Inside the black box of outcome additionality: Effects of early-stage government subsidies on resource accumulation and new venture performance

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ABSTRACT

This paper examines the outcome additionality of prestigious early-stage government subsidies. Drawing on arguments from liabilities of newness and certification literatures we develop a mediated model that unpacks the outcome additionality of the subsidy. We hypothesize that subsidized new ventures attract more human and financial capital than their non-subsidized counterparts because the association with a prestigious government organization signals legitimacy of the new venture. Such legitimacy is crucial for attracting qualified employees and financiers. The effect of the access to human and financial capital, in turn, has long-term and substantial influence on performance, whereas the effect of the subsidy itself is marginal and short-lived. Applying a novel matching approach, we compare 130 approved applicants of a prestigious government subsidy with a control group of 154 applications rejected at the very last stage, thereby overcoming some of the selection and endogeneity biases associated with similar studies. The hypothesized model receives strong support by the data. These findings have several implications for government support of new ventures as well as scholars in the field.

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1. Introduction

The role of new ventures as engines for economic development and employment has garnered substantial attention during the last couple of decades. Much of this focus stems from the commonly shared view that such businesses account for a significant part of job creation, productivity growth and innovation (Storey, 1994; Henrekson and Johanson, 2010). For example, net job growth in the United States economy occurs almost exclusively through startup firms. Although being important, however, the prospects of new ventures are very uncertain with the majority of them failing during their five first years of existence (Sarasvathy et al., 2011; Jenkins et al., 2014). These insights regarding the simultaneous importance and vulnerability of new ventures have led governments around the world to develop policies to increase startup rates and support the growth and development of young firms.

The frailty of new ventures compared to their established counterparts is often summarized in the term 'liabilities of newness' (Stinchcombe, 1965; Baum, 1996). Organizations are socially stratified, and absent a track record, new ventures enter at the lower strata. Liabilities of newness largely stem from a lack of legitimacy in the eyes of potential resource providers, including employees, customers, and financiers (Aldrich, 1999). Hence, such resource providers are skeptical to engaging in economic exchange with an unknown entity. The persistence of liabilities of newness is well established (e.g., Hannan and Freeman, 1977). However, new ventures can devise strategies to overcome some of these liabilities. In particular, numerous studies have shown that establishing ties with important organizations helps alleviate liabilities of newness (e.g., Baum and Oliver, 1991; Venkataraman and Van de Ven, 1998). Such relationships increase the legitimacy of the new venture by signaling to others that it is worthy of resource exchange, thus facilitating acquisition of additional important resources from other stakeholders. In other words, the relationships with important organizations serve to certify the legitimacy of new ventures.

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Government policies in the form of selective financial support to new ventures are common. Apart from providing important financial resources, such interventions potentially provide a signaling effect to other stakeholders. If the government agency and the subsidy are considered legitimate and prestigious, the receipt of such a subsidy can be considered a signal of quality of the new venture (Kleer, 2010). By receiving a government subsidy, the new venture can be viewed as being certified as a legitimate entity, which potentially helps in overcoming some of the liabilities of newness and facilitates obtaining additional resources from other sources such as venture capitalists or banks (Lerner, 1999; Kleer, 2010). In being a certification of legitimacy, the subsidy can potentially provide benefits way beyond the actual financial resources provided. A growing body of literature has started to examine the potentially complex effects of government subsidies handed out to businesses (e.g., Buisseret et al., 1995; Clarysse et al., 2009; Hsu et al., 2009; Autio and Rannikko, 2015), typically under the rubric of 'outcome additionality'.

In this paper we aim at opening the black box of outcome additionality and reveal the mechanisms that transform public subsidies into firm-specific effects. More specifically, we examine how subsidies awarded to innovative new ventures through a specific government program influence the ability to attract further financing and employees. We then analyze the extent to which the subsidies and potential ensuing financial and human resources impact subsequent performance. By conducting these analyses we make several important contributions to the literature.

Most importantly, we develop a model were we jointly assess the impact of governmental subsidies on access to resources and subsequent venture performance. Thus, we shed light on causal mechanisms in terms of the extent to which human and financial capital transform subsidies into outcomes. This opening up of the black box of outcome additionality is important for our deeper understanding and theorizing about the role of subsidies in influencing important firm level outcomes. We do this by extending existing research with new perspectives.

First, we contextualize the concepts of certification and additionality in the realm of new ventures. Prior research suggests that this type of certification may be particularly relevant for new ventures because information asymmetry is especially pronounced here (Meuleman and De Maeseneire, 2012). To this we add that because of liabilities of newness, being certified by a reputable governmental agency as a legitimate organization is likely to be particularly important to new firms.

Second, the concept of liability of newness is well established and has received widespread support across multiple contexts. To date, however, it has not featured in the literature that tries to explain the implications of government subsidies to businesses. Because of its salience, we believe that it provides an important complimentary lens to the more common assessment of how subsidies can help overcome the challenge of information asymmetry.

Third, existing studies of additionality have particularly examined how government subsidies influence access to financial resources. For example, Lerner (1999) shows that subsidized firms are more likely to receive venture capital, suggesting that obtaining an R&D subsidy increases the access to long-term debt, and Feldman and Kelley (2006) argue that a receipt of a government R&D subsidy in general increase the funding from other sources. Prior studies have not, however, examined how certification directly influences the access to human capital in startup firms, i.e., how government subsidies influence the ability of new ventures to overcome liabilities of newness and attract qualified employees. While it is true that research has examined the relationship between subsidies and employment growth in startup firms (Colombo et al., 2012; Koski and Pajarinen, 2012), it has not considered that people are reluctant to join new ventures because of

liabilities of newness and that a certification from a government subsidy may have a direct effect on the attraction of competent staff. Thus, by examining also the willingness of employees to join the new venture receiving an innovation subsidy we examine a different stakeholder as well as an additional resource category. In doing so, we extend the scope of the literature and the discussion of the impact of government subsidies.

The remaining sections of this paper are organized as follows. The next section reviews the literature and develops hypotheses. These hypotheses are tested using linear regressions. We then present the results and discussions respectively, provide our conclusions and finally suggest future research routes.

2. Theoretical framework and hypotheses development

2.1. Hypotheses development: resource acquisition

Industrial countries spend significant effort and funds on programs that attempt to funnel public resources directly into innovative business projects and startup firms that are anticipated to have particularly large societal benefits. The changes in R&D spending, company behavior or performance that have positive societal impact but would not have occurred without public support are referred to as additionalities. Outcome additionality concerns how governmental support affects the targeted firm's outcome and performance (Georghiou, 2002; Clarysse et al., 2009). It is possible to identify three conceptually distinct reasons why government subsidies to new ventures may be beneficial.

First, subsidies for R&D and innovative activity can be justified on the basis of knowledge spill-over effects. Firms cannot fully capture the value of R&D investments since some knowledge spills over and benefits competitors. Thus, there is a risk that firms invest less than what is socially optimal. This is likely a particularly pronounced problem for new ventures because they lack the resources to defend their intellectual property in court (Baumol, 1993; Meuleman and De Maeseneire, 2012). Consequently, young firms may completely forego reaping any financial benefits from their innovative activities. This might substantially curb new ventures' willingness to invest into innovation. Subsidies can stimulate them to increase their investments to higher and socially more optimal levels.

