USD) in the year prior to first receiving public funding. Column (6) evaluates firms lacking revenues, Column (7) firms that have more than ten employees, and Column (8) profitable firms, all in the year that the firm first receives public funding from any source. *FI Equity*, *DE Grant* and *DE Loan* are firm–year dummy variables for the post–public funding period taking value one if the firm receives the specified type of public funding in or prior to year t. Control variables as shown in Table 2 and firm, firm age and calendar year fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

Panel A: Patent Applications

	Industry		Firm Age	Low Private	Low	No	Employees	Profit
	R&D	Tech	0–2 years	Financing	Liquidity	Revenues	>10	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FI equity	0.224*	-0.601**	0.115	-0.770***	0.394	0.211	0.114	-0.388
	[0.121]	[0.281]	[0.169]	[0.289]	[0.447]	[0.300]	[0.305]	[0.428]
DE loan	0.195*	-0.084	0.112	0.347	0.069	0.407*	0.084	0.088
	[0.112]	[0.128]	[0.079]	[0.278]	[0.203]	[0.234]	[0.150]	[0.195]
DE grant	0.009	-0.038	0.037	0.233*	0.308	0.350	0.123	0.074
	[0.067]	[0.137]	[0.116]	[0.125]	[0.247]	[0.275]	[0.103]	[0.095]
Observations	1,211	244	1,076	622	269	294	527	777
Pseudo R-squared	64.8%	30.1%	38.0%	29.8%	43.6%	34.3%	46.2%	36.7%
H0: FI equity = DE loan = DE grant								
Chi2 statistic	3.32	4.13	0.38	10.45	0.92	0.20	0.04	1.15
Prob > chi2	0.19	0.13	0.83	0.01	0.63	0.91	0.98	0.56

Panel B: Intangibles Ratio

	Industry		Firm Age	Low Private	Low	No	Employees	Profit
	R&D	Tech	0–2 years	Financing	Liquidity	Revenues	>10	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FI equity	-0.088	0.014	0.010	0.041	0.048	-0.058	0.045	0.058
	[0.054]	[0.050]	[0.034]	[0.070]	[0.053]	[0.040]	[0.052]	[0.096]
DE loan	0.053**	0.087***	0.056***	0.093***	0.113***	0.093***	0.026	0.022
	[0.022]	[0.029]	[0.018]	[0.025]	[0.040]	[0.035]	[0.016]	[0.015]
DE grant	0.034***	0.043***	0.064***	0.050***	0.045	0.078**	0.016	0.037***
	[0.012]	[0.016]	[0.011]	[0.012]	[0.034]	[0.031]	[0.012]	[0.009]
Observations	5,630	3,332	7,825	7,602	2,044	2,719	3,281	6,687
R-squared	74.2%	70.3%	73.0%	70.1%	74.8%	78.6%	75.4%	72.1%
H0: FI equity = DE loan = DE grant								
F statistic	3.00	1.29	1.15	1.15	1.12	4.75	0.26	0.41
Prob > F	0.05	0.28	0.32	0.32	0.33	0.01	0.77	0.67

Table 8: Unveiling Cross-Sectional Variation: Investment Activity

Table 8 replicates Table 2 for different subsamples of entrepreneurial firms. The dependent variables are two measures of investment activity: labor expenses (Panel A) and other operating expenses (Panel B). Column (1) evaluates firms conducting research and development, while Column (2) evaluates information, communication and technology firms. Column (3) looks at firms up to two years old in the year they first receive public funding from any source. Column (4) evaluates the subsample of firms that received cumulatively little private financing (of less than 500,000 NOK, corresponding to approximately 63,000 USD) up to the year of first receiving public funding from any source, while Column (5) examines firms running low on cash (less than 8,000 NOK, corresponding to approximately 1,000 USD) in the year prior to first receiving public funding. Column (6) evaluates firms lacking revenues, Column (7) firms that have more than ten employees, and Column (8) profitable firms, all in the year that the firm first receives public funding from any source. *FI Equity*, *DE Grant* and *DE Loan* are firm–year dummy variables for the post–public funding period taking value one if the firm receives the specified type of public funding in or prior to year t. Control variables as shown in Table 2 and firm, firm age and calendar year fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

