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The Effect of Subsidies on New Ventures? Access to Bank Loans

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Abstract

This study examines the effect of new ventures? subsidy receipt on the use of long-term bank loans. Since access to financial resources is crucial for these firms to develop, administrations have increasingly initiated selective support programs to foster innovation and growth of start-ups. For such support to become effective it is, however, important that firms can augment these publicly provided resources with additional means, at least in the longer-run. Studying 5,297 new ventures founded between 2005 and 2009 in Germany, we test whether the subsidy itself may facilitate access to bank loans. Applying econometric techniques that account for the endogenous nature of a subsidy receipt, we find support for the hypothesis that subsidized young firms are more likely to use bank loans and obtain a larger share of their financing mix from banks and that this effect is stronger in highly information-opaque sectors. The results suggests that the effect may be attributed to a certification effect providing relevant information for banks? loan assessment procedures.

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ABSTRACT

This study examines the effect of new ventures' subsidy receipt on the use of long-term bank loans. Since access to financial resources is crucial for these firms to develop, administrations have increasingly initiated selective support programs to foster innovation and growth of start-ups. For such support to become effective it is, however, important that firms can augment these publicly provided resources with additional means, at least in the longer-run. Studying 5,297 new ventures founded between 2005 and 2009 in Germany, we test whether the subsidy itself may facilitate access to bank loans. Applying econometric techniques that account for the endogenous nature of a subsidy receipt, we find support for the hypothesis that subsidized young firms are more likely to use bank loans and obtain a larger share of their financing mix from banks and that this effect is stronger in highly information-opaque sectors. The results suggests that the effect may be attributed to a certification effect providing relevant information for banks' loan assessment procedures.

Keywords: *Government policy* • *Certification* • *Public subsidies* • *Industry affiliation* • New ventures

JEL Classifications: *G32* • *H25* • *O38*

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1. INTRODUCTION

For new ventures, gaining access to financial resources is one of the key challenges they have to overcome in order to successfully build up their business operations (Berger and Udell, 1998). While the entrepreneur is usually not able or willing to provide all necessary funds from his private wealth, external capital may be difficult to obtain due to the high level of uncertainty and opacity that stems from the liability of newness of the start-up (Wiklund et al., 2010). Despite information asymmetries between the entrepreneur and external capital providers, bank loans continue to play a major role in financing young firms, particularly, in bank-based capital markets as in Western Europe (Achleitner et al., 2011). Thus, it seems that debt providers are able to select new ventures that fit to their lending strategy. So far, little is known about how debt providers assess the risk of new ventures and which criteria inform their lending decision. This study adds to the understanding of the role of public funding agencies play for the lending decision of debt providers. In particular, we examine whether the receipt of subsidies as a common financing instrument for new ventures are relevant in this context. Since gaining access to financial resources of new ventures might be crucial to foster innovation, prosperity and growth, governments try to find appropriate solutions to support them. There exist various subsidy types such as government grants, loans, venture capital and guarantee programs. This study focuses on governmental grants, which are not only the most frequently used subsidy type of support, but also directly provide financial resources to fund operations and growth investments (Colombo et al., 2013). Besides this direct liquidity effect, governmental grants may serve as a certification instrument that informs debt providers about a young firms' otherwise hard-to-observe prospects. Selective grants may then reduce information asymmetries and, thereby, lending uncertainty (Colombo et al., 2011; Kleer, 2010).

Prior empirical studies indeed suggest that receiving subsidies affects transactions between young firms and capital providers. Besides evidence for a positive effect of R&D grants on venture capital access (Lerner, 1999), SMEs may benefit from subsidies through raising long-

term debt (Meuleman and DeMaeseneire, 2012) and facilitate access to other funding sources, such as federal government programs and public venture capital (Feldman and Kelley, 2006). Yet, the financing demand of new firms as well as the extent of information asymmetries strongly depends on the sector. Moreover, governments tend to be committed to support and develop selective industries (Wydra et al., 2010).

This study contributes to previous research by explicitly accounting for the sector heterogeneity with regard to demand for debt and the selection of firms into subsidy schemes. The KfW/ZEW Start-up panel database constitutes a representative sample of both subsidized and unsubsidized newly founded legally independent firms ageing one to five years. We complement information on 5,297 new ventures founded between 2005 and 2009 in Germany with data from secondary sources, such as the German Federal Statistical office and Creditreform Database, to gain additional information about location specific macroeconomic characteristics and the firm credit rating. By comparing subsidized and unsubsidized new ventures and controlling for various factors that might affect bank loan access, we examine if there are differences of the likelihood of bank loan usage and volume of bank loans in use for new ventures. To account for differences in financing demand and information opaqueness, we distinguish between high-tech and low-tech industries as well as between knowledge-based and non-knowledge-based services new ventures.

The results show that the receipt of public grants increases the likelihood of new ventures to raise bank debt and the volume of bank loans and that this effect is strongest for high-tech new ventures and young knowledge-based service firms. The certification through subsidy receipt thus appears to be stronger for new ventures from sectors, which are prone to greater information asymmetries. This indicates that grants add relevant information for banks to reach a lending decision especially for firms in information opaque sectors.

The paper proceeds as follows. In Section 2, we briefly review the relevant literature on bank loans and subsidies for new ventures. Section 3 presents the econometric framework and

Section 4 describes the data. In Section 5, we discuss the results of our econometric analysis and before concluding in Section 6.

2. THEORETICAL BACKGROUND

2.1 The Relationship between New Ventures, Subsidies and Bank Loans

New ventures are subject to the liability of newness as their future is uncertain and success or failure are difficult to predict. Failure rates of young companies are significantly higher than for their older counterparts (Wiklund et al., 2010). Uncertainties about the functionality of the business model, the fast pace of entrepreneurial situations (Bird, 1988), managerial acumen (Sapienza and Gupta, 1994), and overall doubts about the industry's survival (Zimmerman and Zeitz, 2002) are major challenges for new ventures. Given that uncertainty is a main characteristic of an entrepreneurial environment, it has direct implications for new ventures, and potential investors.

If a new venture aims to raise outside finance from banks or outside investors, information asymmetries are prevalent (Blumberg and Letterie, 2008). Founders are usually better informed than outsiders due to the difficulty of assessing the quality of young firms and the abilities of the founders. The required information is usually uneconomic to obtain, difficult to interpret (Mason and Stark, 2004) or does not even exist. This partially one-sided distribution of information has an effect on the contract between the new venture and the outsider, such as a bank. Information asymmetries cannot be fully contracted away, which causes two distinctive agency problems (Van Osnabrugge, 2000). First, a financing contract between a new venture and a bank can lead to moral hazard problems because of a modification of the founders' incentive structure. As it is difficult for banks to monitor the behavior of the founders, the founder may have an incentive to change behavior in comparison to a situation in which only the founder's personal capital is at stake. For instance, founders could replace low risk-return projects with high-risk return ones. As a consequence, due to fixed interest payments banks

bear the risk, but do not benefit from the high returns in the case of a successful outcome (Schröder, 2013). Anticipating this, banks may be reluctant to lend in the first place because of the high credit default risks compared to lower interest gains through repayment obligations. Second, banks would like to be able to identify new ventures which are more likely to repay a loan, since the expected return for banks depends on the probability of repayment (Stiglitz and Weiss, 1981). Adverse selection problems therefore arise if banks cannot completely verify the abilities of the founders or the business concept of the new venture. Thus, agency problems make outside financing expensive and restraint lending decisions especially for investments of higher uncertainty (Hottenrott and Czarnitzki 2011).

Entrepreneurial finance literature identified criteria relevant for the banks' assessment process of new ventures including founder's experience, business characteristics, gender, and ethnicity (Marlow and Patton, 2005; Smallbone et al., 2003). Further factors are the personal wealth and the willingness of the founder to use it as collateral. Collateral addresses both uncertainty problems and its use aligns the interests of the founder with those of the bank (Berger and Udell, 1998).

The spreading of public subsidy programs drew attention to their role as information factor in lending decisions (Colombo et al., 2013; Grilli and Murtinu, 2012; Meuleman and DeMaeseneire, 2012). Previous studies indeed stressed that public subsidies may serve as quality certificates because they provide outsiders with additional information (Feldman and Kelley, 2006; Kleer, 2010; Lerner, 1999).