Second, information asymmetry and the ensuing market failure is another reason for government subsidies, particularly relevant for new ventures. While large publicly listed companies divulge substantial and detailed information, there is less need for written contracts, reports, and other formal documents that can be examined by outsiders in small private firms (Carney, 2005). Furthermore, because of short operating history and underdeveloped control systems there is a lack of credible external information in young firms. Hence, it can be particularly challenging to collect information about new ventures. Entrepreneurs therefore hold considerable private knowledge about their businesses that is not easily assessed for outsiders. This information asymmetry makes it hard for financiers to differentiate between high risk and low risk targets, which can be used opportunistically by entrepreneurs leading to the adverse selection problem (Stiglitz and Weiss, 1981). Consequently, providers of debt and equity financing are likely to be overly restrictive in providing money to new ventures. Subsidies can compensate for this market failure, providing funding to new ventures needing external resources.

Liabilities of newness provides a third, albeit less explored, justification for government subsidies to new ventures. Compared to mature firms, which have established a level of viability, new ventures are more likely to fail because they lack track records providing evidence that their proposed offerings and manage-

ment capacity are competitive (Ostgaard and Birley, 1994). That is, early-stage firms generally lack external credibility and legitimacy with potential customers, suppliers, employees, investors, or other stakeholders, and hence encounter greater difficulty in obtaining resources necessary for survival and growth (Stuart et al., 1999). To overcome this liability of newness, entrepreneurs can perform activities that make their ventures more reliable and accountable, increasing their legitimacy and thereby the ability to attract needed resources (Meyer and Rowan, 1977; Hannan and Freeman, 1984). One way of enhancing legitimacy is through affiliations with prominent parties, where some portion of their legitimacy spills over to the associated firm (Rindova et al., 2005). That is, when the quality of a new venture cannot be directly observed, external actors instead rely on the quality of its affiliates (Stuart et al., 1999; Hsu, 2004). To the extent that government agencies are considered knowledgeable, they are viewed as due diligence experts and hence their investments convey a valuable legitimizing endorsement (c.f. Stuart et al., 1999). Hence, this certification-based approach may help legitimate new ventures that lack a track record. Such certification is likely to be particularly important to high-growth, innovative new ventures since they are especially dependent on external sources for rapidly securing resources given obstacles to generate them internally (Aldrich and Fiol, 1994).

Building on this logic, we propose that if the government agency and the subsidy it provides are regarded as legitimate and prestigious, being rewarded such a government subsidy can serve as information signals signaling that the new venture is certified by a trusted source. This legitimizes the new venture and makes it more attractive as a resource exchange partner for various stakeholders. Importantly, receipt of a subsidy is not sufficient in and of itself, i.e., the subsidy has to be perceived as a signal of quality (Lerner, 1999; Kleer, 2010). There is broad empirical support concerning the importance of third party certification for securing resources and other benefits. Such certifying institutions include auditors (Hogan, 1997), industrial alliance partners (Rao et al., 2008), investment banks (Gulati and Higgins, 2002) and venture capitalists (Hsu, 2004). Also existing research on government subsidies has proposed that selective subsidies may provide a positive signaling effect to uninformed parties, such as potential capital providers (Lerner, 1999; Feldman and Kelley, 2006; Meuleman and De Maeseneire, 2012). The overarching conclusion is that certification provides various benefits, including the ability to obtain financing. Applied to the context of government subsidies for new ventures, it suggests the following hypothesis:

Hypothesis 1a. Prestigious early-stage public subsidies reduce liabilities of newness due to certification effects leading to increased access to financial resources.

As argued above, liabilities of newness extend beyond the ability to secure financial resources. Recruiting qualified employees is one of the most important but challenging resource issues for small new firms, which has been addressed in numerous studies (e.g., Williamson et al., 2002; Cardon, 2003; Colombo et al., 2012; Greer et al., 2015). Unlike larger and well-known firms, startup firms lack a track record and can rarely rely on their name to attract new employees (Aldrich, 1999). Williamson et al. (2002) argue that this disadvantage primarily stem from lower levels of organizational familiarity and legitimacy. Young firms with smaller market shares, limited distribution networks, less media coverage and fewer investments in recruitment marketing, are unfamiliar to most job applicants. Since the job seeker needs to be aware of the employer before even consider a job opportunity, lack of familiarity can easily lead to recruitment failure (Williamson et al., 2002). Awareness is just the first step, though. In order to be considered an attractive employer, organizational legitimacy will also affect the recruitment success, when job seekers view organizations with

higher levels of legitimacy as more predictable, meaningful and trustworthy compared with firms possessing lower levels of legitimacy (Suchman, 1995). High levels of organizational legitimacy can be a signal that the organization has the resources to pay competitive salaries, offer career opportunities, job security and in general treat employees well. Hence, organizational reputation influences recruitment success, when employers with better reputations attract not only more, but also higher quality, applicants (Turban and Cable, 2003). Many startup firms lack organizational legitimacy and reputation as an employer of choice due to limited track records. Therefore, most small and young businesses need to find ways to overcome the barriers of unfamiliarity and low organizational legitimacy in order to successfully attract skilled job seekers.

In line with the discussion above, one way of enhancing legitimacy is to develop relationships with legitimate organizations. When uncertainty about the quality of an organization is high, prominent affiliations serve as an endorsement, resolving uncertainty regarding the focal organization (Rindova et al., 2005). The certification function arrives from the belief that legitimate organizations will make high-qualitative and thorough evaluations of potential associates before entering into a business relationship. Thereby a relationship with a legitimate organization is likely to signal to job seekers that the young firm is a legitimate, reliable and credible (Williamson et al., 2002).

That public subsidies have a positive impact on employment growth has been shown in previous studies (Lerner, 1999; Almus, 2004; Colombo et al., 2012; Koski and Pajarinen, 2012). Colombo et al. (2012), when assessing the impact of public subsidies on employment growth, argued that selective subsides, i.e., subsidies awarded through a screening procedure carried out by specialists, imply a certification effect that reduce information asymmetries between recipient firms and their external stakeholders. Lerner (1999), when analyzing the US subsidy SBIR program, suggested that knowledgeable government officials seem to certify firms to third parties, including to job seekers; "The awards themselves might have served as a signal to venture capitalists or, alternatively, might have allowed the firm to attract high-quality managers [..]". (p. 313).

On the basis of the above discussion, we argue that receiving a subsidy from a prestigious governmental organization has two positive effects on the recruiting prospects. First, the subsidized venture will gain from the increased awareness, stemming from marketing efforts initiated by the governmental organization. Hence the awarded venture's familiarity among job seekers will increase. Second, the affiliation with the governmental organization will enhance the young venture's legitimacy due to spill-over effects. Taken together, new ventures that receive prestigious and competitive government subsidies should be able to attract a larger number of and more qualified job candidates due to increased awareness and certification signals. This leads to the following hypothesis:

Hypothesis 1b. Prestigious early-stage public subsidies reduce liabilities of newness due to certification effects leading to increased acquisition of human resources.

2.2. Hypotheses development: firm performance

The results concerning the relationship between government subsidies and firm performance are mixed (Lerner, 1999; Girma et al., 2007; Hall and Maffioli, 2008; Koski and Pajarinen, 2012). The reason for this, we argue, is that the causal mechanisms through which subsidies influence performance have not been sufficiently considered. Above we have argued that government subsidies provide certification to new ventures that help them overcome some

of the liabilities of newness. Consequently, these new ventures are better able to attract resources from the environment, specifically financial and human resources. However, neither funding nor additional employees are ultimate goals for entrepreneurs per se. Rather, these resources are considered means to reach the mission to build prospering and sustainable businesses. Hence, we propose that it is the acquisition and utilization of these resources rather than the subsidies themselves that influence subsequent performance. That is, while subsidies may have some direct performance effects, they are likely to be minor and to wear off rapidly.