Panel A: Total Labor Expenses

	Industry		Firm Age	Low Private	Low	No	Employees	Profit
	R&D	Tech	0–2 years	Financing	Liquidity	Revenues	>10	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FI equity	0.203	0.105	0.102	0.062	0.089	0.141	0.236	-0.053
	[0.215]	[0.138]	[0.152]	[0.168]	[0.305]	[0.258]	[0.241]	[0.324]
DE loan	0.168***	0.139**	0.190***	0.214***	-0.014	0.120	0.210***	-0.034
	[0.064]	[0.061]	[0.062]	[0.070]	[0.110]	[0.145]	[0.058]	[0.055]
DE grant	0.125***	0.157***	0.217***	0.199***	0.118	0.207***	0.252***	0.107***
	[0.038]	[0.048]	[0.041]	[0.034]	[0.079]	[0.071]	[0.048]	[0.035]
Observations	6,386	3,801	9,616	9,612	3,411	3,669	4,446	7,202
R-squared	92.5%	93.6%	89.3%	93.2%	91.0%	83.1%	95.6%	95.3%
H0: FI equity = DE loan = DE grant								
F statistic	0.22	0.10	0.33	0.36	0.53	0.19	0.16	2.47
Prob > F	0.80	0.91	0.72	0.70	0.59	0.83	0.85	0.09

Panel B: Total Other Operating Expenses

	Industry		Firm Age	Low Private	Low	No	Employees	Profit
	R&D	Tech	0–2 years	Financing	Liquidity	Revenues	>10	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FI equity	0.197	0.075	0.022	0.027	-0.148	0.157	0.570**	0.633***
	[0.252]	[0.115]	[0.188]	[0.118]	[0.330]	[0.316]	[0.281]	[0.226]
DE loan	0.237***	0.157***	0.385***	0.372***	0.278**	0.522***	0.250***	-0.004
	[0.064]	[0.056]	[0.066]	[0.075]	[0.113]	[0.173]	[0.063]	[0.056]
DE grant	0.199***	0.082*	0.198***	0.254***	0.197**	0.349***	0.227***	0.041
	[0.039]	[0.046]	[0.043]	[0.037]	[0.081]	[0.075]	[0.055]	[0.039]
Observations	6,386	3,801	9,616	9,612	3,411	3,669	4,446	7,202
R-squared	93.8%	94.9%	90.9%	93.8%	91.8%	84.5%	95.7%	95.6%
H0: FI equity = DE loan = DE grant								
F statistic	0.13	0.68	4.23	3.20	0.83	0.76	0.78	3.78
Prob > F	0.88	0.51	0.01	0.04	0.44	0.47	0.46	0.02

Table 9: Unveiling Cross-Sectional Variation: Product and Capital Markets

Table 9 replicates Table 2 for different subsamples of entrepreneurial firms. The dependent variables are revenues (Panel A) and firm equity market value (Panel B) to measure the product and capital market reaction, respectively. Column (1) evaluates firms conducting research and development, while Column (2) evaluates information, communication and technology firms. Column (3) looks at firms up to two years old in the year they first receive public funding from any source. Column (4) evaluates the subsample of firms that received cumulatively little private financing (of less than 500,000 NOK, corresponding to approximately 63,000 USD) up to the year of first receiving public funding from any source, while Column (5) examines firms running low on cash (less than 8,000 NOK, corresponding to approximately 1,000 USD) in the year prior to first receiving public funding. Column (6) evaluates firms lacking revenues, Column (7) firms that have more than ten employees, and Column (8) profitable firms, all in the year that the firm first receives public funding from any source. *FI Equity*, *DE Grant* and *DE Loan* are firm–year dummy variables for the post–public funding period taking value one if the firm receives the specified type of public funding in or prior to year t. Control variables as shown in Table 2 and firm, firm age and calendar year fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