2.2 Subsidy Receipt as a Quality Certification

Government initiatives to support new ventures often aim at providing them with funding, which constitutes a direct effect of public grants on new venture financing. A secondary effect may arise when subsidy grants work as quality certificates. For such certification to be credible

three conditions must be met (Megginson and Weiss, 1991; Myers and Majluf, 1984; Spence, 1973). First, the awarding authority must have reputational capital at stake. Second, it must be costly for the recipient (for instance in terms of time and effort) to acquire the certificate, and third, the subsidy receipt must be observable and verifiably for outsiders.

Indeed, the awarding processes for grants is usually conditioned on strict requirements since funding agencies have an incentive to establish a thorough assessment procedure. First, the allocation of scarce public money requires a careful selection of those ventures that are likely to provide a return to the public investment. Second, it is self-interest of the agency to pick potential successful start-ups to avoid a negative reputation (Bergström, 2000; BMWi, 2012). By delegating the assessment of the business models and the founders' attributes to highly trained and experienced personnel, funding agencies aim to ensure quality standards and credibility of the awarding process. Usually, a new venture interested in receiving a subsidy has to complete a time-consuming and costly application process. In Germany, for instance, in a first step the coherence and sustainability of the business model needs to be verified by the responsible Chamber of Commerce. Second, the founders have to set out their personal abilities to manage and lead a new venture and to submit an obligatory business plan. Thus, the selection procedure is costly for both sides, the applicant and the awarding authority. In case of a positive evaluation, the subsidy decision is usually made available by the firm and funding agency through public statements. The subsidy receipt is therefore easily observable to banks and other investors. Taking into account this additional information, adverse selection problems may be reduced due to the supplementary, external assessment by the funding agency and the reflected commitment of the applicant firm. If the receipt of a subsidy is indeed an uncertainty reducing certification of the hard-to-observe quality of a young firm, banks may be more likely to lend to subsidized new ventures. In response to reduced information costs, a subsidy may not only have an effect on the likelihood to raise debt, but also on lending volumes and other terms and conditions offered by the bank.

In a European context, few studies have studied the effects of subsidies of financing constraints. Lerner (1999) showed that SBIR program awardees have better access to external equity due to the quality certification through subsidy receipt. Further, he pointed out that the certification is particularly important for high-tech new ventures, where it is difficult to assess the risk of business projects. Colombo et al. (2013) found for Italian new-technology-based firms that the receipt of public subsidies increased the investment rate and reduced the investment-cash flow sensitivity. These findings suggest relaxed financing constraints because of better access to financial debt. Also Meuleman and DeMaeseneire (2012) found for Belgian SMEs that the receipt of R&D subsidies positively correlates with long-term debt.

The results from these studies indicate that the level information opaqueness of the firm (high-tech or complex technology-based) or the type of investment (R&D versus more tangible investment) affects the need for a certification and its information value.

2.3 The Effect of Subsidy Receipt for Manufacturing New Ventures

While new ventures overall present significant information asymmetries for outsiders, new firms from certain industry sectors are likely to be among the more information-opaque firms (Cumming, 2012). The major reason for the uncertainty of a banks' lending decision into high-tech new ventures can be traced back to the complex and difficult assessment procedure. It is more difficult for banks to observe and monitor investment projects than assets-in-place (Smith Jr and Watts, 1992). As high-tech new ventures are more likely to have more intangible assets both in absolute and relative terms, and, hence, less reliably measurable collateral, to invest in compared to young low-tech firms which increases information asymmetry between, particularly, high-tech new ventures and banks. Further, the problem of adverse selection is predominant in the high-tech sector as the founders of high-tech firms have more relevant information and knowledge about the risks of the business model and specific business-related

projects (Grilli and Murtinu, 2015). Complex products and technologies often imply that the founders possess a greater insight into the technology than a bank, even if banks tend to specialize in certain sectors (Hoewer et al., 2011). In case of high uncertainty, banks may decide to ration credit, rather than e.g. raise interest rates, in order to circumvent the problem of adverse selection (Carpenter and Petersen, 2002; Stiglitz and Weiss, 1981). At the same time, high-tech firms may have a higher financing demand than other start-ups due to investment in specialized human capital and manufacturing tools and machinery. Thus, high-tech new ventures may benefit more from suitable certification instruments. If the extent of information asymmetry decreases from high-tech to medium-tech right and to low-tech new ventures, we hypothesize that the receipt of a subsidy might have a stronger effect in reducing information asymmetry for young high-tech firms.

2.4 The Effect of Subsidy Receipt for Service New Ventures

Service sector new ventures are common business formations and play an important role in the functioning of innovation and growth (Czarnitzki and Spielkamp, 2003). Nonetheless, young services companies are relatively understudied in particular regarding their challenges in raising financial resources. Service companies' business models usually show a close interaction between production and consumption. As a result of this so-called co-terminality, the consumer cannot usually test the service before purchasing it (Sirilli and Evangelista, 1998). Similarly, an investor or a bank cannot assess the product entirely since it is difficult for service new ventures to provide banks with physical evidence of quality. The content of service products and processes can therefore be described as highly informational and intangible. Thus, the banks' perceived uncertainty of the future prospects of service new ventures may be high. In the context of service firms, adverse selection problems arise as the founders of service new ventures have more relevant knowledge about how to maintain the quality of the service

products and the processes (Carman and Langeard, 1980). Human resources and the organizational structure are key competitive factors for young service new ventures (Nahapiet and Ghoshal, 1998; Neu and Brown, 2005). Therefore, the educational background but also so-called soft-skills of the founder and the employees, as well as previous work and industry experience play a major role in the success of the company. The assessment of such capabilities, however, challenges banks, as the procedure is time consuming and requires specialized and experienced personnel. Moreover, service new ventures tend to have more complex business models, such as firms offering service products based on scientific practices. Thus, the information asymmetries between these kind of service new ventures, which offer knowledge-intensive services, and debt providers may also be higher compared to new service firms with simpler business models.

Based on the nature of the business model, knowledge-intensive services are both more equipment- and people-based compared to their less-knowledge-intensive counterparts. For instance, conducting experiments in natural science or in engineering depends highly on the presence of costly tools and machinery, as well as on well-trained employees and founders. In comparison with other services, knowledge-intensive are more complex and, thus, more difficult to assess. Thus, if information asymmetry is higher in knowledge-intensive sectors compared to other service firms, we expect that the information value of a subsidy may be higher for banks that face a lending decision to knowledge-intensive service ventures.

Kernel density plots presented in Figure 1 show the distribution of bank loans (as share of total financing) for subsidized versus unsubsidized firms. For large parts of the distribution, subsidized firms show higher bank loan financing shares compared to the non-subsidized group. However, when looking at the industry-specific distributions presented in Figure 2, it turns out that this pattern is much more pronounced among high-tech new ventures and knowledge-based service firms. This pattern might suggest that the relationship between public subsidies and access to bank loans differs in these more information opaque industries. While this observation

is not sufficient to derive causality between subsidy receipt and use of bank loans, the following analysis aims to investigate this link controlling for selection into a subsidy scheme and taking into account other factors that explain bank financing of new firms.

Figure 1 about here

Figure 2 about here

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3. ECONOMETRIC FRAMEWORK

We adopt an econometric approach that allows us to study the effect of a ventures' subsidy receipt on the accessibility and the volume of bank loans. Building on the industry heterogeneity described above, we differentiate between a cross-industry analysis and sector specific models for high- and low-tech as well as knowledge-intensive service new ventures and other service firms. Given the non-random nature of subsidy awards to new firms, we implement models that allow correcting for selection bias and endogeneity. In particular, we estimate instrumental variable models and conduct non-parametric matching procedures. The basic model can be written as:

$$y_1 = y_2' \beta_1 + x_1' \beta_2 + u \quad (1)$$

Where y_1 is the dependent variable, in our case bank loans, and y_2 is the endogenous variable, in our case the grant receipt. The vector x_1 represents the set of exogenous variables determining the lending decision.

We propose two-stage models in which the subsidy award is modelled in the first stage and access to bank loans in the second stage. The subsidy award can be described as:

$$y_2 = x_1' \gamma_1 + x_2' + e \quad (2)$$

The second stage bank loan equation in its simplest form is then:

$$y_1 = \hat{y}_2' \beta_1 + x_1' \beta_2 + u \tag{3}$$

It is important to note that the attributes of a new venture that affect the subsidy decision, may also explain the accessibility of bank loans. Technically speaking, the treatment variable and the error term in the bank loan equation are correlated so that the estimator will be inconsistent. A typical solution is to use instrumental variables (Wooldridge, 2012)[4]. For this approach, it is necessary to identify instrumental variables (IV) which correlate with the treatment variable but not with the error term. In the following, we therefore conduct (1) IV probit regressions to examine the probability of bank loan access, and (2) linear two-stage-least squares (2SLS) and IV tobit regressions, to investigate the volume of financial debt.