A body of literature has examined the influence of initial resources endowments and subsequent performance of new ventures (e.g., Cooper et al., 1994; Dahlqvist et al., 2000). New ventures struggle to obtain the resources needed for initiating operations and reaching a stable operating platform. Upon entering the market, initial resource endowments act as buffers against environmental selection. These endowments serve to protect the organization from 'running out of fuel' until it is able to internally generate resources or on a continuous basis mobilize resources from the environment. Upon founding, the new venture develops routines that are adapted to match environmental requirements, which leads to an imprinting effect and path dependency. Thus, there is reason to assume that initial human and financial resources influence subsequent performance for an extensive period of time. For example, financial capitalization of young innovative firms buys entrepreneurs time to successfully execute existing strategic plans, undertake more ambitious strategies, or enter new strategic routes (Cooper et al., 1994). Capable employees are crucial to venture growth by helping entrepreneurs to execute their plans and objectives (Gilbert et al., 2006). The above discussion leads to the following hypotheses:

Hypothesis 2a. Financial resources have a positive influence on new venture performance.

Hypothesis 2b. Human resources have a positive influence on new venture performance.

In sum, our theoretical arguments suggest that government subsidies primarily influence new ventures' access to financial and human capital, and that these resources in turn influence performance. The direct influence of subsidies on performance, on the other hand, is likely to be minor and to wear off rapidly. This leads to the following mediation hypotheses:

Hypothesis 3a. The acquisition of financial resources mediates the relationship between prestigious early-stage public subsidies and performance.

Hypothesis 3b. The acquisition of human resources mediates the relationship between prestigious early-stage public subsidies and performance.

3. Method

3.1. Research design and sample

Assessing the impact of subsidies is challenging because it is virtually impossible to address the counterfactual. How would recipients of subsidies perform if they had not received the subsidy and vice versa? Two approaches dominate this research. In survey based studies, subsidized firms or policy makers are asked about the outcomes of the subsidies and what would have happened had they not received the subsidy. This presumes that the respondents are capable of counterfactual analysis, which is no easy task (Georghiou, 2002). These studies tend to systematically bias estimated impact leading to exaggerated results. In part this is because more positive assessments increase the probability of

renewing subsidy programs and of receiving additional subsidies (Klette et al., 2000; Norrman and Bager-Sjögren, 2010).

Matching techniques provide an alternative. Popular designs involve assigning a control group of 'perfect twins' of similar firms that did not apply for the subsidy, or multivariate propensity score matching (PSM) of non-subsidized firms (Rosenbaum and Rubin, 1983). These techniques have been criticized because they only consider observable characteristics. Those applying for subsidies and those who do not likely differ in systematic non-observable ways, because subsidies are not randomly assigned but firms self-select into applying for subsidies (Georghiou, 2002; Kerr et al., 2014).

An alternative matching approach that we apply in this research is to instead limit the sampling of the comparison group to those firms that applied and fulfilled all set criteria for the subsidy but, in the end, did not receive it. More specifically, we compare the small percentage of firms that qualified for the subsidy with the almost equally small 'second tier' of firms that passed all screening steps except for the last one. Thus, we are able to construct two groups that are matched on observable as well as unobservable characteristics to such an extent that the assignment of the subsidy (the treatment) approaches close to randomness (cf. Kerr et al., 2014). In addition, we have access to extensive detailed data from both groups of firms, which allow us to control for a number of remaining systematic differences between them. By applying this type of matched sample approach, we attempt to minimize the issue of unobserved heterogeneity between funded and non-funded ventures.

The sample was constructed in close collaboration with the Swedish Governmental Agency for Innovation Systems (VINNOVA) who gave us full access to the data we requested. They operate the program VINN NU ('Win Now'), which awards grants of 300 kSEK (approximately 40 kUSD) to up to 24 companies annually. This program targets new ventures that are less than one year of age at the time of application, that are in the process of developing a unique and innovative product or service, and that are development-oriented and wish to expand. Recipients must have a developed idea and proof of concept. The subsidy is intended to be used as a springboard to receive additional equity financing from other sources. While 50 percent of the subsidy should be dedicated to business development, such as sales and marketing, the remaining part could be used for other activities, including R&D. VINN NU is one of the more well-known subsidy programs targeting young firms in Sweden, where the firms receiving the subsidy get relatively high attention in media coverage and other public forums. Thus, given the design of the subsidy as a grant awarded by a prestigious government agency, that it is selective and competitive and that the recipients receive quite a bit of media attention, this subsidy meets the requirement of representing positive signaling of a trusted third party. Thus, this kind of subsidy indeed qualifies as an incidence of certification.

Our study utilizes data for firms applying for the subsidy between 2002 and 2008. In order to fully understand the VINN NU evaluation process, we made three in-depth interviews with two persons working with the program at VINNOVA. The evaluation of the applicants was extensive and identical across the seven years from which we obtain our data. In a first step, internal experts screened all applications, eliminating those deemed non-eligible or less appropriate. Approximately 50% of the applications were eliminated this way. The remaining applications were subjected to due diligence carried out by external experts. They evaluated the applications utilizing a standardized form rating them on a scale from one to six, a higher number indicating greater viability. Only those receiving the highest scores were retained. VINNOVA staff then pruned this sample to ensure that the number of candidates did not exceed the number of grants that had been allotted. When

Table 1
Overview of sample – total applications, supported and non-supported applications.

Cohort	(Total applications)	Supported	Non-supported
2002	431	14	17
2003	189	20	26
2004	81	19	28
2005	77	20	18
2006	84	20	18
2007	90	21	24
2008	80	16	23
Total	1102	130	154

Notes: Total applications = total number of applications to the VINN NU program each year. Supported = total number of supported applications each year. Non-supported = total number of applications that almost received the subsidy but was rejected in the final selection stage. This study's sample includes the supported and non-supported applications, amounting to a total of 284 applications.

prompted, VINNOVA could provide no tangible decision criteria for this final round of elimination, or specify any differences between those who received the grant and those who did not. Still, while we conclude that this final selection comes close to random assignment, there is still an element of selection in the last round. Hence, we cannot fully rule out some unobserved heterogeneity in the ventures receiving subsidy from the control group, which is a limitation of our study. In order to reduce this caveat, we controlled for sample selection bias by comparing differences along a range of variables for those receiving the grant and those making it into the final round not receiving it. No statistically significant differences in these variables were found, besides a minor difference in founder age (see Table 2c). For the same reason, as a robustness check we also conducted a propensity score matching procedure (see below).

In total, 1102 new ventures applied for the subsidy. 284 made it to the final evaluation stage. Out of these, 130 applications (11.8% of all applicants) were supported and 154 (14.0% of all applicants) were rejected. Thus, the approval rate in the final selection stage was close to 50% which is ideal for our purpose of comparing recipients with the 'second tier' of firms almost receiving the subsidy. These 284 firms constitute our sample (see Table 1 for an overview).[1]

We also conducted a pre-study consisting of interviews with eight entrepreneurs who had applied for VINN NU subsidies. The interviews took place during the spring of 2013 and lasted between one and two hours each. The aim was to get a deeper understanding about the firms' funding processes in general and more specifically about the entrepreneurs' perceptions about how the receiving of VINN NU subsidies affected future resource acquisitions, including the ability to attract qualified employees and additional funding.