Panel A: Total Revenues

	Industry		Firm Age	Low Private	Low	No	Employees	Profit
	R&D	Tech	0–2 years	Financing	Liquidity	Revenues	>10	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FI equity	0.142	-0.015	-0.180	-0.396	-0.288	0.172	0.020	0.638*
	[0.249]	[0.174]	[0.194]	[0.305]	[0.262]	[0.211]	[0.403]	[0.331]
DE loan	0.257***	0.207**	0.364***	0.272***	0.255*	0.285	0.364***	0.012
	[0.085]	[0.085]	[0.083]	[0.084]	[0.140]	[0.176]	[0.082]	[0.060]
DE grant	0.074	0.016	0.088*	0.145***	-0.004	-0.004	0.213***	0.058
	[0.046]	[0.056]	[0.053]	[0.041]	[0.098]	[0.084]	[0.069]	[0.042]
Observations	6,386	3,801	9,616	9,612	3,411	3,669	4,446	7,202
R-squared	91.7%	93.2%	87.6%	93.0%	89.0%	65.9%	94.6%	95.3%
H0: FI equity = DE loan = DE grant								
F statistic	1.69	2.16	6.31	2.82	2.41	1.63	1.27	1.81
Prob > F	0.19	0.12	0.00	0.06	0.09	0.20	0.28	0.17

Panel B: Firm Equity Market Value

	Industry		Firm Age	Low Private	Low	No	Employees	Profit
	R&D	Tech	0–2 years	Financing	Liquidity	Revenues	>10	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FI equity	0.253	0.337***	0.366***	0.543***	0.343*	0.372**	0.145	0.232
	[0.173]	[0.123]	[0.102]	[0.203]	[0.197]	[0.174]	[0.188]	[0.141]
DE loan	0.032**	-0.012	-0.005	-0.009	0.003	0.018	-0.009	-0.002
	[0.015]	[0.014]	[0.010]	[0.007]	[0.025]	[0.023]	[0.013]	[0.005]
DE grant	0.018**	0.010	0.033***	0.003*	0.051**	0.049**	0.003	0.002
	[0.008]	[0.009]	[0.008]	[0.002]	[0.023]	[0.021]	[0.010]	[0.004]
Observations	6,364	3,774	9,457	9,467	3,330	3,613	4,388	7,048
R-squared	99.3%	99.6%	99.5%	99.5%	99.4%	99.5%	99.7%	99.8%
H0: FI equity = DE loan = DE grant								
F statistic	1.19	4.61	11.54	4.45	2.38	2.52	0.47	1.52
Prob > F	0.31	0.01	0.00	0.01	0.09	0.08	0.62	0.22

A Appendix: Institutional Background

Figure A1: **Government Spending Across Countries**

Figure A1 shows the cross-country comparison of general government spending on economic affairs as a percentage of GDP. These are the average values over 2007–2018 (source: OECD stat).

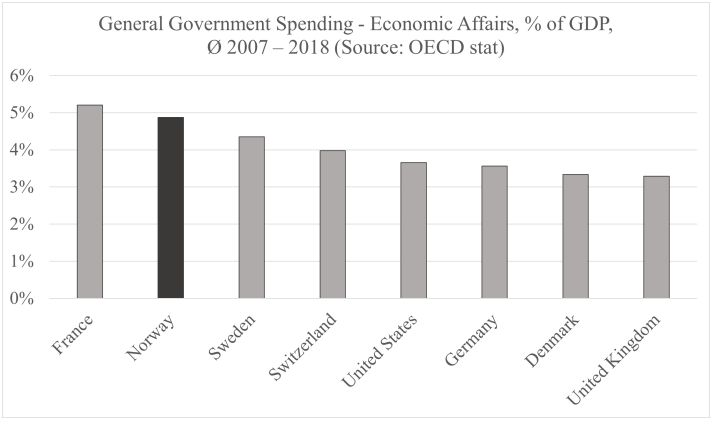


Figure A2: **Venture Capital Investments Across Countries**

Figure A2 shows the cross-country comparison of total venture capital (VC) investments in USD per capita over 2007–2018 (source: OECD stat).