However, the application of the instrumental variables approach is based on assumptions of valid instruments and functional forms. Non-parametric matching estimators have the advantage not to require functional form nor error term distribution assumptions (Angrist, 1995; Heckman et al., 1997). Thus, we conduct a propensity score matching routine, which is a variant of the nearest neighbor matching. In particular, we allocate each subsidy recipient with the most similar non-recipient firm. The allocation is based on the similarity in the propensity scores, estimated from a probit model with a dummy variable indicating the receipt of a subsidy. The average difference in loan access and loans share in total financing, i.e. the average treatment effect on the treated, can be estimated as:

$$\alpha^{TT} = \frac{1}{N^S} \sum_{i=1}^{N^S} \left(Y_i^S - \hat{Y}_i^C \right) \tag{4}$$

where Y_i^S indicates the outcome of treated firms and $\hat{Y}_i^C$ the counterfactual situation, i.e. the potential outcome which would have been realized if the treatment group had not been treated. $S \in \{0,1\}$ indicates the receipt of a subsidy and N^S the number of treated firms. In order to ensure a suitable allocation, we imply a threshold for the maximum distance between an allocated pair

[4] See pages 512-553 for further details on the method if instrumental variables.

of observations. If the distance exceeds the threshold, the observation will be dropped to avoid bias (Smith and Todd, 2005).

4. DATA AND DESCRIPTIVE STATISTICS

4.1 Empirical Setting: KfW/ZEW Start-up Panel

In this paper, we use the KfW/ZEW Start-up panel which was established in 2008 by the Centre for European Economic Research (ZEW), KfW Bankengruppe[5] and Creditreform[6] in order to examine newly founded, legally independent firms in Germany. The firms are interviewed via a telephone survey with a target size of 6,000 interviews per year. See Fryges et al. (2009) for a detailed description. The initial data set used for the following analysis comprises information on approximately 6,000[7] start-ups from the cohorts 2005 to 2009. The data set contains quantitative and qualitative relevant information about the financial situation of the new venture (financing sources and finance structure), and about the receipt of a subsidy grant (subsidy type and period of receipt). Furthermore, firm specific data (e.g. number of patents, number of employees), as well as information about the founders (e.g. gender, education and work experience) are included. We enrich the data set from secondary sources, in particular location-specific economic data from the German Federal Statistical Office. After elimination incomplete records, the final sample consist of 5,297 observations from 4,244 firms.

4.2 Variables

Bank financing: The first dependent variable indicates whether a new venture uses long-term bank loans (DBankloans). Firms using long-term bank loans are coded 1 (and 0 otherwise). 21% of the firms in our sample have some bank financing. It should be noted that long-term bank loans explicitly exclude short-term debt in terms of overdraft facilities. The share of long-

[5] Germany's largest state-owned promotional bank.
[6] Germany's largest credit rating agency.
[7] 1,774 start-ups in 2005, 3,944 in 2006, 6,374 in 2007, 6,645 in 2008 and 6,191 in 2009.

term banks loans in use to total capital (ShareBankloans) is used to measure the relative importance of bank loans in a firm's financing mix. This overall share in our sample is 11%, but among new ventures with at least some bank financing the average ratio of long-term bank loans in use to total capital is 51/49, which emphasizes the relevance of bank loans for financing new ventures in Continental Europe.

Government grants: The main independent variable of interest indicates whether a new venture has received a public grant (DSubsidy) in a particular year. This variable is coded 1 for subsidy receipt and 0 otherwise. Overall the share of subsidized firms is 17%. We focus on grant-based subsidies which are the most frequently awarded support for new firms in Germany. More importantly, the assessment process is well documented, bound by strict quality standards, and easily accessible for outsiders. In our data, 26% of all subsidized new ventures have access to bank loans, whereas only 21% of non-subsidized new ventures are debt-backed. Moreover, subsidized new ventures use a greater share of long-term financial debt (13%) compared to their non-subsidized counterparts. These results are drawn from one-side t-tests, which are significant at the 1%-level.[8] We excluded other subsidy types, such as loans, guarantees and equity programs to avoid problems of reverse causality and distorting effects.

Control variables:

We control for founders' characteristics and capabilities as key lending criteria for debt providers, since these factors might influence knowledge, managerial abilities, problem-solving skills, motivation and self-confidence. Previous studies have pointed out that female entrepreneurs are more likely to found businesses with lower levels of overall capitalization (Carter and Rosa, 1998), lower ratios of financial debt (Haines et al., 1999). Therefore, we control for the founders' gender (Gender). In our sample, the share of female founded business is 19% on average.

[8] Table 1 exhibits the average numbers for DBankLoans and SharedBankLoans without taking into account DSubsidy.

One of the most analysed entrepreneurial variables for human capital is the entrepreneurs' education. This variable serves as a proxy for underlying factors that may directly influence how a new venture is organized and managed (Cooper et al., 1994). We include the dummy variable Educ, which takes 1 for entrepreneurs with a university degree and 0 otherwise. On average, 23% of the founders in our sample are graduated.

Further, we control for the industry experience (Exp) of a founder, because previous studies have shown that relevant working experience might increase the probability of receiving external financing (Wright et al., 1997). Therefore, we control for the years of industry experience of a founder. In our sample, the average founder has relevant working experience of 15 years.

We also include firm-specific control variables, since debt providers are particularly interested in the characteristics of the new venture when making a lending decision. An important criterion for the lending decision of banks is the capacity utilization in percent (Capacity) of a new venture. By including this variable, we are able to control for the interplay between human capital and the organizational structure of a new venture. This key figure might reflect the capabilities of the founders to manage future expectations correctly and to use the resources efficiently to reduce costs and, lastly, increase the likelihood of survival (Cooper et al., 1994).

Further, we take into account the new ventures' age in years (Age) to control for the fact that older firms have established track records that banks can observe. Those reputation effects might increase the volume on access to financial debt, suggesting that older firms have more access to bank loans. Indeed, Bougheas et al. (2006) find a positive relationship for firm age and short-term, as well as for firm age and long term debt, based on an examination of the FAME database covering all UK registered SMEs up to 11 years. In our sample of start-ups the average new venture exists for two years.

Additionally, two major criteria for the lending decision of banks are the revenue (LnRevenue) and whenever the new ventures already makes some profit (Profit). Revenue from sales

indicates the market size and the profitability of a new venture implies a reduction of risk and uncertainty for banks as a return of a new venture makes future repayment obligations possible. Bougheas et al. (2006) find that profitable firms get indeed more financing overall, regardless of funding source. The average revenue is 340,761€ and 49% of new venture make profits.

We also include the natural logarithm of the new ventures tangible assets (lnTangibleAssets) since the more tangible the new ventures' assets are, the greater is the companies' liquidation value. New ventures can reduce adverse selection and moral hazard problems by pledging their assets as collateral or contracting for fixed charges on certain tangible assets (Cassar, 2004). On average, new ventures hold tangible assets worth of 15,667€. The distribution of tangible assets is skewed to the left indicating that many new ventures have only few tangible assets. Further, we include the number of valid patents (Patents) as a proxy for intangible assets. Patents provide a mechanism to signal the quality of a patentee (Czarnitzki et al., 2014; Hsu and Ziedonis, 2013; Long, 2002). In our sample, the average number of patents is 0,28, whereas the maximum number of 140 patents can be observed for a new venture from the knowledge-based service sector.

Previous literature has pointed out that external equity finance, such as venture capital investments , have a positive certification effect on attracting further external capital (Megginson and Weiss, 1991). Equity investors have not only developed conceptional abilities to deal with adverse selection and moral hazard problems, but also gained high experience in evaluating uncertain business models. Therefore, we include a variable (DEquityFinance) which is takes the value 1 for 4% of the firms.

We also take into account macro-economic regional factors. We suggest that new ventures' foundations in rural areas are considered more uncertain as they tend to lack relevant networks partner, access to financial sources and a greater catchment area for potential customers due to a higher geographical distance. For this study, the proportion of forest area (ForestArea) in the new ventures' administrative district is included as a control variable to addresses the problem

that banks are simply not sufficiently reachable in rural areas. In previous literature, there is no consensus about the importance of the lenders' proximity to firms. Alessandrini et al. (2009) show that a greater functional distance between borrower and lender aggravate financing constraints, particularly for small firms. However, there are contradictory findings which highlight an increase in lender productivity with respect to new technology usage causing no disadvantages for borrowers after relocating differently (Petersen and Rajan, 2002). Another important macro-economic regional factor is the number of employees in the high-tech sector (HighTechEmployees) in the new ventures' administrative district are used as proxies to make rural areas measurable. By including this variable, we control for the opportunities to access human capital, and highly educated workforce in particular for high growth firms. The more specific human capital is to the type of business model, the greater the probability of the success of a new venture (Cooper et al., 1994).