Independent variables were taken from the detailed application submitted by each firm. In addition, we matched the sample with data from the Swedish Companies Registration Office where all Swedish companies have to file detailed annual statements by law. This allows us to measure invested financial capital, number of employees and performance over several subsequent years. The data include annual observations for all firms until 2011 or until they went out of business. In total, 37 businesses went out of business (13% of the sample). They are included in the sample until their last year of observation. Analyses were also conducted with these firms removed, where the results were more or less identical. Because of our research design, the number of observations varies

across cohorts from nine years for the 2002 cohort, to three years for the 2008 cohort.

3.2. Variables and measures

3.2.1. Dependent variable: performance

There is no established consensus regarding suitable performance indicators of new ventures. For example, during early phases profitability and net assets are typically negative among innovative new ventures. In this study we followed the lead of Brush and VanderWerf (1992) using annual sales as the performance indicator. The variable, $Sales_{AVG}$, is constructed as the average annual sales from the year following the filing of the subsidy application until year 2011.

3.2.2. Mediating variables: access to financial and human resources

External equity was used as the measure of access to financial resources. External equity includes funding from existing or new shareholders from e.g., founders, business angels or venture capitalists.[2] In order to ensure that we tapped into financial resources raised as a function of the initial subsidy and not because of subsequent performance, we measured this variable, $Equity_{Y1}$, the year after the subsidy was received (or not). We had access to measures of debt as well but preferred to use this solely as a control variable. The reason is that equity is considered the major external source of financing to innovative startup firms, while debt is fairly uncommon in such ventures (Berger and Udell, 1998). This was confirmed in this study of innovative high-growth startups, where only 17.7 percent of the firms had raised any debt at all and amounts raised were typically much smaller than the amounts of equity. To measure access to human capital, we examined the number of employees. For the same reasons, this variable, $Employees_{Y1}$, was measured the year after the subsidy was received (or not).

3.2.3. Independent variable: subsidy

The variable Subsidy is coded 1 in case the firm received the VINN NU subsidy and 0 if the application was rejected in the final selection stage.

3.2.4. Control variables

A number of control variables are used in the equations. We include three industry dummies: Construction (28.5% of the sample), Transportation (26.3% of the sample) and Manufacturing (24.5% of the sample), with 'other' as the hold out category. The dummy variable Region control, coded 1 for urban location (Stockholm, Uppsala, Skåne, and Västra Götaland, 72% of the sample) and 0 otherwise, is used for controlling geographical origin. To control for cohort effects, we include cohort variables for the years 2002-2008, where the Cohort 2008 is the hold out variable. We also include a dummy variable to control for IP protection strategy, $IPR strategy_{Y-1}$, coded 1 if the firm had or planned to apply for a patent at the time of the application for a VINN NU subsidy, and 0 otherwise. Four control variables are used to control for firm size and financial conditions. The intangible asset variable $Intangible assets_{Y-1}$ includes balanced payments for R&D, software development, patents, licenses, trademark, etc., at firm foundation. $Employees_{Y-1}$ controls for initial size in terms of numbers of employees. $Equity_{Y-1}$ and $Debt_{Y-1}$ measure amount of equity and debt financing received the year prior to the VINN NU application. All financial measures are in thousands of SEK.

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[1] During the first two years of existence the number of applications to the VINN NU program was significantly higher in comparison with later years. This was, according to VINNOVA, due to more intense marketing efforts these years. The number of applications that passed to the final selection stage was on the same level during all years. In the regressions, we control for cohort effects.

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[2] Our pre-study interviews indicate that a vast majority of the external equity arrives from business angels.

Research about venture capitalists and business angels suggests that entrepreneur background and experience impact the likelihood of getting funded (Mason and Stark, 2004; Hsu, 2007; Franke et al., 2008; Hoenig and Henkel, 2015). Hence, as control variables we also included a number of factors related to the founder and the team. The variable Founder invest$_{Y-1}$ indicates the total amount of capital that the founder had invested before applying for the VINN NU subsidy. The control variable Startup team$_{Y-1}$ measures founder team size before the VINN NU application. In order to capture experience, the variable Founder age$_{Y-1}$, indicating the founders' age at the time for the application, was introduced. We also control for the founder's gender, Founder gender, where 1 indicates female and 2 male. Unfortunately, our dataset lack other human capital measures, such as formal education, previous startup experience, or industry experience (Davidsson and Honig, 2003), as well as information about value propositions and business models for the respective ventures. Including such control variables would have further improved the robustness of our model, and is thus a limitation of the study.

3.3. Analyses and robustness tests

All variables with the exception for the binary were logged (primarily to mitigate the effects of heteroscedasticity and the influence of extreme observations) and standardized (to obtain a scale free analysis)[3]. To estimate and conduct inference in our models, we relied on ordinary least square regressions (OLS) using SPSS, version 22. To test the extent of the mediation, we use the Sobel's test (Sobel, 1982). Since our analyses involve binary variables, we followed the recommendations of Baron and Kenney (1986) and calculated bias corrected estimates and standard errors for the Sobel's test using bootstrap methods (developed by UCLA Statistical Consulting Group). Furthermore, due to our relatively large sample ($n = 284$) and that the Gauss-Markov assumptions seemed satisfied (except for non-spherical distributed errors)[4], we expect the estimators of our linear regression model to be consistent and closely follow a multivariate normal distribution.[5]

Tables 2a and 2b present descriptive statistics and correlations for the variables used in the study. Most independent and control variables exhibited small to moderate correlations. VIF tests reached a maximum value of 2.837, which is well below critical values (Hair et al., 2005).

In order to assess if the firms receiving the subsidy and the 'second tier' firms were indeed similar, we compared means of size of the founder team, founder age, founder investments, equity levels, debt levels, intangible assets, number of employees, and IPR strategy the year before the firms applied for a VINN NU subsidy.[6] The t-tests show no statistically significant differences between the groups, besides for a minor difference in the founders' average age (see Table 2c).[7] This lends support to the validity of our sampling strategy and the chosen matching approach.

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[3] Except for the binary variables, we employed the Grubb's test and tested for outliers in our transformed data. At a 5% significance level, no outliers were found.

[4] We also conducted analyses using White's heteroscedasticity robust standard errors. Results were essentially identical.

[5] Full rank of the matrix covariates is ensured by examinations of VIF factors (see below). The exogeneity property of the covariates is assumed to hold because of our sampling strategy (cf. the discussion of the endogeneity problem above). We also conducted a regression equation specification error test, i.e., the RESET test (Ramsey, 1969). We found that the hypothesis of a linear regression specification could not be rejected.

[6] The decision to make the comparison of factors measured the year before a VINN NU application is due to that effects occurred already the same year a subsidy was approved for a number of firms.

[7] We also compared means of the variables growth ambition, internationalization ambition and survival across time resulting in no significant differences between

Table 2a
Description of variables.