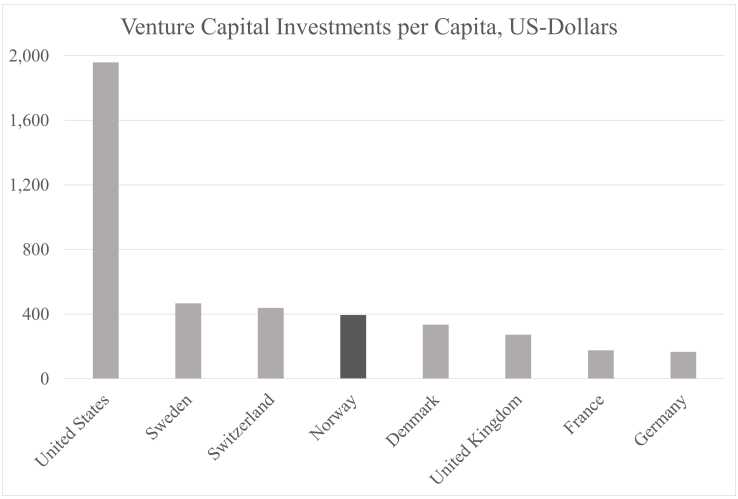


Table A1: Government Capital Supply to Public Funding Programs

Table A1 presents a time-series overview of the government capital supply into the different public funding programs aimed at fostering entrepreneurship—DE grants, DE loans, and FI equity—in my sample period (2006–2017) in Norway. Amounts are reported in millions of Norwegian kroner (NOK) (on average approximately eight Norwegian kroner to the USD). The annual budget proposals for DE grants and DE loans are made by the Ministry of Trade, Industry and Fisheries, while the budget is approved by parliament. These are nonrolling annual budgets, which implies that the allocated budget is spent in that particular year. Similarly to the directly provided funding, the establishment of and allocation of capital to the financial intermediaries (government VCs) that administer public equity are based on annual budget proposals from the Ministry of Trade, Industry and Fisheries and are approved by parliament. The allocated government capital is made partially available for investments upon the signing of a contract with the government VC management firm and partially in tranches on call.

CY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
DE grant	152	192	254	322	294	403	397	421	506	667	769	413
DE loan	511	204	137	1,254	329	275	140	243	281	471	331	430
FI equity	1,161	0	2,359	0	0	0	0	0	500	0	650	400
Total	**1,824**	**396**	**2,750**	**1,576**	**623**	**678**	**537**	**664**	**1,287**	**1,138**	**1,750**	**1,243**
of which % DE grant	8.3%	48.5%	9.2%	20.4%	47.2%	59.4%	73.9%	63.4%	39.3%	58.6%	43.9%	33.2%
of which % DE loan	28.0%	51.5%	5.0%	79.6%	52.8%	40.6%	26.1%	36.6%	21.8%	41.4%	18.9%	34.6%
of which % FI equity	63.6%	0.0%	85.8%	0.0%	0.0%	0.0%	0.0%	0.0%	38.9%	0.0%	37.1%	32.2%

Table A2: Government Capital Supply and Economic Conditions

Table A2 shows contemporary Pearson correlations between the government capital supply amounts to each public funding program (DE grants, DE loans, and FI equity) and between the capital supply amounts allocated to these programs and several indicators of economic market conditions in Norway in the sample period (2006–2017). One, two, and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

	DE grant	DE loan	FI equity
DE grant	1		
DE loan	-0.049	1	
FI equity	-0.2309	-0.2138	1
Total government expenditure	0.8561***	-0.0821	-0.2689
Brent oil price high	-0.017	-0.5399*	0.4988*
Crude oil export	-0.7524***	-0.4087	0.3898

B Appendix: Additional Figures and Tables

Figure B1: **Enhanced Matching: Least Total Distance**

Figure B1 shows the distribution of the least total distance between publicly funded firms and their privately financed matched counterparts. For every pre–public funding calendar year, I calculate the absolute difference (distance) in each of six outcome variables of interest (total patent applications, intangibles ratio, total labor expenses, total (non-labor-related) operating expenses, total revenues and firm equity market value), in the levels of private VC equity, private non-VC equity, (private) bank loans, and in total assets. I sum up the individual variable-level distances across all ten variables and all pre–public funding years to calculate the pre–public funding total distance and keep only the privately financed firm with the least total distance as a matched control firm. When there is more than just one matched firm, which is the case only if the total distance is zero, I pick a matched control firm randomly.