Finally, we include year dummies for 2008 and 2009 to control for time effects.

Table 1 provides an overview about all main variables of our econometric models.

Instrumental variables: We carefully selected instrumental variables for various industry sectors in order to examine the effectiveness of subsidies correctly and take into account the specific nature of selective subsidy awarding procedures. Table A.1 exhibits an overview about the instrument variables used for this study.

Table 1 about here

Sector classification: We categorize new ventures according to their type of business following Fryges et al. (2009) based on NACE (2008), and Muller and Zenker (2001) for service firms Table 2 shows the means of our main variables by industry sector. Fruther, Tables 3 summarizes the definition of high-tech manufacturing (17%), low-tech manufacturing (23%), knowledge-intensive services (23%) and other services (37%). Table 4shows details for the different

sectors. For the 925 high-tech new ventures and 1,220 low-tech new ventures analyzed in the following, of our main variables we see that more low-tech firms use more bank loans in absolute (+8.8% in DBankLoans) and relative volume terms (+4.9% in ShareBankLoans), and have also a higher probability of receiving governmental grants (+5.5% in DSubsidy). Further, we examine 3,152 new ventures from the service sector. In our sample, we have also information about 1,119 young knowledge-intensive service firms and 1,953 non-knowledge-intensive service firms. We can state that non-knowledge-intensive service new ventures have a higher probability of gaining access to bank loans (+9.3% in DBankLoans) as well as using more financial debt in relative terms (+4.1% in ShareBankLoans).

Table 2 about here

Table 3 about here

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5. RESULTS

5.1 The Probability Effect of Subsidy Receipt on Bank Loan Access

Table 4 summarize the results from the IV probit regression models on the likelihood of bank loan access. For each model, the table reports first- and second-stage results. Model 1 analyzes the cross-industry treatment effect of subsidy receipt on the likelihood of whether a new venture uses bank loans. This baseline model shows that subsidy receipt has indeed a positive effect on the likelihood of the usage of bank loans in line with our hypothesis that the subsidy receipt serves as quality certificate, which reduces adverse selection problems between banks and new ventures. In the first stage, the instrumental variables IndustryR&D and IncomePerCapita are highly significant at the 1%-level and show the expected signs.

Results from Model 2 show that the effect is even stronger for subsidized high-tech new ventures. The results for low-tech new ventures (Model 3), on the other hand, do not show a significant effect of subsidy receipt on bank loan access. This suggests that for these firms a subsidy receipt does not translate into a higher probability of using bank loans. This may suggest that banks do not need (nor use) additional information since they are able to assess low-tech new ventures appropriately without taking into account additional information sources. Alternatively, the financing demand of low-tech new ventures could be lower leading to fewer firms seeking bank financing or to lower requested amounts.

Model 4 indicates that, similar to high-tech manufacturing firms, the subsidy receipt reduces adverse selection problems between banks and new ventures in the knowledge-intensive service sector. The assessment procedure of governmental institutions may provide relevant information about the business model and future prospects of the knowledge-based service new ventures.

In order to compare the effect of subsidy receipt on bank loans access, we run the same model on 1,199 non-knowledge-based service new ventures. As the results for Model 5 show, in that case we do not find evidence for subsidized new ventures to be more likely of gaining access to bank loans compared to non-subsidized new ventures. These results are also in line with our expectations that quality certificates are particularly valuable in environments where information asymmetries are large.

When considering the control variables, we find that former industry experience of the entrepreneur has a positive effect on the likelihood of receiving financial debt. The more relevant experience the founder has, the greater the probability of the success of a new venture (Cooper et al., 1994), which appears to be a relevant criterion for the lending decision. We also find new ventures' age having a positive effect on bank loan access. Older firms are more likely to have established track records that banks can observe, which might increase the likelihood of access to financial debt. Further, the revenue has also a positive effect on bank loan access,

since this variable potentially decrease uncertainty for banks. Another important point to mention is the significance of private equity investments in service new ventures for a bank's lending decision. Banks trust in the abilities of venture capitalists, business angels and other specialized firms, since they have developed exceptional skills to deal with adverse selection and moral hazard problems (Gompers and Lerner, 2001).

Table 4 about here

5.2 The Volume Effect of Subsidy Receipt on Bank Loan Access

It might be not only of interest whether subsidized new ventures from certain industries have a better access to bank loans in terms of probability, but also whether subsidized new ventures receive relatively more loans. Table 5 summarize the results from our 2SLS instrumental variable regressions for the share of bank loans in use compared to financing after subsidy receipt. For each model, the tables report first- and second-stage results and relevant test statistics.

Model 1 shows that subsidized new ventures tend to use approximately 34% more bank loans to total financing compared to those firms with no subsidy receipt.

Considering industry heterogeneity, we first examine bank loan access of high- and low-tech new ventures in the manufacturing industry. Model 2 shows highly significant coefficients for the subsidy receipt for manufacturing high-tech new ventures. They have an approximately 39% larger bank loans share compared to firms in the same sectors without a subsidy.

For new ventures from low-tech manufacturing industries, however, we do not find evidence that a subsidy receipt affects the share of bank loans (Model 3). Again, we interpret this result

as a weak or an even not existing subsidy certification effect for less information opaque low-tech new ventures.

Finally, Models 4 and 5 compare knowledge-based service new ventures to other service firms. For the former, we find that on average firms have approximately 39% higher financing shares from bank loans compared to their non-subsidized counterparts. For other service firms, on the other hand, we do not find a significant effect. Hence, the receipt of a subsidy does not seem to serve as a quality certificate for non-knowledge-intensive service new ventures.

When considering the control variables in Table 5, we find similar results compared to the IV probit regression models examining the likelihood of bank loan access. New ventures' age and the revenue have a positive effect on the volume of bank loans access, since an increase of both variables can be interpreted as a decrease of perceived uncertainty by banks. In line with that, the results show that profitability increases the likelihood of receiving financial debt for new ventures in Model 1, Model 3 and Model 4.

Table 5 about here

5.3 Accounting for Functional Form Assumptions

As a robustness check, we test the sensitivity of the results to the assumption of a continuous dependent variable in the linear estimation approach since the share of bank loans is naturally censored at zero. Therefore, we estimate IV tobit regression models that account for the censoring in the dependent variable (Table 6). The results confirm the previous findings of the 2SLS instrumental variable regressions. For highly information opaque new ventures, a subsidy receipt increases the volume of bank loans access, whereas low-tech new ventures and young

non-knowledge-intensive service firms do not indirectly benefit from subsidies with respect to receiving more financial debt. The control variables bear the expected and same signs compared to Table 5. Further, the instrument variables of the first stage regressions models are highly significant and also show the expected signs.

Table 6 about here

In addition to the parametric models presented so far, we apply propensity score matching models to test the robustness of the results to the choice of instruments and functional form assumptions. The results of the matching models (Table 7) indicate that the receipt of a subsidy has a positive and significant effect on the likelihood of bank loan usage and the share of bank loans for the aggregated model and for high-tech new ventures. Thus, the findings of the matching models are in line with the results presented in sections 5.2 and 5.3.

Table 7 about here

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6. CONCLUSION

In this paper, we examined whether the receipt of a subsidy grant may serve as a quality certificate for young firms that is used by banks and supports their lending decisions. Access to debt funding is a key challenge for new ventures, because the founders usually have not the financial resources to cover the new ventures' financing needs all by themselves. However, external capital may be difficult to obtain due to the inherent uncertainty of new ventures affecting the relationship between young firms and banks. By adopting the certification theory framework, we focus on the indirect effect of subsidy receipt for new ventures and analyze the potential to reduce information asymmetries. Insights on such indirect effects by subsidy grants

to new ventures are important since direct grants constitute a frequently implemented policy instrument.

The result that such certification effect may be stronger in more information opaque sectors adds to previous insights. In particular, we find a positive effect of a subsidy receipt on the access to (and the use of) bank loans for high-tech manufacturing and knowledge-intensive service firms, but not for low-tech manufacturing and other service firms.