Variables	Mean	Min	Max	S.D.	N
1 Subsidy	.458	0	1	.499	284
2 Construction	.236	0	1	.425	284
3 Transportation	.275	0	1	.447	284
4 Manufacturing	.254	0	1	.436	284
5 Region control	.650	0	1	.478	277
6 Cohort 2002	.109	0	1	.312	284
7 Cohort 2003	.162	0	1	.369	284
8 Cohort 2004	.165	0	1	.372	284
9 Cohort 2005	.134	0	1	.341	284
10 Cohort 2006	.134	0	1	.341	284
11 Cohort 2007	.158	0	1	.366	284
12 IPR strategy$_{Y-1}$	1.282	1	2	.451	284
13 Startup team $_{Y-1}$	2.352	1	8	1.530	284
14 Founder age$_{Y-1}$	45.770	29	77	9.734	183
15 Founder gender	1.860	1	2	.349	276
16 Founder invest$_{Y-1}$	176	0	17400	1056	284
17 Equity$_{Y-1}$	113	−991	2861	285	284
18 Debt$_{Y-1}$	88	0	1500	215	284
19 Intangible assets$_{Y-1}$	83	0	2045	241	284
20 Employees$_{Y-1}$	.577	0	7	1.124	284
21 Equity$_{Y1}$	763	−864	26398	2281	284
22 Employees$_{Y1}$	1.926	0	21	2.331	284
23 Sales$_{AVG}$	1888	0	87453	6115	284

We conducted several robustness tests. First, we performed alternative analyses. For example, in one analysis we included only firms that applied for a VINN NU subsidy between 2002 and 2004. Irrespectively of how the sample was constructed, results were materially identical. Second, we tested the robustness of our model by a random sub-sample consisting of 60 percent of the original sample. The same results are stable also in this analysis.

Third, we added a test of our sampling strategy through propensity score matching (Rosenbaum and Rubin, 1983). An econometric approach to adjust a treatment effect for measured confounders in non-randomized studies is an alternative to the commonly used regression adjustment (for an overview, see Stuart, 2010). The propensity score is defined as the probability of receiving treatment based on the same covariates as in our model. Based on logistic regressions, our model correctly classifies 59.9 per cent of the cases. We also applied the Hosmer–Lemeshow goodness-of-fit test for logistic regressions to assess the validity of the PSM approach. The observed value of this test equals 2.028, and implies that the null hypothesis is not rejected (p-value = .980), supporting that the PSM yields a god model fit to our data.[8] We used nearest neighborhood matching to create a matched sample were we paired the 130 firms that received the VINN NU subsidy with the closest value of the 130 cases in the 'second tier' group. Our analysis shows that there is no significant mean difference between any of our continuous baseline covariates (cf., Austin, 2011). The only standardized difference above the recommended 0.1 (Normand et al., 2001) is Equity$_{Y-1}$ with a value at −0.112. This together with our paired sample gives confidence to our matching and provides an indication that the PSM model has been correctly specified. We used the PSM scores for another robustness check, i.e., a paired sample t-test, where we examine whether the paired sample differ on our three performance variables. Table 2d shows that there is a larger effect in the group receiving the subsidy. There is an effect also in the 'second tier' group, but not at the same level. Finally, we also ran the regression models with the PSM samples instead of our original sample, generating almost the exact same results. In this paper, we report

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subsidized versus rejected applicants (the results are available upon request from the authors).

[8] It should be noted that the PSM model was only specified with data from the original model not including more covariates than could be influential.

Table 2b
Correlations.

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1 Subsidy												
2 Construction	−.342**											
3 Transportation	−.324**	−.359**										
4 Manufacturing	.097	.005	−.048									
5 Region control	−.035	.012	.030	.045								
6 Cohort 2002	.048	.029	−.037	.016	−.154**							
7 Cohort 2003	−.002	.002	−.020	.009	−.156**	−.196**						
8 Cohort 2004	.050	.013	−.015	−.023	−.138*	−.173**	−.175**					
9 Cohort 2005	.050	.036	−.086	−.001	−.138*	−.173**	−.175**	−.154**				
10 Cohort 2006	−.059	−.073	.102	−.027	−.152*	−.191**	−.193**	−.171**	−.171**			
11 Cohort 2007	−.053	−.035	−.005	−.132*	.032	.022	.058	−.131*	−.016	.028		
12 IPR strategy$_{Y-1}$	.004	−.047	−.050	−.002	−.142*	.198**	.205**	−.057	−.125*	−.123*	−.014	
13 Startup team $_{Y-1}$	.019	−.115	−.017	−.016	−.075	.269**	−.155*	.114	.086	−.009	.082	.020
14 Founder age$_{Y-1}$	−.013	.090	−.043	−.037	−.020	.095	−.121*	.129*	.068	−.006	.037	−.057
15 Founder gender	−.032	−.020	.004	−.016	−.162**	.017	−.011	.013	.052	−.032	−.134*	.068
16 Founder invest$_{Y-1}$	−.079	−.052	.122*	−.035	−.141*	−.033	−.151*	.150*	−.005	.103	.019	−.024
17 Equity$_{Y-1}$	.020	−.123*	.023	−.035	−.106	−.069	−.040	.134*	.073	.060	−.068	−.014
18 Debt$_{Y-1}$	.055	−.082	.040	−.011	−.128*	−.071	−.071	.183**	−.003	.143*	−.057	−.005
19 Intangible assets$_{Y-1}$	−.136*	.177**	−.043	−.072	−.142*	.078	−.119*	.060	.165**	.034	.015	−.055
20 Employees$_{Y-1}$	.088	.047	−.107	.066	−.126*	−.043	−.028	.055	.167**	−.081	.022	−.061
21 Equity$_{Y1}$	−.130*	.307**	−.129*	−.022	−.017	.044	−.079	−.026	.125*	−.008	−.052	−.105
22 Employees$_{Y1}$	−.217**	.225**	.026	−.026	.038	.079	.052	−.019	.018	−.053	.019	.000
23 Sales$_{AVG}$	.122*	.084	−.113	.124*	−.004	−.020	−.048	.054	.054	.008	−.025	−.030

Variables	13	14	15	16	17	18	19	20	21	22
14 Founder age$_{Y-1}$	.021									
15 Founder gender	.095	−.031								
16 Founder invest$_{Y-1}$	.216**	.056	.060							
17 Equity$_{Y-1}$	.196**	.080	−.021	.443**						
18 Debt$_{Y-1}$	.260**	.038	−.058	.471**	.675**					
19 Intangible assets$_{Y-1}$	−.117	.138*	.006	.410**	.245**	.199**				
20 Employees$_{Y-1}$	−.113	−.001	−.029	.175**	.111	.106	.160**			
21 Equity$_{Y1}$	−.287**	.077	−.002	.059	.074	.032	.463**	.384**		
22 Employees$_{Y1}$	−.114	−.018	.034	.122*	.015	−.040	.235**	.254**	.470**	
23 Sales$_{AVG}$	−.141	.002	−.031	−.065	.014	.025	−.006	.210**	.180**	.095

$p < .10$ (two-tailed).
*** $p < .001$.
** $p < .01$.
* $p < .05$.

Table 2c
t-tests of equality of means the year before subsidy applications.

Variable	Supported		Non-supported		t-test
	Mean	S.D.	Mean	S.D.	
Startup team $_{Y-1}$	2.254	1.371	2.435	1.653	1.010
Founder age$_{Y-1}$	44.212	9.552	46.981	9.748	−1.922†
Founder invest$_{Y-1}$	115.231	277.058	226.766	1411.927	.959
Equity$_{Y-1}$	124.985	339.240	102.740	231.155	−.634
Debt$_{Y-1}$	104.277	252.680	74.481	177.682	−1.129
Intangible assets$_{Y-1}$	91.092	24.970	75.597	241.632	−.539
Employees$_{Y-1}$	.569	1.154	.584	1.101	.113
IPR strategy$_{Y-1}$	91.092	24.970	75.597	241.632	−.539

† $p < 0.10$.