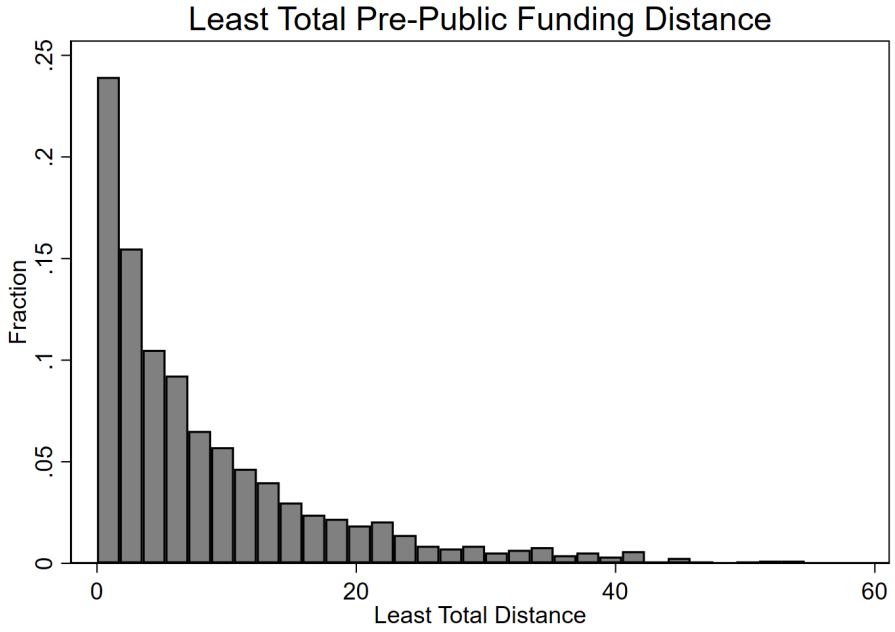


Figure B2: **Development of Matched Firms**

Figure B2 presents the development of publicly funded and privately financed matched firms from firm inception up to firm age of five with regard to the six outcome variables of interest (total patent applications, intangibles ratio, total labor expenses, total other operating expenses, total revenues and firm equity market value). Publicly funded firms are presented in blue, while privately financed matched firms are presented in red.