These results indicate that the receipt of a subsidy is advantageous for start-ups in two ways. First, it aims to help directly to cover capital requirements. Second, it affects the behavior of banks, which use the subsidy receipt to better inform their lending decisions to the benefit of the new venture. However, it is important to stress that such information is only valuable in that regard if the subsidy programs and the awarding government agency fulfill the conditions of selectivity and credibility. Government agencies therefore may want to assure high standards in the selection process not only for invoking a large direct return to the public investment, but also to support the indirect value of the subsidy receipt.

We encourage more research on the certification value of public subsidies in other institutional context and for other types of firms. Further, it would have been desirable to study the effects on what would have been the "idea control group", i.e. firms that applied for subsidy schemes but had been rejected within the assessment procedure. Likewise, information about the actual financing demand of the firm would allow a more refined analysis.

Moreover, an in-depth examination of differences in subsidy types (or awarding agencies) would be interesting. Local, national and supranational institutions are important sources for public and financial support, but they may differ concerning their credibility and hence in terms of their awarded grants' information values.

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Figures and Tables

Figure 1 Kernel density estimates of the distribution of the share of bank loans in use by subsidized and non-subsidized new ventures

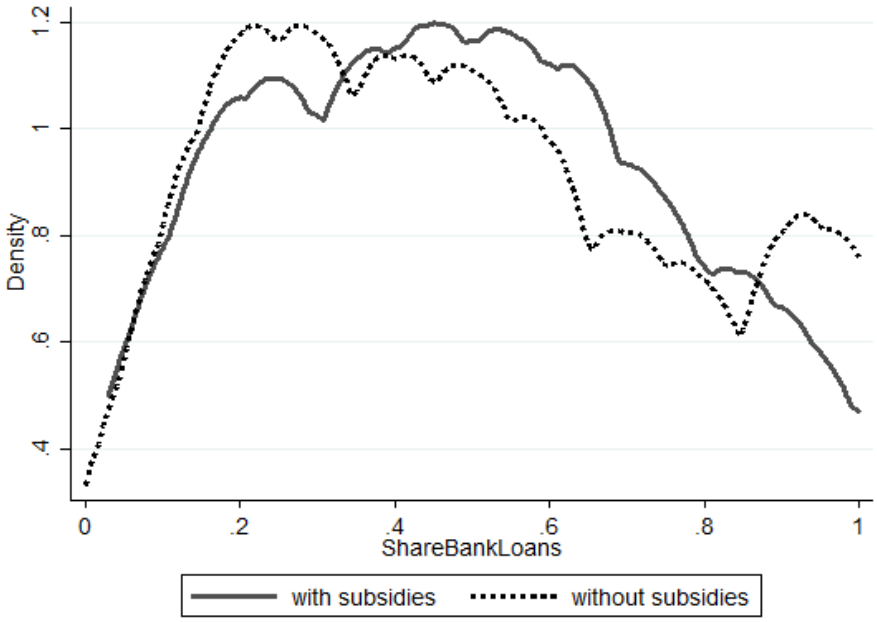

Figure 2 Kernel density estimates of the distribution of the share of bank loans in use by subsidized and non-subsidized new ventures for industry sectors

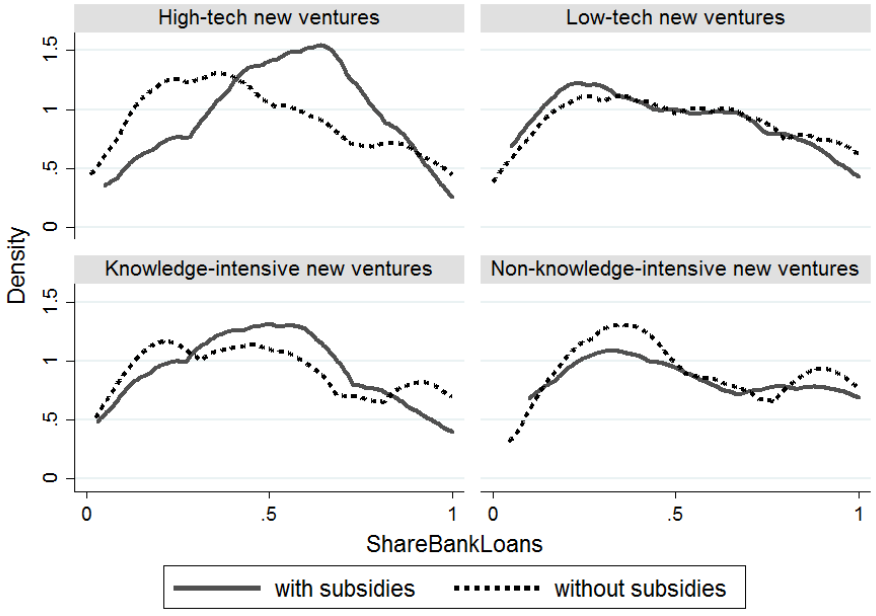

Table 1 The variables of the econometric model

Variable	Description	N	Mean	S.D.	Min	Max
Bank financing						
DBankLoans	One for bank loans in use	5,297	0.21	0.41	0.00	1.00
ShareBankLoans	Share of bank loans in use to total capital in use	5,297	0.11	0.25	0.00	1.00
Governemt grants						
DSubsidy	One for new ventures' subsidy grant receipt	5,297	0.17	0.38	0.00	1.00
Control variables						
Gender	One for founder is female or at least one female founder	5,297	0.19	0.39	0.00	1.00
Educ	One for founders with a university degree	5,297	0.23	0.42	0.00	1.00
Exp	Founders' industry experience in years	5,297	14.71	9.65	1.00	56.00
Capacity	Capacity utilization in percent	5,297	77.11	27.13	0.00	200.00
Age	Age of the new venture	5,297	2.11	1.12	1.00	5.00
Profit	One for new ventures with profit	5,297	0.49	0.50	0.00	1.00
lnRevenue	Logarithm of the new ventures' revenue in EUR	5,297	10.76	3.32	0.00	17.22
lnTangibleAssets	Logarithm of new ventures' materials and equipment in EUR	5,297	5.93	4.55	0.00	18.60
Patents	Number of valid patents	5,297	0.28	4.10	0.00	140.00
DEquityFinance	One for new ventures using external equity finance	5,297	0.04	0.20	0.00	1.00
HighTechEmployees	Number of employees in high-tech sector in new ventures' administrative district[a]	5,297	11.38	6.86	0.70	55.30
ForestArea	Proportion of forest area in new ventures' administrative district[a]	5,297	26.67	14.69	0.90	64.90
2008	One for year 2008	5,297	0.41	0.49	0.00	1.00
2009	One for year 2009	5,297	0.29	0.45	0.00	1.00
Instrument variables						
IndustryR&D	Average R&D costs in industry sector	5,297	15,122.54	14,027.37	1,238.48	47,783.15
SizeR&D	Average R&D intensity in new ventures' size categories	5,297	0.19	0.04	0.02	0.20
Banks	Number of bank branches in new ventures' administrative district[a]	5,297	75.09	44.83	6.00	315.00
PrivateBanks	Number of private bank branches in new ventures' administrative district[a]	5,297	11.23	25.01	0.00	229.00
IncomePerCapita	Per capital income in new ventures' administrative district	5,297	19,050.60	2,294.68	13,930.00	31,138.00
HouseholdIncome	Household income in new ventures' administrative district	5,297	1580.36	192.92	1,127.90	2,397.00

[a] Data available for 2008. Data sources are GENESIS database and Cr

Table 2 Means of main variables by sector

	High-tech sector (N = 925)	Low-tech sector (N = 1,220)	Knowledge-intenisve service sector (N = 1,199)	Non-nowledge-intenisve service sector (N = 1,953)
DBanksLoans	0.186	0.276	0.130	0.223
ShareBankLoans	0.091	0.142	0.073	0.112
DSubsidy	0.160	0.205	0.170	0.154

Source: KfW/ZEW-Start-up Panel.