Table 2d
Paired sample t-test of differences for supported and non-supported applications before and after subsidy application.

		Supported mean	Non-supported mean
Pair 1	Equity$_{Y-1}$	124.985	
	Equity$_{Y1}$	1184.170	
	Sig.	p-value < 0.001	
Pair 2	Employees$_{Y-1}$	.569	
	Employees$_{Y1}$	2.403	
	Sig.	p-value < 0.001	
Pair 3	Sales$_{Y-1}$[a]	76.695	
	Sales$_{AVG}$	2987.535	
	Sig.	p-value < 0.001	
Pair 4	Equity$_{Y-1}$		102.740
	Equity$_{Y1}$		384.60
	Sig.		p-value < 0.001
Pair 5	Employees$_{Y-1}$		.584
	Employees$_{Y1}$		1.550
	Sig.		p-value < 0.001
Pair 6	Sales$_{Y-1}$[a]		132.828
	Sales$_{AVG}$		1622.653
	Sig.		p-value < 0.001

[a] Average sales the year before subsidy application.

the matching analysis of the original data (models 0 to 4) as well as the final regression model for the PSM groups (see 'PSM model' in Table 3). The other analyses and results are available upon request from the authors.

4. Results

Fig. 1 provides graphical illustrations of the development of the mean values of the two samples regarding equity, number of employees, and annual sales. All three graphs clearly show that the two samples start out at very similar levels for the three indicators and that both samples exhibit growth over the studied period. Over time, however, a gap opens up with the recipients of the VINN NU subsidy substantially outperforming the 'second tier' firms that almost received the subsidy for all three variables. Importantly, while the increase of equity funding and number of employees take place soon after subsidy approval, the difference in performance arrives later. Moreover, the graphs indicate that the increase in employees occurs earlier than the increase in equity funding, which obviates the idea that the increase in employees is an indirect effect of additional funding. The gaps thereafter keep growing every year throughout the studied period. After the seventh year,

Table 3
Regression tests of hypotheses.

	Sales$_{AVG}$ Model 0	Equity$_{Y1}$ Model 1	EMP.$_{Y1}$ Model 1B	Sales$_{AVG}$ Model 2A	Sales$_{AVG}$ Model 2B	Sales$_{AVG}$ Model 3	Sales$_{AVG}$ Model 3A	Sales$_{AVG}$ Model 3B	Sales$_{AVG}$ Model 4	Sales$_{AVG}$ PSM model
Equity$_{Y1}$				.358*** [.079]			.348*** [.081]		.220** [.079]	.199* [.081]
Employees$_{Y1}$					.527*** [.082]			.520*** [.083]	.445*** [.086]	.407*** [.089]
Subsidy		.194** [.072]	.141* [.066]			.112† [.077]	0.044 [.075]	0.039 [.071]	0.007 [.007]	−0.008 [.142]
Construction	0.012 [.094]	0.181 [.089]	0.073 [.082]	−0.07 [.091]	−0.045 [.084]	−0.015 [.096]	−0.078 [.092]	−0.053 [.086]	−0.083 [.491]	−0.053 [.086]
Transportation	.196* [.093]	0.065 [.087]	.274** [.080]	.163$^{···}$ [.088]	0.041 [.087]	.180† [.093]	.157* [.089]	0.038 [.087]	0.044 [.085]	0.118 [.091]
Manufacturing	0.128 [.091]	0.07 [.084]	0.06 [.078]	0.102 [.086]	0.095 [.082]	0.126 [.091]	0.101 [.086]	0.095 [.082]	0.084 [.080]	0.107 [.083]
Region control	0.03 [.075]	0.008 [.070]	−0.052 [.064]	0.022 [.071]	0.052 [.067]	0.022 [.075]	0.019 [.071]	0.049 [.068]	0.044	0.004
Cohort 2002	.524* [.249]	−0.455 [.230]	0.065 [.212]	.684** [.238]	.487* [.223]	.519* [.248]	.678** [.238]	.485* [.223]	.590** [.222]	.557* [.221]
Cohort 2003	.573* [.246]	−0.16 [.228]	0.037 [.210]	.634** [.233]	.558* [.220]	.579* [.245]	.635** [.233]	.560* [.221]	.598** [.217]	.545* [.219]
Cohort 2004	.520* [.221]	−0.076 [.205]	−0.141 [.189]	.558** [.209]	.606** [.198]	.537* [.221]	.563** [.210]	.610** [.221]	.616** [.195]	.648** [.202]
Cohort 2005	0.427 [.544]	−0.197 [.506]	−0.511 [.466]	0.499 [.514]	0.645 [.488]	0.349 [.545]	0.418 [.518]	0.615 [.492]	0.62 [.482]	0.617 [.477]
Cohort 2006	1.686 [1.012]	1.197 [.941]	−0.08 [.866]	1.171 [.962]	1.673† [.904]	1.458 [1.013]	1.131 [.966]	1.590† [.910]	1.321 [.897]	1.114 [.890]
Cohort 2007	0.278 [.282]	−.468† [.262]	−0.382 [.241]	0.426 [.268]	.459† [.254]	0.246 [.282]	0.409 [.270]	.445† [.256]	0.519 [.252]	0.475 [.250]
IPR strategy$_{Y-1}$	0.093 [.074]	0.106 [.068]	0.021 [.063]	0.058 [.070]	0.084 [.066]	0.097 [.074]	0.060 [.070]	0.085 [.066]	0.064 [.065]	0.066 [.067]
Startup team$_{Y-1}$	−0.066 [.079]	−0.042 [.073]	−0.048 [.067]	−0.049 [.075]	−0.039 [.071]	−0.064 [.079]	−0.049 [.075]	−0.038 [.071]	−0.33 [.070]	−0.03 [.072]
Founder age$_{Y-1}$	−0.013 [.009]	−0.012 [.008]	−.019* [.008]	−0.008 [.008]	−0.002 [.008]	−0.011 [.009]	−0.007 [.008]	−0.001 [.008]	0 [.008]	0.003 [.008]
Founder gender	−0.153 [.201]	−0.068 [.187]	0.08 [.174]	−0.117 [.019]	−0.182 [.089]	−0.134 [.201]	−0.11 [.191]	−0.175 [.181]	−0.154 [.177]	−0.127 [.177]
Founder invest.$_{Y-1}$	0.046 [.068]	−0.03 [.063]	0.054 [.054]	0.058 [.064]	0.019 [.061]	0.048 [.068]	0.058 [.064]	0.02 [.061]	0.031 [.060]	0.03 [.060]
Equity$_{Y-1}$	0.101 [.099]	.153† [.092]	−.121† [.068]	0.056 [.0094]	.183* [.089]	0.116 [.099]	0.063 [.095]	.187* [.090]	0.143 [.089]	0.088 [.092]
Debt$_{Y-1}$	0.061 [.112]	−0.058 [.104]	0.037 [.074]	0.081 [.106]	0.062 [.100]	0.06 [.112]	0.08 [.106]	0.061 [.100]	0.074 [.089]	0.063 [.099]
Intangible assets$_{Y-1}$	−0.056 [.123]	0.079 [.114]	−0.004 [.076]	−0.091 [.116]	−0.105 [.110]	−0.066 [.123]	−0.094 [.117]	−0.108 [.110]	−0.119 [.108]	−0.121 [.109]
Employees$_{Y-1}$	.217* [.105]	0.028 [.097]	.434*** [.053]	.359* [.099]	−0.018 [.082]	.211* [.105]	.201* [.099]	−0.017 [.101]	0.01 [.099]	0.052 [.104]
Constant	0.536 [.548]	0.796 [.512]	0.769 [.471]	0.187 [.523]	0.063 [.495]	0.434 [.551]	1.57 [.527]	0.034 [.499]	-83 [.491]	−0.237 [.507]
R^2	.177	.185	.359	.271	.347	.187	.272	.348	.378	.370
Adjusted R^2	.080	.083	.278	.180	.265	.086	.176	.262	.292	.276
F	1.821*	1.815*	4.473***	2.972***	4.234***	1.846*	2.836***	4.037***	4.369***	3.905**
N	284	284	284	284	284	284	284	284	284	260

* $p < .05$.