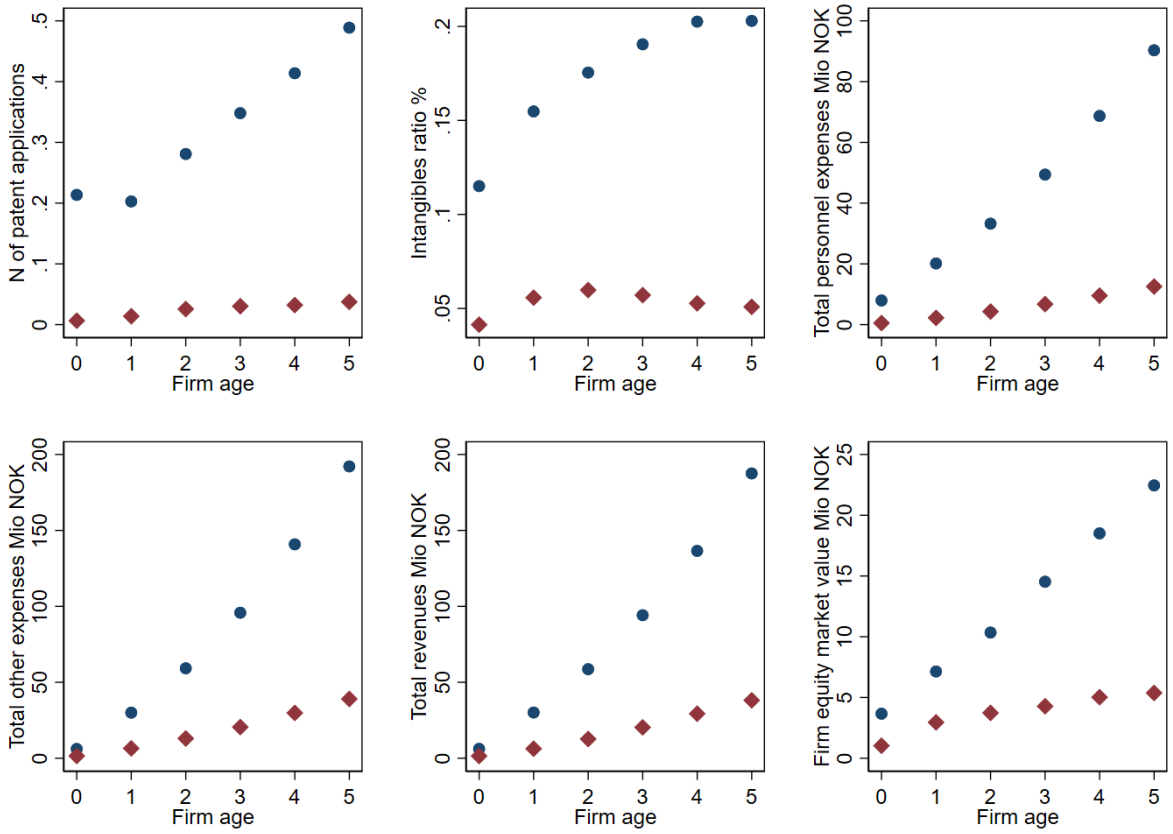


Table B1: Selection of Privately Financed Firms with Innovation Potential

Table B1 describes the process for selecting privately financed firms with high innovation potential (firm pool before the enhanced matching). Panel A begins with all firms newly founded in Norway between 2004 and 2017, from which I remove financial services and real estate firms, newly formed subsidiaries of established companies, holding company structures, and firms in noninnovative industries. This procedure yields a population of 79,196 newly formed firms. Of course, it is unlikely that most of these firms have growth aspirations or the intention to develop large-scale commercial innovation. Panel B describes the process for identifying the subsample of firms that have a high propensity to engage in innovation based on ex ante observable characteristics at the time the firm first appears in the tax registry data. Although any one flag may yield false negatives or false positives, by developing a series of flags to be applied together, I aim to produce a robust measure of future innovation potential based on observable firm characteristics. The first flag is whether the firm has an English-language firm name. The idea behind this flag is that, because Norway is a country of only approximately five million people, an English-language firm name helps the firm be recognizable to a broader, international audience and therefore is a natural choice for an entrepreneur who intends to grow. The second flag is whether the firm is located in a regional innovation hub in Norway. The four innovation hubs in our data are Oslo, Bergen, Stavanger and Trondheim. These are the four largest cities in the country, and each hosts a major research university and has an associated technology cluster (Hvide and Jones, 2018). The third flag tracks whether one of the company's nonexecutive board members lives in a geographically distant area from the city in which the company operates. The idea here is that the choice of a geographically distant board member in the year of establishment is a potential indication that the founders (or an investor) have recruited a board member with specific technical or market expertise not readily found nearby. To remain agnostic about which of these flags is more or less salient in a particular setting, I flag a firm as having high innovation potential if it satisfies at least one of the three criteria. This process is described in detail in Kisseleva, Mjøs, and Robinson (2024), who link these flags to later firm outcomes. Each flag, both on its own and in combination with the others, is highly predictive of a firm's obtaining a patent, obtaining later-stage private VC financing, achieving an exit for investors, and having higher than average four-year revenue growth. Even more importantly, this ex ante innovation sample received over 90% of the total equity capital invested in all businesses in Norway in my sample period.