Table 3 Sector definition and distribution

	NACE Rev. 1	Occurence (%)		
		N	Mean	SD
High-tech	22.33, 23.30, 24.20, 24.11, 24.12-4, 24.17, 24.30, 24.41, 24.42, 24.61, 24.62-4, 24.66, 29.11, 29.60, 30.02, 31.62, 32.10, 32.20, 33.20, 33.30, 35.30, 29.12-4, 29.31-2, 29.40, 29.52-6, 30.01, 1.10, 31.40, 31.50, 32.30, 33.10, 33.40, 34.10, 34.30, 35.20, 72.2	5,297	0.17	0.38
Low-tech	15 – 37 (without sectors 1 + 2), 45	5,297	0.23	0.42
Knowledge-intensive	64.2, 72 (without 72.2), 73.1, 74.2, 74.3, 73.2, 74.11-4, 74.4	5,297	0.23	0.42
Non-knowledge-intensive	50 – 52 (without 51.1), 55, 60.1, 60.2, 61, 62, 63.1, 63.2, 60.3, 63.3, 63.4, 64.1, 65-67, 69, 70, 71.1, 71.2, 71.3, 71.4, 74.5 – 74.8 (without 74.84.7), 80.4, 90, 92, 93	5,297	0.37	0.48

Source: KfW/ZEW-Start-up Panel.

Table 4 IV probit for likelihood of bank loans in use (DBankLoans)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Cross-industry		High-tech new ventures		Low-tech new ventures		Knowledge-intesive service new ventures		Non-knowledge-intesive service new ventures	
VARIABLES	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
DSubsidy		1.803***		2.303***		0.864		2.239***		0.719
		(0.439)		(0.386)		(0.701)		(0.466)		(0.796)
Gender	-0.0003	-0.020	-0.013	-0.047	-0.047	0.036	-0.012	-0.069	0.021	0.026
	(0.013)	(0.050)	(0.036)	(0.135)	(0.031)	(0.123)	(0.029)	(0.130)	(0.018)	(0.078)
Educ	-0.018	-0.020	0.018	-0.193*	-0.087**	0.083	-0.014	0.005	-0.024	-0.053
	(0.012)	(0.053)	(0.026)	(0.104)	(0.035)	(0.142)	(0.024)	(0.097)	(0.020)	(0.090)
Exp	-0.002***	0.004*	-0.003***	0.019***	-0.001	0.003	-0.001	-0.001	-0.001*	0.0008
	(0.0005)	(0.002)	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.004)	(0.001)	(0.004)
Capacity	0.0005***	-0.0002	0.0002	0.001	0.001	0.001	0.001*	-0.001	0.0004	-0.001
	(0.0002)	(0.001)	(0.0004)	(0.001)	(0.0004)	(0.002)	(0.0004)	(0.001)	(0.0003)	(0.002)
Age	-0.062***	0.169***	-0.018	0.065	-0.083***	0.196***	-0.066***	0.194***	-0.055***	0.104*
	(0.005)	(0.028)	(0.013)	(0.045)	(0.011)	(0.070)	(0.011)	(0.043)	(0.008)	(0.056)
Profit	-0.001	0.061	0.024	0.033	0.015	0.063	-0.019	0.118	-0.013	0.012
	(0.010)	(0.040)	(0.024)	(0.090)	(0.020)	(0.085)	(0.021)	(0.084)	(0.017)	(0.069)
lnRevenue	0.006***	0.036***	0.005	0.016	0.008*	0.043**	0.002	0.046*	0.009***	0.052***
	(0.002)	(0.011)	(0.003)	(0.014)	(0.004)	(0.020)	(0.003)	(0.025)	(0.003)	(0.019)
lnTangibleAssets	-0.001	-0.005	-0.001	-0.00003	0.001	-0.008	-0.001	-0.005	-0.003	-0.011
	(0.001)	(0.005)	(0.003)	(0.010)	(0.002)	(0.009)	(0.002)	(0.010)	(0.002)	(0.008)
Patents	-0.001	-0.005	-0.0005	-0.002	0.0008	-0.002	-0.001	-0.003	-0.005	-0.062
	(0.001)	(0.004)	(0.001)	(0.006)	(0.001)	(0.007)	(0.001)	(0.007)	(0.003)	(0.051)
DEquityFinance	0.004	0.174*	0.067	-0.025	0.012	0.458*	-0.013	0.039	-0.040	0.303*
	(0.025)	(0.095)	(0.047)	(0.189)	(0.062)	(0.243)	(0.046)	(0.185)	(0.046)	(0.168)
HighTechEmployees	0.0004	0.003	0.002	-0.001	0.001	0.001	-0.002	0.016***	0.0002	-0.002
	(0.001)	(0.003)	(0.002)	(0.007)	(0.002)	(0.006)	(0.002)	(0.006)	(0.001)	(0.005)
ForestArea	-0.0003	0.002	0.0004	0.003	-0.0005	0.005	-0.001	-0.003	-0.0005	0.002
	(0.0003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.002)
NumberBanks			-0.001***						-0.0003**	
			(0.0003)						(0.0002)	
HouseholdIncome							-0.0002***			
							(0.00006)			
SizeR&D					1.549***				1.135***	
					(0.382)				(0.263)	
IndustryR&D	-0.00007***		0.00001***							
	(0.00002)		(0.000002)							
IncomePerCapita	-0.00002***				-0.00002***					
	(0.000002)				(0.000005)					
NumberPrivateBanks							-0.0009***			
							(0.0003)			
Constant	0.448***	-2.143***	-0.149	-2.054***	0.528***	-2.204***	0.731***	-2.343***	0.157**	-1.657***
	(0.067)	(0.129)	(0.109)	(0.296)	(0.125)	(0.402)	(0.106)	(0.336)	(0.066)	(0.300)
Exogeneity Wald test		7.72***		9.28***		0.63		6.98***		0.47
Observations	5,297	5,297	925	925	1,220	1,220	1,199	1,199	1,953	1,953

This table presents estimates of the probit regressions with instrument variables to investigate the effect of subsidy receipt (DSubsidy) on the likelihood of bank loans in use (DBankLoans). Year dummies not reported. Model 1 reports the results for the cross-industry examination of the effect of the dummy variable subsidy receipt on the likelihood of bank loans in use. In the first stage, we calculate the variable subsidy receipt with the instrumental variables IndustryR&D and IncomePerCapita. In the second stage, we replace the variable DSubsidy with its predicted value of subsidy receipt from the first stage and we estimate the effect of DSubsidy on the dependent variable DBankLoans. Industry dummies not reported for Model 1. Model 2, Model 3, Model 4 and Model 5 proceed analog to the procedure of Model 1, only by adjusting the type of instrument variabels in the first-stage regressions to estimate the susbsidy receipt for high-tech new ventures (Model 2), for low-tech new ventures (Model 3), for knowledge-intensive service new ventures (Model 4) and for non-knowledge-intensive service new ventures. In the second stage of each Model, we estimate the effect of DSubsidy on the dependent variable DBankLoans for industry-specific new ventures. Standard errors are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 5 IV 2SLS for volume of bank loans in use (ShareBankLoans)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Cross-industry		High-tech new ventures		Low-tech new ventures		Knowledge-intesive service new ventures		Non-knowledge-intesive service new ventures	
VARIABLES	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
DSubsidy		0.335***		0.386**		0.105		0.387**		0.104
		(0.125)		(0.156)		(0.135)		(0.170)		(0.162)
Gender	-0.0003	-0.010	-0.012	-0.018	-0.048	0.017	-0.011	-0.012	0.021	-0.009
	(0.013)	(0.010)	(0.036)	(0.024)	(0.031)	(0.026)	(0.029)	(0.022)	(0.018)	(0.013)
Educ	-0.018	0.003	0.017	-0.026	-0.087**	0.015	-0.014	0.003	-0.024	-0.002
	(0.012)	(0.010)	(0.026)	(0.019)	(0.036)	(0.026)	(0.024)	(0.019)	(0.020)	(0.015)
Exp	-0.002***	0.001	-0.003**	0.003***	-0.001	0.0004	-0.001	-0.001	-0.001*	0.0002
	(0.0005)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Capacity	0.0005***	-0.0001	0.0001	0.00002	0.001	0.0001	0.001*	-0.0002	0.0004	0.0001
	(0.0002)	(0.0001)	(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0003)
Age	-0.062***	0.039***	-0.018	0.014	-0.083***	0.039**	-0.066***	0.044***	-0.055***	0.021*
	(0.005)	(0.009)	(0.013)	(0.009)	(0.011)	(0.016)	(0.011)	(0.014)	(0.008)	(0.012)
Profit	-0.001	0.028***	0.023	0.018	0.015	0.042***	-0.019	0.031**	-0.013	0.018
	(0.010)	(0.008)	(0.025)	(0.017)	(0.021)	(0.016)	(0.021)	(0.016)	(0.016)	(0.012)
lnRevenue	0.006***	0.003**	0.005*	0.001	0.008*	0.004	0.002	0.004	0.009***	0.006**
	(0.002)	(0.001)	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
lnTangibleAssets	-0.001	-0.002*	-0.001	-0.0005	0.001	-0.002	-0.001	-0.002	-0.003	-0.002*
	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Patents	-0.001	-0.0004	-0.0003	-0.0001	0.0001	-0.0004	-0.001	0.0003	-0.005	-0.002
	(0.001)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)
DEquityFinance	0.004	-0.019	0.067	-0.054*	0.012	0.032	-0.014	-0.029	-0.040	-0.012
	(0.025)	(0.015)	(0.047)	(0.030)	(0.062)	(0.048)	(0.047)	(0.025)	(0.046)	(0.026)
HighTechEmployees	0.0004	0.0004	0.002	-0.001	0.001	0.001	-0.002	0.003**	0.0002	-0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
ForestArea	-0.0003	0.001**	0.0004	0.0002	-0.0005	0.001	-0.001	-0.0002	-0.0005	0.001*
	(0.0003)	(0.0003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)
NumberBanks			-0.001***						-0.0003**	
			(0.0003)						(0.0002)	
HouseholdIncome							-0.0002***			
							(0.00001)			
SizeR&D					1.584***				1.134***	
					(0.364)				(0.265)	
IndustryR&D	-0.00007***		0.00001***							
	(0.00003)		(0.000003)							
IncomePerCapita	-0.00001***				-0.00001***					
	(0.00002)				(0.000004)					
NumberPrivateBanks							-0.0001**			
							(0.0003)			
Constant	0.746***	-0.141**	-0.097	-0.093*	0.507***	-0.123	0.745***	-0.161**	0.157**	-0.030
	(0.069)	(0.055)	(0.125)	(0.055)	(0.118)	(0.090)	(0.105)	(0.078)	(0.066)	(0.063)
F-Test of excl. Instruments	18.43***		17.57***		16.77***		8.73***		12.40***	
Underidentification test	40.07***		35.18***		28.50***		18.58***		22.40***	
Hansen J statistic	0.70		2.20		0.83		0.001		0.000	
Observations	5,297	5,297	925	925	1,220	1,220	1,199	1,199	1,953	1,953