** $p < .01$.

*** $p < .001$.

† $p < .10$ (one-tailed for the variables equity, employees and subsidy, otherwise two-tailed). Besides the reported regression coefficients, White's robust standard errors are reported in brackets. F designates the overall significance of the model.
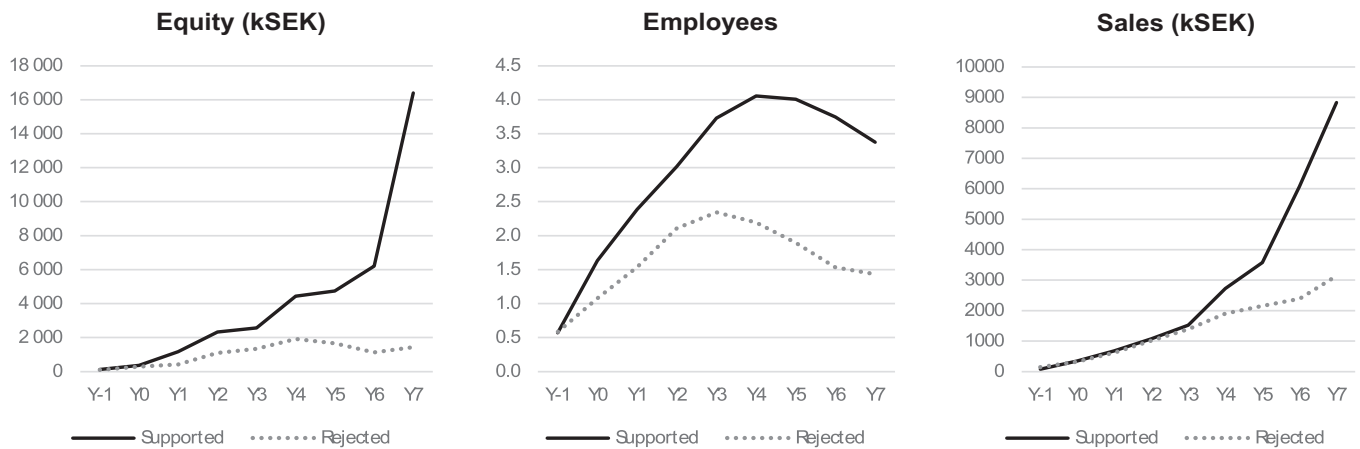
Fig. 1. Illustrations of differences between supported and non-supported subsidy applications.

equity raised, number of people employed and sales achieved are more than twice as high among those receiving the subsidy. These results provide some preliminary support for our hypotheses and also indicate that the effect of the initial subsidy seems to be long-term rather than a quick fix. A final important observation is that the subsidy of 40 kUSD is very small in magnitude compared to the total amount of equity financing raised.

In order to test the hypotheses we turn to the results of the OLS regressions, exhibited in Table 3. Model 0 shows the base model containing the study's control variables, with performance as the dependent variable. This model explains 17.7% of the variation in data. Positive and significant effects can be noted from the industry control Transportation and from the cohort variables 2002–2004, indicating that older firms are associated with higher sales. Also the variable measuring the number of employees before VINN NU application has a positive and significant effect on sales.

Next we examine the effect of receiving the VINN NU subsidy on accessing financial and human capital (Models 1A and 1B). Model 1A shows a positive effect of the VINN NU subsidy on attracting external equity ($\beta = .194$, p-value < .01). This supports Hypothesis 1a stating that an early-stage public subsidy reduces liabilities of newness due to signaling effects so that it increases new ventures' access to financial resources. Model 1B indicates that firms awarded the subsidy also attract more employees ($\beta = .141$, p-value < .05). This lends support to Hypothesis 1b stating that early-stage public subsidies reduce liabilities of newness due to signaling effects, which leads to increased acquisition of human resources. Our pre-study interviews provided additional support for the finding that the award of a VINN NU subsidy increases the possibility to attract personnel due to signaling effects. These interviews also revealed that the VINN NU applicants recruited highly qualified staff who had several other employment opportunities.

Next, the effects of initial financial and human capital on performance are examined. Model 2A tests Hypothesis 2a stating that financial resources have a positive influence on new venture performance. The result shows that higher levels of equity are significantly and positively related to performance ($\beta = .358$, p-value < .001). This supports Hypothesis 2a. In a similar way, Model 2B tests Hypothesis 2b stating that human resources have a positive influence on new venture performance. Here we find a significant and positive effect of the number of employees on performance ($\beta = .527$, p-value < .001), supporting Hypothesis 2b.

Thereafter, we test the mediation effects outlined in Hypotheses 3a and 3b. In Model 3 performance is the dependent variable, and we include receiving the VINN NU subsidy as an explanatory variable. We find that the variable is positively and significantly related to performance ($\beta = .112$, p-value < .10). We then add equity in Model 3A. In this model equity is positively and significantly related to performance ($\beta = .348$, p-value < .001). Explained variation of the data is also substantially improved, and has now increased from 18.7% to 27.2%. At the same time, the estimate of the VINN NU subsidy is reduced and not significant ($\beta = .044$). When calculating the indirect effect we obtain .068 (=.112 − .044) and find that the effect is significant (Sobel's test = 2.675, p-value < .01). Taken together, we find evidence in favor of Hypothesis 3a stating that the acquisition of financial resources mediates the relationship between early-stage public subsidies and performance.

Model 3B includes the Employees variable instead of equity, which is consistent with Hypothesis 3b stating that the acquisition of human resources mediates the relationship between early-stage public subsidies and performance. The results show that the Employees variable has a positive and statistically significant effect on performance ($\beta = .520$, p-value < .001). Explained variation of the data increases from 18.7% to 34.8%. Model 3B also shows that when the Employees variable (the mediator variable) is included in the regression, the subsidy variable no longer influences performance ($\beta = .039$, p-value = .584). The indirect effect yields .073 (= .112 − .039) and is significant (Sobel's test = 2.881, p-value < .01). Thereby we also find support for Hypothesis 3b stating that the acquisition of human resources mediates the relationship between early stage public subsidies and performance.

Finally, we test a model where we include the combined effect of the VINN NU subsidy, external equity and the number of employees simultaneously (Model 4). The model shows that equity ($\beta = .220$, p-value < .01) as well as the number of employees ($\beta = .445$, p-value < .001) are positively and significantly related to performance while the subsidy variable is not ($\beta = .007$, p-value = .215). Explained variation of the data is now increasing from 18.7% to 37.8%, which is a statistically significant improvement over Model 3. These results show that the number of employees is the most prominent mediator variable of the two, both in terms of magnitude and significance. Moreover, the indirect effect amounts now to .105 (= .112 − .007), and the effect is significant (Sobel's test = 3.114, p-value < .001). Consequently, by conventional standards external equity and employees fully mediate the relation between performance and subsidies in innovative startup firms. The last model in Table 3, PSM model, is our robustness test. The regression is based on the PSM matched sample and reports almost identical results which gives confidence to our twin sample approach.