Panel A: Full Sample	Firms	% of (A)
Firms (C-corps) founded in 2004–2017	321,548	
- Financial services and real estate firms	-143,496	
- Subsidiaries of established companies	-19,499	
- Holding structures	-6,275	
- Transaction data not matched	-27,930	
- Noninnovative industry	-45,152	
Newly established firms in potentially innovative industries: (A)	**79,196**	100.00%

Panel B: Ex Ante Innovation Flags	Firms	% of (A)
English name	26,452	33.40%
Located in an innovation hub (Oslo, Bergen, Stavanger, Trondheim)	23,887	30.16%
At least one geographically distant board member	14,148	17.86%
At least one ex ante innovation flag:	46,121	58.24%
...out of which privately financed	45,166	

Table B2: Heterogeneous Treatment Effects on Innovation Output

Table B2 presents the estimation results from running the aggregated cohort model proposed by Sun and Abraham (2021) on two proxies for innovation output: patent applications and the intangibles ratio. The effects are calculated separately by the firm's age upon receipt of public funding and then aggregated to the time-to-public funding level. This model requires that the underlying subsample includes only publicly funded firms (and their matched counterparts) that receive public funding solely from one source (DE grant *or* DE loan *or* FI equity) and do so after the year of inception. Control variables as shown in Table 2 and firm, firm age and calendar year fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

	Patent Applications Poisson			Intangibles Ratio OLS		
	FI Equity	DE Loan	DE Grant	FI Equity	DE Loan	DE Grant
	(1)	(2)	(3)	(4)	(5)	(6)
t=-3	-0.019	-0.016	-0.091***	0.008	-0.038**	-0.030***
	(0.047)	(0.028)	(0.021)	(0.061)	(0.017)	(0.011)
t=-2	-0.097	-0.035*	-0.045***	0.070*	-0.045***	-0.023***
	(0.068)	(0.018)	(0.012)	(0.039)	(0.013)	(0.008)
t=0	0.248*	0.006	0.044***	0.012	0.021**	0.026***
	(0.142)	(0.013)	(0.012)	(0.043)	(0.011)	(0.007)
t=1	0.274	0.017	0.093***	0.073	0.030**	0.049***
	(0.166)	(0.021)	(0.017)	(0.055)	(0.014)	(0.009)
t=2	0.386*	0.044	0.149***	0.092	0.018	0.061***
	(0.220)	(0.028)	(0.023)	(0.064)	(0.017)	(0.011)
t=3	0.415	0.062*	0.193***	0.115*	0.018	0.063***
	(0.263)	(0.035)	(0.030)	(0.065)	(0.020)	(0.013)
t=4	0.469	0.075*	0.223***	0.026	0.029	0.059***
	(0.30)	(0.043)	(0.036)	(0.101)	(0.024)	(0.015)
t=5	0.491	0.080	0.224***	0.026	-0.010	0.038**
	(0.330)	(0.051)	(0.038)	(0.121)	(0.027)	(0.017)
Observations	448	4,467	12,113	364	3,687	10,247
R-squared	81.0%	83.4%	98.2%	73.4%	73.0%	71.9%
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm age FE	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table B3: Heterogeneous Treatment Effects on Investment Activity

Table B3 presents the estimation results from running the aggregated cohort model proposed by Sun and Abraham (2021) on two measures of investment activity: labor expenses and other (non-labor-related) operating expenses. The effects are calculated separately by the firm's age upon receipt of public funding and then aggregated to the time-to-public funding level. This model requires that the underlying subsample includes only publicly funded firms (and their matched counterparts) that receive public funding solely from one source (DE grant *or* DE loan *or* FI equity) and do so after the year of inception. Control variables as shown in Table 2 and calendar year, firm age and firm fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