This table presents estimates of linear two-stage-least squares regressions with instrument variables to investigate the effect of subsidy receipt (DSubsidy) on the volume of bank loans in use (ShareBankLoans). Year dummies not reported. Model 1 reports the results for the cross-industry examination of the effect of the dummy variable subsidy receipt on the volume of bank loans in use. In the first stage, we calculate the variable subsidy receipt with the instrumental variables IndustryR&D and IncomePerCapita. In the second stage, we replace the variable DSubsidy with its predicted value of subsidy receipt from the first stage and we estimate the effect of DSubsidy on the dependent variable ShareBankLoans. Industry dummies not reported for Model 1. Model 2, Model 3, Model 4 and Model 5 proceed analog to the procedure of Model 1, only by adjusting the type of instrument variabels in the first-stage regressions to estimate the susbsidy receipt for high-tech new ventures (Model 2), for low-tech new ventures (Model 3), for knowledge-intensive service new ventures (Model 4) and for non-knowledge-intensive service new ventures. In the second stage of each Model, we estimate the effect of DSubsidy on the dependent variable ShareBankLoans for industry-specific new ventures. Standard errors are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 6 IV tobit for volume of bank loans in use (ShareBankLoans)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Cross-industry		High-tech new ventures		Low-tech new ventures		Knowledge-intesive service new ventures		Non-knowledge-intesive service new ventures	
VARIABLES	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
DSubsidy		1.659***		2.255***		0.489		3.283**		0.473
		(0.597)		(0.800)		(0.520)		(1.516)		(0.635)
Gender	-0.0002	-0.029	-0.013	-0.054	-0.047	0.037	-0.011	-0.098	0.021	0.0002
	(0.013)	(0.045)	(0.036)	(0.135)	(0.031)	(0.086)	(0.029)	(0.181)	(0.018)	(0.056)
Educ	-0.018	-0.007	0.018	-0.175*	-0.087**	0.054	-0.014	0.014	-0.024	-0.030
	(0.012)	(0.048)	(0.026)	(0.104)	(0.035)	(0.098)	(0.023)	(0.139)	(0.020)	(0.067)
Exp	-0.002***	0.003*	-0.003***	0.018***	-0.001	0.002	-0.001	-0.003	-0.001*	0.0002
	(0.0005)	(0.002)	(0.001)	(0.005)	(0.001)	(0.003)	(0.001)	(0.006)	(0.001)	(0.003)
Capacity	0.001***	-0.0003	0.0002	0.005	0.001	0.001	0.001*	-0.002	0.0004	-0.00004
	(0.0002)	(0.001)	(0.0004)	(0.001)	(0.0004)	(0.001)	(0.0004)	(0.002)	(0.0003)	(0.001)
Age	-0.062***	0.163***	-0.018	0.067	-0.083***	0.135**	-0.066***	0.297**	-0.055***	0.060*
	(0.005)	(0.041)	(0.013)	(0.048)	(0.011)	(0.055)	(0.011)	(0.116)	(0.008)	(0.045)
Profit	-0.001	0.082**	0.024	0.049	0.015	0.087	-0.019	0.191	-0.013	0.034
	(0.010)	(0.035)	(0.024)	(0.086)	(0.020)	(0.059)	(0.021)	(0.117)	(0.016)	(0.051)
lnRevenue	0.006***	0.029***	0.005	0.013	0.008*	0.026*	0.002	0.058**	0.009***	0.038***
	(0.002)	(0.008)	(0.003)	(0.013)	(0.004)	(0.014)	(0.003)	(0.026)	(0.003)	(0.013)
lnTangibleAssets	-0.001	-0.006	-0.001	0.0001	0.001	-0.006	-0.001	-0.009	-0.003	-0.009
	(0.001)	(0.004)	(0.003)	(0.009)	(0.002)	(0.006)	(0.002)	(0.014)	(0.002)	(0.006)
Patents	-0.001	-0.005	-0.0005	-0.002	0.0001	-0.002	-0.001	-0.003	-0.005	-0.042
	(0.001)	(0.004)	(0.001)	(0.006)	(0.001)	(0.005)	(0.001)	(0.009)	(0.003)	(0.038)
DEquityFinance	0.004	0.065	0.067	-0.125	0.012	0.232	-0.013	-0.028	-0.040	0.109
	(0.025)	(0.078)	(0.047)	(0.176)	(0.062)	(0.146)	(0.046)	(0.251)	(0.046)	(0.113)
HighTechEmployees	0.0003	0.003	0.002	-0.002	0.001	0.002	-0.002	0.023**	0.0002	-0.002
	(0.0008)	(0.003)	(0.002)	(0.007)	(0.002)	(0.004)	(0.002)	(0.010)	(0.001)	(0.004)
ForestArea	-0.0003	0.003*	0.0004	0.003	-0.0005	0.003	-0.001	-0.003	-0.0005	0.002
	(0.0003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.004)	(0.0005)	(0.002)
NumberBanks			-0.001***						-0.0003**	
			(0.0003)						(0.0001)	
HouseholdIncome							-0.0002***			
							(0.0001)			
SizeR&D					1.559***				1.135***	
					(0.377)				(0.263)	
IndustryR&D	-0.0001***		0.00001***							
	(0.00002)		(0.000002)							
IncomePerCapita	-0.0001***				1.559***					
	(0.000002)				(0.377)					
NumberPrivateBanks							-0.001***			
							(0.0003)			
Constant	0.749***	-1.947***	-0.151	-1.974***	0.523***	-1.484***	0.731***	-3.320***	0.157**	-1.265***
	(0.067)	(0.272)	(0.109)	(0.318)	(0.125)	(0.343)	(0.106)	(0.742)	(0.066)	(0.275)
Observations	5,297	5,297	925	925	1,220	1,220	1,199	1,199	1,953	1,953

This table presents estimates of the tobit regressions with instrument variables to investigate the effect of subsidy receipt (DSubsidy) on the volume of bank loans in use (ShareBankLoans) to check the robustness of the results on table 5. Year dummies not reported. Model 1 reports the results for the cross-industry examination of the effect of the dummy variable subsidy receipt on the volume of bank loans in use. In the first stage, we calculate the variable subsidy receipt with the instrumental variables IndustryR&D and IncomePerCapita. In the second stage, we replace the variable DSubsidy with its predicted value of subsidy receipt from the first stage and we estimate the effect of DSubsidy on the dependent variable ShareBankLoans. Industry dummies not reported for Model 1. Model 2, Model 3, Model 4 and Model 5 proceed analog to the procedure of Model 1, only by adjusting the type of instrument variabels in the first-stage regressions to estimate the susbsidy receipt for high-tech new ventures (Model 2), for low-tech new ventures (Model 3), for knowledge-intensive service new ventures (Model 4) and for non-knowledge-intensive service new ventures. In the second stage of each Model, we estimate the effect of DSubsidy on the dependent variable ShareBankLoans for industry-specific new ventures. Standard errors are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 7 Results for matching

	Mean delta	p-value
	Model (1)	
	Cross-Industry effects (N=898)	
DBankLoans	0.050***	0.006
ShareBankLoans	0.022**	0.033
	Model (2)	
	Effects for high-tech industry (N=294)	
DBankLoans	0.157***	0.002
ShareBankLoans	0.091***	0.002
	Model (3)	
	Effects for low-tech industry (N=247)	
DBankLoans	0.051	0.129
ShareBankLoans	0.009	0.380
	Model (4)	
	Effects for knowledge-intensive services (N=201)	
DBankLoans	0.060**	0.035
ShareBankLoans	0.035**	0.039
	Model (5)	
	Effects for non-knowledge-based services (N=300)	
DBankLoans	0.003	0.462
ShareBankLoans	0.007	0.380

This table presents the main results for the propensity score matching model to examine the effect of subsidy receipt on the likelihood of bank loan access (DBankLoans) and the volume of bank loans in use compared to total capital in use (ShareBankLoans). In Model (1), we allocate each subsidy recipient with their closest non-recipient. The allocation is based on the similarity in the propensity scores, estimated from a probit model with a dummy variable indicating the receipt of a subsidy and the explanatory variables of our economic models (Appendix, Table A2 and Table 1). Model 2, Model 3, Model 4 and Model 5 proceed analog to the procedure of Model (1), only by adjusting the new ventures' industry type. Model (2) examines the effect of subsidy receipt for high-tech new ventures, Model (3) for low-tech new ventures, Model (4) for knowledge-intensive service new ventures and Model (5) for non-knowledge-intensive service new ventures. N = Number of matched pairs. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Appendix

Table A.1 Applicability of the instrumental variable approach

Dependent variable	Instrumental variables	Applicability of instrumental variables
DSubsidy (Cross-industry examination)	IndustryR&D	Highly correlated with x_i: R&D is a major determinant for the innovativeness of young firms. Subsidy awarding institutions aim to support especially those firms with great innovation potential to create a social return.
		Weak correlation with u_i: Banks focus on the profitability and the availability of collateral. Even if high R&D-costs might be a lending-criterion, other criteria are more important for banks.
	IncomePerCapita	Highly correlated with x_i: Subsidy awarding institutions aim to subsidize new ventures notably in underdeveloped areas. Low-tech new ventures are more likely to be situated in such areas.
		Weak correlation with u_i: Banks do not put a focus on local external macro-economic factors, such as per capital income, but rather take internal factors into consideration
DSubsidy (For high-tech new ventures)	IndustryR&D	Highly correlated with x_i: R&D is a major determinant for the innovativeness of young high-tech firms. Subsidy awarding institutions aim to support especially those firms with great innovation potential to create a social return.
		Weak correlation with u_i: Banks focus on the profitability and the availability of collateral. Even if high R&D-costs are typical for the high-tech industry, other criteria are more important for banks.
	Banks	Highly correlated with x_i: High-tech new ventures have comparatively high capital requirements. If not enough financial resources are available or physically accessible, growth and innovation potential will be hampered.
		Weak correlation with u_i: Banks do not take the number of banks into major consideration since banks focus on profitability figures while reaching an investment decision.
DSubsidy (For low-tech new ventures)	SizeR&D	Highly correlated with x_i: Innovation is not a prerogative of high-tech firms. Likewise, young low-tech firms might be rewarded with subsidies for their growth potential
		Weak correlation with u_i: The perceived uncertainty and the likelihood to generate a direct return are major criteria for banks to reach an investment decision
	IncomePerCapita	Highly correlated with x_i: Subsidy awarding institutions aim to subsidize new ventures notably in underdeveloped areas. Low-tech new ventures are more likely to be situated in such areas.
		Weak correlation with u_i: Banks do not put a focus on local external macro-economic factors, such as per capital income, but rather take internal factors into consideration.
DSubsidy (For knowledge-based service new ventures)	HouseholdIncome	Highly correlated with x_i: Subsidy awarding institutions aim to subsidize new ventures notably in underdeveloped areas. Low-tech new ventures are more likely to be situated in such areas.
		Weak correlation with u_i: Banks do not put a focus on local external macro-economic factors, such as household income, but rather take internal factors into consideration.
	PrivateBanks	Highly correlated with x_i: Knowledge-based service new ventures have high capital requirements compared to other young service firms. Subsidy awarding institutions are willing to support these firms, especially if not enough financial sources, such as banks, are physically accessible due to positional disadvantages. The number of private banks can be used as a proxy for the spatial accessibility of banking and finance.
		Weak correlation with u_i: Banks do not take the number of banks into major consideration since banks focus on profitability figures while reaching an investment decision.
DSubsidy (For other service new ventures)	SizeR&D	Highly correlated with x_i: As non-knowledge-based service new ventures can also have relevant growth and innovation potential, governments are highly interested in supporting these kinds of young firms in particular.
		Weak correlation with u_i: The perceived uncertainty of the future products and processes for non-knowledge-based services is high. Adverse selection problems arise as the founders have more relevant information and knowledge about the uncertainty of specific business-related projects than banks. Thus, R&D-activity plays a minor role for the banks' decision process.
	Banks	Highly correlated with x_i: It is difficult for young non-knowledge-based service new venture to call attention from venture capital firms or business angels, who typically invest in young high-tech firms, software companies and scientific service new ventures. Hence, banks are one of the few remaining financing sources for non-scientific low ventures. If, however, the new venture is situated in an area with a small number of banks, it will require substantial efforts to reach banks.
		Weak correlation with u_i: Banks focus on profitability and success figures, such as revenue and profit, and the presence of collateral.

Table A.2 Probit regression results for propensity score matching (DSubsidy)

	Model 1	Model 2	Model 3	Model 4	Model 4
	Cross-industry effect	Effects for high-tech industry	Effects for low-tech industry	Effects for scientific services	Effects for non-scientific services
Gender	-0.084	-0.032	-0.250*	-0.101	0.003
	(0.055)	(0.144)	(0.133)	(0.127)	(0.079)
Educ	-0.016	0.119	-0.165	-0.049	-0.021
	(0.052)	(0.106)	(0.144)	(0.096)	(0.088)
Exp	-0.005**	-0.009*	-0.003	-0.004	-0.004
	(0.002)	(0.006)	(0.005)	(0.005)	(0.004)
Capacity	0.004***	0.001	0.004**	0.004***	0.005***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Age	-0.110***	0.059	-0.159***	-0.169***	-0.125***
	(0.020)	(0.046)	-0.038	(0.043)	(0.034)
Profit	0.009	0.062	0.132	-0.016	-0.108
	(0.044)	(0.109)	(0.089)	(0.094)	(0.074)
lnRevenue	0.004	0.010	-0.009	-0.002	0.015
	(0.007)	(0.014)	(0.016)	(0.013)	(0.013)
lnTangibleAssets	-0.006	-0.014	-0.002	-0.006	-0.010
	(0.005)	(0.011)	(0.009)	(0.010)	(0.008)
Patents	-0.012	-0.011	-0.0004	-0.019	-0.259
	(0.009)	(0.018)	(0.010)	(0.025)	(0.181)
DEquityFinance	0.042	0.180	0.075	0.027	-0.053
	(0.104)	(0.192)	(0.251)	(0.201)	(0.211)
HighTechEmployees	-0.002	0.011	-0.002	-0.011	0.001
	(0.003)	(0.007)	(0.006)	(0.007)	(0.005)
ForestArea	-0.002	0.002	-0.004	-0.002	-0.002
	(0.001)	(0.004)	(0.003)	(0.003)	(0.002)
Constant	-0.819***	-1.334***	-0.510**	-0.639***	-1.077***
	(0.115)	(0.250)	(0.240)	(0.219)	(0.200)
Observations	5,297	925	1,220	1,199	1,953

Table A.2 presents the main results for the probit regressions to calculate the propensity scores for the matching models, with a dummy variable indicating the receipt of a subsidy and the explanatory variables of our economic models. Year dummies not reported. Industry dummies not reported for Model 1. Standard errors are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.