5. Discussion

In this paper we set out to examine how the receipt of a government subsidy influences the performance of new ventures. In doing

so, we aimed at contributing to the small but growing literature examining the additionality of government subsidies. We hypothesized and found that the implications of the relatively small subsidy equaling 40 kUSD extended way beyond the monetary amount both in terms of magnitude and time. In fact, it appeared that the effects just continued to grow for the full seven years following the receipt of the subsidy included in our study (see Fig. 1). This is a very interesting and important discovery. What could be a reasonable explanation for such a dramatic finding? In this paper we focused on the liabilities of newness. This concept is derived from the idea of the social stratification of organizations with new ventures entering at the lowest rungs of the ladder (Stinchcombe, 1965). Because of low status, it is difficult for new ventures to attract the financial and human resources necessary for survival and growth. But just like people can move up the social ladder by associating themselves with higher status individuals, new ventures can benefit greatly from being certified by third party institutions. On the basis of our results, it appears that the receipts of a prestigious and highly competitive government subsidy provides an important quality signal, which moves new ventures several rungs up that ladder in a way that is difficult for other ventures to mimic. Because of the unique challenges of new ventures in establishing legitimacy, we believe the certification effect of government subsidies to be particularly strong in this context compared to many other types of businesses. Our results seem to support this notion. Thus, we would encourage those interested in the study of certification generally – and outcome additionality specifically – to further explore the implications in the new venture context.

Ecological theories emphasize that founding conditions matter because of imprinting and path-dependence. Empirical studies have confirmed that initial resource endowments have long-term performance implications (Cooper et al., 1994; Dahlqvist et al., 2000). To this we add the finding that a comparatively small initial subsidy equivalent of 40 kUSD seems to have remarkably strong and long-lasting implications among innovative, growth-oriented new ventures. The graphs included in Fig. 1 are indeed very illustrative of this phenomenon. The findings were also borne out in our multivariate analyses of firm-level variance. It appears to us that more research in this vein examining the impact of initial resources for later outcomes would likely be very valuable. Databases suitable for such purpose are increasingly becoming available. For example, large-scale initiatives such as the PSED (Panel Study of Entrepreneurial Dynamics, e.g., Reynolds (2010)) and the KFS (Kauffman Firm Survey, e.g., Coleman and Robb (2009)) are now publically available for scholars to be used.

Specifically, we developed a model to open up the black box of outcome additionality by investigating how human and financial capital transform subsidies to excess performance. We started by examining how the VINN NU subsidy awarded in Sweden influences new ventures' success in accessing subsequent financial and human capital. We hypothesized and found that they outperformed similar 'second tier' firms on both these resource categories, explained by direct signaling effects. Previous studies have found similar results for financial capital (Lerner, 1999; Feldman and Kelley, 2006; Meuleman and De Maeseneire, 2012). The replication of such results indicates that our context share similarities with prior studies and speaks to the validity of our findings. While previous research has appointed signaling as an indirect effect facilitating increase in employment growth in startup firms (Colombo et al., 2012), we are, to our knowledge, the first to examine how a subsidy like this directly influences the success of recruiting people in newly established firms. It should be kept in mind that the vast majority of companies in the sample are knowledge-intensive and recruit highly educated and qualified employees with other employment options, a fact that was confirmed in the pilot interviews. In other words, recruitment is a challenge for these firms. Furthermore, in the qualitative interviews, we explored if it potentially was the subsequent funding (possibly from prestigious business angels) rather than the initial subsidy that led to the improved recruitment success. We found no support for such a 'secondary' effect. Instead, it seems like the certification of the subsidy itself, including its positive effect on increased awareness about the subsidized firm, serves to make the new venture a more attractive employer. Moreover, the found positive influence of human resources on performance indicates that the subsidized firms succeeded to hire persons with desired qualities and thereby with abilities to make strong contributions. We believe that our finding regarding signaling effects on recruitment in young firms is important. Future studies in the field would benefit from moving beyond the single-eyed focus on certification effects on obtaining financial resources.

6. Implications

Our opening up of the 'black box' of additionality should be valuable to policy makers. In particular, our findings regarding the causal structure of subsidies influencing the access to financial and human capital reveals that a little can go a long way. Understanding that the money serves to certificate the quality of the recipient in the eyes of potential employees and investors, rather than constituting an important financial contribution is a central insight from this study. The design of government programs, i.e., the nature and structure of the subsidy, seem critically important. In most industrialized countries, there are several support programs targeting new ventures. We would suspect that the extent to which such programs are perceived as valuable and actually work to certify new ventures as legitimate entities varies greatly depending on the prestige of the particular program. It seems that the way the subsidy is designed, how attractive and competitive it is and how prestigious it is perceived is likely to be important for the extent to which it serves as a certification of the quality of new ventures. This is something that governments should keep in mind when designing subsidies for new ventures in order to ensure that money is wisely spent. In his assessment of the SBIR program in the USA, Lerner (1999, p. 317) speculated that "it might be possible that a program that offered much more modest subsidies could also be effective in certifying the quality – and spurring the growth – of small high-technology firms". Our paper provides evidence in support of this speculation. The resource leverage of the VINN NU program appears very substantial. For example, the recipients of the VINN NU grant raised more money compared to those not receiving the grant at a magnitude multiple times greater than the actual grant, which is quite modest.

Our study also provides information about the topic of when it is most effective to award subsidies to firms. Because of imprinting and path-dependency and as illustrated by our results it appears that the earlier the better. The longer a firms is in existence, the more difficult and expensive it becomes to change its path of development. Moreover, it is during its early existence that the liabilities of newness is the highest and the value of certification the greatest. On the flipside, the fate of any individual new venture is uncertain and many fail during their first years of existence. Therefore the risk of investing into a firm that fails is higher the younger it is. Hence, there has to be a balance between these two.

There is a push for evidence-based management in the literature (e.g., Rousseau et al., 2008) and a debate about research designs that qualify as capable of providing sufficient evidence to render recommendations for managers and entrepreneurs (Frese et al., 2014). Randomized controlled experiments typically rank the highest in terms of generating solid evidence. Such approach would be ideal for establishing not only the effectiveness of government programs, but more importantly also what constitutes effective

entrepreneurship more broadly. A challenge is though that few government programs in support of entrepreneurship are likely to allow such randomized controlled experiments. Although we consider the research design of our study to come close in terms of isolating the effect of the subsidy, we acknowledge that our sampling procedure is not entirely random with an element of selection in the final round. Hence, we cannot fully rule out some unobserved heterogeneity in the ventures receiving the subsidy from those firms who did not. This is a limitation of our study. Having said that, we consider that the generation of the data, in close collaboration with the government authority, provided us with close to random assignment, supported by multiple robustness tests. Thereby our empirical approach, utilizing a novel matching design, increases the validity and trustworthiness of the results and recommendations over and above many other studies in the field. We believe that similar research designs would be valuable in the evaluation of government programs more generally.

Finally, from the entrepreneurs' perspective our results are straightforward: In case you start an innovative new venture, an early subsidy has a performance effect particularly if followed by additional funding and recruitments. The limited work it takes to apply for such a subsidy is thereby well worth the effort.

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