	Ln (Total Labor Expenses+1) OLS			Ln (Total Other Operating Expenses+1) OLS		
	FI Equity	DE Loan	DE Grant	FI Equity	DE Loan	DE Grant
	(1)	(2)	(3)	(4)	(5)	(6)
t=-3	0.154	-0.176***	-0.218***	-0.017	-0.236***	-0.217***
	(0.192)	(0.054)	(0.032)	(0.184)	(0.060)	(0.036)
t=-2	0.146	-0.070**	-0.107***	-0.105	-0.109***	-0.109***
	(0.138)	(0.035)	(0.019)	(0.142)	(0.041)	(0.021)
t=0	0.066	0.053*	0.082***	0.096	0.080**	0.075***
	(0.208)	(0.032)	(0.017)	(0.183)	(0.038)	(0.020)
t=1	0.155	0.159***	0.169***	0.254	0.233***	0.176***
	(0.241)	(0.047)	(0.025)	(0.212)	(0.056)	(0.029)
t=2	0.434	0.241***	0.239***	0.453*	0.366***	0.268***
	(0.267)	(0.060)	(0.031)	(0.261)	(0.068)	(0.035)
t=3	0.614**	0.294***	0.284***	0.631**	0.455***	0.331***
	(0.295)	(0.072)	(0.037)	(0.284)	(0.079)	(0.041)
t=4	0.726**	0.298***	0.312***	0.605*	0.475***	0.367***
	(0.313)	(0.084)	(0.045)	(0.327)	(0.092)	(0.049)
t=5	0.700*	0.308***	0.321***	0.420	0.493***	0.392***
	(0.359)	(0.095)	(0.052)	(0.411)	(0.103)	(0.057)
Observations	448	4,467	12,113	448	4,467	12,113
R-squared	93.5%	93.1%	94.4%	94.6%	94.1%	95.2%
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm age FE	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table B4: Heterogeneous Treatment Effects on Product and Capital Markets

Table B4 presents the estimation results from running the aggregated cohort model proposed by Sun and Abraham (2021) on revenues and firm equity market value to measure the product and capital markets reaction, respectively. The effects are calculated separately by the firm's age upon receipt of public funding and then aggregated to the time-to-public funding level. This model requires that the underlying subsample includes only publicly funded firms (and their matched counterparts) that receive public funding solely from one source (DE grant *or* DE loan *or* FI equity) and do so after the year of inception. Control variables as shown in Table 2 and calendar year, firm age and firm fixed effects are included in all specifications. Standard errors are clustered at the firm level. A constant term is estimated but suppressed for brevity. One, two and three asterisks denote statistical significance at the 10, 5, and 1% levels, respectively.

	Ln (Total Revenues+1) OLS			Ln (Firm Equity Market Value+1) OLS		
	FI Equity	DE Loan	DE Grant	FI Equity	DE Loan	DE Grant
	(1)	(2)	(3)	(4)	(5)	(6)
t=-3	0.100	-0.221***	-0.176***	-0.188	-0.003	-0.009
	(0.202)	(0.070)	(0.043)	(0.115)	(0.008)	(0.007)
t=-2	0.042	-0.078*	-0.068***	-0.097*	0.004	-0.005
	(0.182)	(0.046)	(0.024)	(0.051)	(0.003)	(0.004)
t=0	0.080	0.032	0.009	0.368***	0.004	0.012***
	(0.232)	(0.043)	(0.024)	(0.108)	(0.003)	(0.003)
t=1	0.306	0.215***	0.087**	0.397***	0.007	0.016***
	(0.254)	(0.063)	(0.035)	(0.137)	(0.005)	(0.004)
t=2	0.648**	0.378***	0.168***	0.464***	0.002	0.020***
	(0.326)	(0.080)	(0.043)	(0.155)	(0.003)	(0.005)
t=3	0.860**	0.519***	0.229***	0.439***	0.000	0.016***
	(0.355)	(0.094)	(0.051)	(0.151)	(0.004)	(0.005)
t=4	1.052**	0.551***	0.267***	0.412***	0.002	0.016***
	(0.415)	(0.109)	(0.061)	(0.156)	(0.005)	(0.005)
t=5	0.892*	0.584***	0.296***	0.373**	0.002	0.011**
	(0.505)	(0.123)	(0.070)	(0.157)	(0.005)	(0.005)
Observations	448	4,467	12,113	446	4,410	11,951
R-squared	91.7%	92.5%	93.7%	98.8%	99.9%	99.7%
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm age FE	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes